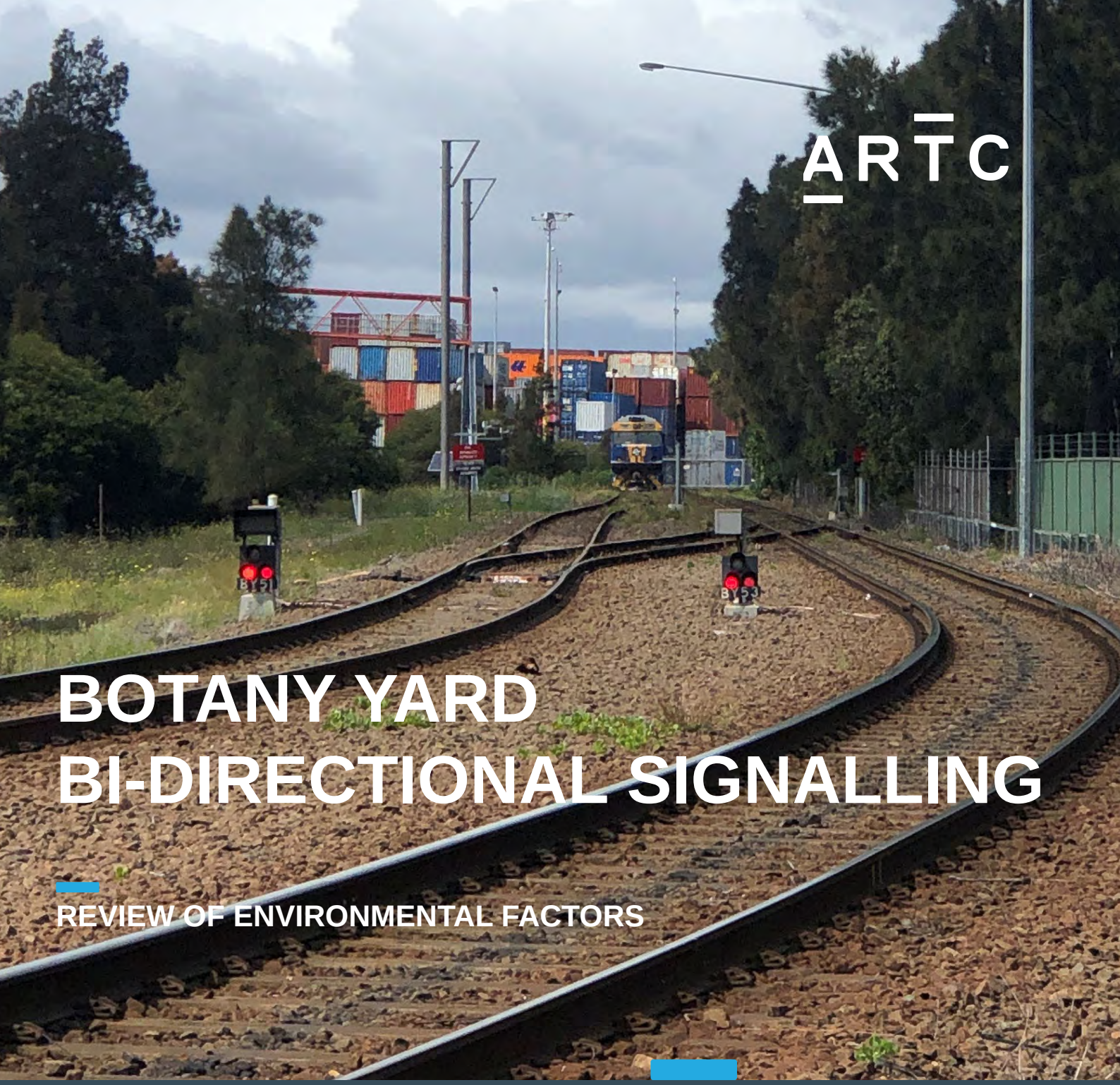

BOTANY YARD BI-DIRECTIONAL SIGNALLING

REVIEW OF ENVIRONMENTAL FACTORS

JUNE 2020

Australian Government

BUILDING OUR FUTURE

REVIEW OF ENVIRONMENTAL FACTORS

Botany Yard Bi-Directional Signalling

June 2020

Project Number: 19-505

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ACRONYMS AND ABBREVIATIONS

AHIMS	Aboriginal heritage information management system
ARTC	Australian Rail Track Corporation
BC Act	Biodiversity Conservation Act 2016 (NSW)
Biosecurity Act	Biosecurity Act 2015 (NSW)
BIP	Botany Industrial Park
BOM	Australian Bureau of Meteorology
BRD	Botany Rail Duplication Project
CoPCs	Contaminants of Potential Concern
CSB	Controlled Signal Blocking
DEC	Department of Environment and Conservation
DoAWE	Department of Agriculture Water and the Environment
DPIE	Department of Planning, Industry and Environment
EIA	Environmental impact assessment
EPBC Act	(Cwth) Environment Protection and Biodiversity Conservation Act 1999
EP&A Act	(NSW) Environmental Planning and Assessment Act 1979
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
FM Act	(NSW) Fisheries Management Act 1994
ha	hectares
Heritage Act	(NSW) Heritage Act 1977
HNA	Highly Noise Affected
ICNG	NSW Interim Construction Noise Guideline (DECC, 2009)
ILs	Investigation Levels
ISEPP	(NSW) State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environment Plan
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (*c.f.*)
NCA	Noise Catchment Areas
NML	Noise Management Levels

NPfI	NSW EPA Noise Policy for Industry (EPA, 20117)
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
OOHWs	Out of Hours Works
ORS	Operational Requirement Specification
PBRL	Port Botany Rail Line
RBL	Rating Background Level
REF	Review of Environmental Factors
RING	NSW Rail Infrastructure Noise Guideline (EPA, 2013)
SEPP	(NSW) State Environmental Planning Policy
SIS	Species Impact Statement
SMP	Site Management Plan
TEC	Threatened Ecological Community
TOA	Track Occupancy Authority
VC	Vibration Criteria

1. INTRODUCTION

1.1. BACKGROUND

Port Botany, New South Wales' largest Container Port by volume, is a key freight transport asset in Australia that provides essential international connectivity to businesses and the wider community. The Australian Rail Track Corporation (ARTC) manages the freight rail line through Port Botany and seeks to undertake signal and track works under a Bi-Directional Signalling project (the proposal).

To address forecast demands of freight transport vis rail through Sydney, ARTC has concentrated on staged improvements to the Botany Line under a Program of Works funded by the Government. Stages 1 and 2 of the Program of Works have been completed with Stage 3 (the Botany Rail Duplication (BRD) Project) involving the duplication of the remaining single line between Botany and Mascot in the planning assessment phase. The BRD project is being assessed as State Significant Infrastructure by the Department of Planning, Industry and Environment (DPIE).

ARTC have investigated other solutions to improve the efficiency of the Botany Line, including signalling and track works within Botany Yard (the Botany Yard project). To improve the efficiency of train arrival and departures in Botany Yard, the signalling infrastructure needs to be reconfigured to enable bi-directional signalling on the Arrival and Departure tracks (partial bi-directional signalling exists). Additional track works to increase operational performance including removal of an existing siding and motorising of points are also required. These works comprise the proposal.

This Review of Environmental Factors (REF) has been prepared to consider the environmental impacts of the proposal. Additionally, since the proposal and the BRD project will be undertaken concurrently, and within shared and adjacent work areas, a cumulative impact assessment has been included in this REF.

1.2. PURPOSE OF THE REF

This Review of Environmental Factors (REF) has been prepared by NGH Environmental on behalf of ARTC. For the purposes of the proposal, ARTC is the proponent and the determining authority under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of this REF is to describe the proposal, to document the likely impacts of the proposal on the environment, to detail protective measures to be implemented, and to comply with the ARTC Code of Practice for Environmental Impact Assessment of Development Proposals in NSW (Code of Practice) (Australian Rail Track Corporation, 2016). As per the Code of Practice, this proposal falls within a class 4 assessment, triggering the requirement for the preparation of an REF.

The description of the proposed work and associated environmental impacts have been undertaken in the context of Section 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Biodiversity Conservation Act 2016* (BC Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act that ARTC examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

a) The significance of any impact on threatened species as defined by the *Biodiversity Conservation* (BC) Act and/or *Fisheries Management Act 1994* (FM Act), in Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement or Biodiversity Development Assessment Report (BDAR) to be prepared

b) The potential for the proposal to significantly impact a matter of national environmental significance (MNES) or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment and Energy (DEE) for a decision by the Commonwealth Minister for the Environment and whether assessment and approval is required under the EPBC Act
c) Whether a significant impact on the environment is likely, and therefore whether the activity may be considered State Significant Infrastructure pursuant to the *State Environmental Planning Policy (State and Regional Development) 2011.*

This REF has assessed impacts to the environment on three spatial scales outlined below:

Proposal site: means the area directly affected by the proposal. The proposal site includes the footprint of the development and any ancillary works, facilities, accesses or hazard reduction zones that support the construction or operation of the development or activity.

Study area: means the proposal site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account. For this proposal, the study area is the rail corridor which is the same as the proposal site**.** Typically, the study area would extend to 50 m from the proposal site.

Locality: has the same meaning as ascribed to local population of a species or local occurrence of an ecological community (i.e. the area within a 10 km radius of the proposed work area).

1.3. UPDATES TO REF

Following public display, the following changes have been made to this REF;

- Responsibilities column removed from summary table of safeguards and mitigation measures included in Section 8.2 to avoid inconsistencies with delegation of responsibilities between ARTC and the future Construction Contractor. ,
- Section 5 (Consultation) updated to provide further detail on the consultation activities undertaken during the public display period for the REF
- General formatting of the document.

No changes to the Proposal description, scope or assessment as identified in the REF dated May 2020 are proposed in this REF.

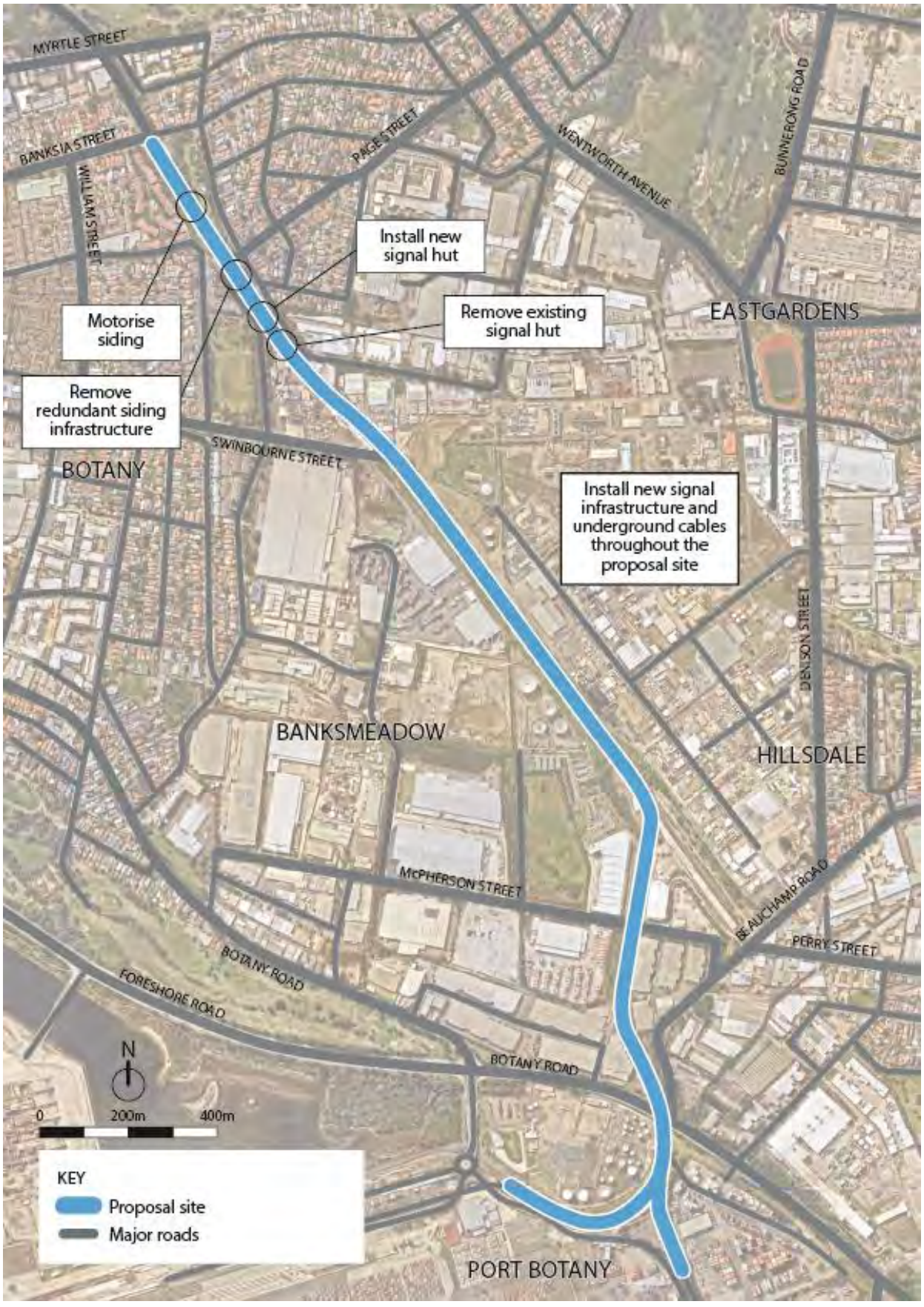

Figure 1-1 Botany Yard Bi-Directional Signalling Upgrade Proposal site (ARTC, 2020)

2. PROPOSAL NEEDS AND CONSIDERATIONS

2.1. PROPOSAL NEEDS

The NSW Freight and Ports Plan 2018-2023 (Transport for NSW, 2018) identified that access by both road and rail to and from freight facilities such as ports is becoming increasingly constrained due to the increased demand of general road users and the capacity of the existing freight network. Currently, the ability to increase the share and efficiency of freight moved by rail through Port Botany is constrained by a number of issues. In order to address these issues, a capacity analysis of the Botany Line as part of the Sydney Metropolitan Freight Strategy 2015-2024 (Australian Rail Track Corporation, 2015) was conducted by ARTC. Based on the predicted growth at the time (2014), it was concluded that the Botany Line would reach capacity by 2022.

ARTC developed a Program of Works, funded by the Federal government under the National Building Program to improve the efficiency of Botany Line, as well as increase its capacity for freight traffic.

The existing Botany Yard signalling system currently allows uni-directional signalling and partial bi-directional along the arrival and departure tracks. This configuration limits operational efficiency of the line as trains occasionally are required to wait for longer periods to enter and depart the Port. The reconfiguration of the Botany Yard signalling system to enable bi-directional signalling will improve the operational efficiency of train movements in Botany Yard.

Botany Yard also includes a disused siding which runs into the Kelloggs factory (a portion of line where rail traffic can be placed clear of running lines; Kelloggs siding) and a non-motorised siding (Gelco siding). The existing configuration at Gelco siding requires the train driver to contact the Network Control Centre to enable the points (moveable components of paired rail that move to allow tracks to diverge or converge) at the siding to be manually operated. As a result, trains are required to idle in this location for some time as they wait to access the siding. Motorising the points at the Gelco siding would remove these constraints and enable trains efficient access to the siding. The proposal includes the provision of works to remove the redundant infrastructure associated with the track connection to the Kelloggs siding and motorisation of the points at Gelco siding.

The proposal will deliver improved operational performance of Botany Yard, which will assist with meeting the objectives of the NSW Freight and Ports Plan 2018-2023 and the Sydney Metropolitan Freight Strategy 2015-2024.

Figure 2-1 Track and civil works associated with the proposal

2.2. PROPOSAL OBJECTIVES

The objective of the proposal is to improve the operational efficiency of train movements in Botany Yard consistent with the overarching objectives of the NSW Freight and Ports Plan 2018-2023 and Sydney Metropolitan Freight Strategy 2015-2024.

2.3. CONSIDERATION OF ALTERNATIVES

2.3.1. Option 1 – Do Nothing

This option would involve not undertaking the proposed works at Botany Yard.

In this option, the current operational performance of Botany Yard would be maintained into the future. This is considered to be inconsistent with the objectives of the NSW Freight and Ports Plan 2018-2023 and Sydney Metropolitan Freight Strategy 2015-2024, as the opportunities for improved freight capacity and transport efficiencies would be limited.

As this option does not meet the proposal objectives, it is not the preferred option and has not been considered further.

2.3.2. Option 2 – Signalling and track upgrade

Option 2 involves undertaking the following works:

- Removal and/or modification of existing signalling infrastructure
- Installation of new signalling infrastructure and equipment including new cable routes
- Finalise the removal of an existing track connection and associated equipment to the dis-used siding (Kelloggs)
- Motorising existing points, turnout renewal and minor re-railing (Gelco sidings)

Undertaking the signalling works will enable additional bi-directional train movements in Botany Yard, which will improve the flexibility of train movements, providing an overall positive benefit to the efficiency of the yard and broader NSW freight rail network. Gelco siding is currently manually operated. This means that a driver is required to wait for approval to enter the siding and then manually operate track levers to enter and exit. Motorising the points at Gelco siding will remove these manual operations and reduce the time it takes for trains to enter and exit the siding.

These works meet the proposal objective to improve the operational efficiency of Botany Yard and as such Option 2 is the selected option and has been assessed in this REF.

2.3.3. Justification of Option

Option 2 is the preferred option as it meets the project objectives, whereby Option 1 would not change the current operating conditions of the rail yard which would limit achievement of the objectives of the NSW Freight and Ports Plan 2018-2023 and Sydney Metropolitan Freight Strategy 2015-2024. The proposal is required to enhance the operational efficiency of freight movement between Port Botany and the wider network.

3. DESCRIPTION OF THE PROPOSAL

3.1. SCOPE OF WORKS

The Botany Yard rail corridor extends for approximately 4km from the Banksia Street footbridge at the north to Penrhyn Road access gate in Banksmeadow in the south, with approximate chainage along the Botany Line from 10.000km to 6.625km.

An operational requirement specification (ORS) and signal functional specification (SFS) for the Botany Line and Botany Yard has been developed to outline the operational requirements and scope of the project. The project scope is indicative and may change as a result of detailed design development. Proposed works include but are not restricted to:

Signal Works

- Removal of 4 existing Signal posts
- Removal of 1 existing Signal Hut
- Installation of 10 new Signal posts
- Installation of 1 new Signal Hut
- Provision of new cable routes to enable new Signal infrastructure above
- Modification to 14 existing Signals (i.e. new indications)

Track Works

- Finalise the removal of a track connection (and associated equipment) to the existing dis-used siding (Kelloggs Siding)
- Motorising of existing points (Gelco Sidings)

All works will be wholly contained within the ARTC rail corridor.

3.2. CONSTRUCTION METHODS

Construction of the proposal would involve the following:

Site Establishment

Site establishment will be undertaken prior to construction, during standard working hours. It would include:

- Establishing environmental controls including erosion and sediment controls, signage and fencing
- Setup of proposed site compounds (site office, toilet, materials storage etc)
    - Banksia Street compound (may also be utilised concurrently for the BRD project)
    - McPherson Street compound
    - Swinbourne Street compound
    - Botany Road compound
- Stockpiling of rail infrastructure and materials.

Track Works

Track works involve:

- Motorising of existing manual points at the Gelco siding involving;
    - Transportation of new motorised points prior to weekend possession, and stored at an appropriate location (Ancillary site)
    - Removal of existing points mechanism, turnout renewal, minor track work and lifting of new motorised points machine into position and commissioning activities.

- Finalise the removal of redundant ARTC rail infrastructure associated with the connection to Kelloggs siding involving;
    - Cutting of existing dis-used track into smaller portions
    - Removal of dis-used track using lifting equipment
    - Removal of old sleepers (may require minor excavation with a five tonne excavator)
    - Removal of associated mechanical signalling equipment.

Any work within three metres of the nearest active rail track (at any height above or below the rail corridor) is considered to be the work in the rail danger zone. Track works are typically undertaken within the danger zone. Some track works may be undertaken during standard working hours where safety and operational mechanisms can feasibly be put in place.

However, the majority of track works will be undertaken during scheduled track possessions which limits impact to freight movement to and from Port Botany and protects worker safety and infrastructure integrity. Track possessions are a pre-planned period during which the rail line is blocked to trains to permit work to be carried out on or near the operating rail line. There are typically 4 to 5 track possessions per year and are arranged across certain lengths of the network. Often these are driven by the peak operations of the commuter rail network given the interfaces between the freight and commuter rail networks within the metropolitan region. As such, track possessions are typically undertaken over a 48 hour period from 2:00am Saturday to the following 2:00am Monday morning.

Signal Works

Signal works will be undertaken during standard construction hours and possession periods. Minor civil works associated with the signal works (such as new cable routes and installation of signal posts and huts) will be undertaken during possession periods where the works cannot be completed during standard construction hours due to safety or operational constraints. Other minor signalling works would be undertaken during standard construction hours. The signal works include:

- Removal and installation of signalling equipment;
    - Installation of Signalling Equipment Room foundations and Signal foundations outside the danger zone with excavator
    - Installation of prefabricated sandwich panel Signalling Equipment Rooms with crane.
    - Enabling/reconfiguration of equipment within Signalling Equipment Room (hand tools and light vehicles)
    - Cable installation in existing and new Combined Services Route
      Signal equipment removal – decommissioning of signal equipment, physical removal of signal assets by use of an excavator, and concrete breaker for foundations
- Install pre-fabricated concrete signal bases and signals at designated locations New cable routes to be installed to enable new signal infrastructure
    - Survey mark out of new Signal route to be installed
    - Excavation of trench (approx. 1m deep) with 5 tonne excavator of signal route to be installed
    - Lay plastic PVC conduits in place (housing for new signal cables)
    - Install pre-fabricated concrete pits at designated locations, connecting the PVC conduits
    - Backfill the trenches with approved materials
    - Minor drainage works to accommodate signal infrastructure

Site Rehabilitation/ Decommissioning

Site rehabilitation and demobilisation works would include:

- Removal of fencing, waste and environmental controls
- Site rehabilitation
- Removal of site amenities.

3.3. EARTHWORKS

Minor excavation works would be undertaken for the proposal as a result of trenching for new cable routes and installation of new signal bases and signals. Excavated spoil would be backfilled into the trenches once cabling is laid. Excavation to establish drainage near the new signal hut will also be undertaken.

Excavation is expected to be 1-1.5 metres deep for cabling, and three metres for signal bases only, and will be undertaken with controls in place as per the mitigation measures identified in section 6.1 due to potential contaminants in the area.

3.4. PROPOSED CONSTRUCTION MATERIALS

Construction materials will include but not be limited to:

- New signalling equipment
- Precast concrete bases
- Cabling
- Timber/concrete sleepers
- Steel/metal rail
- Concrete footings

3.5. PROPOSED CONSTRUCTION EQUIPMENT

General equipment used during the works will include but not be limited to:

- Excavators
- Tamper train
- Sleeper laying machine
- Bobcat
- Vacuum Truck (non-destructive water excavation)
- Track cutter
- Hand tools
- Generator
- Flood lights
- Jack hammers
- Mobile crane
- Vehicle mounted cable winch

As the proposal is located within an area subject to Section 183 of the *Airports Act 1996* and regulation 7 of the *Airports (Protection of Airspace) Regulations 1996,* approval for the operation of a 'controlled activity' must be granted for any crane operation which intrudes the Obstacle Limitation Surface (OLS) .

3.6. TIMING AND HOURS OF WORKS

Construction associated with the proposal would be undertaken intermittently over a period of approximately 36 months. Works are expected to commence in mid-2022, subject to completion of detailed design, and completed by 2025.

Site establishment works, minor signalling works and minor track works would predominantly be undertaken during standard work hours outlined in the Interim Construction Noise Guideline (DECC, 2009; ICNG), being 7am to 6pm, Monday to Friday, 8am to 1pm Saturdays and no work on Sundays or public holidays.

Some of the track works, civil works and signalling works (e.g. CSR installation) would be undertaken during periods when trains are not operating to protect workers and infrastructure. These works are planned to be undertaken across approximately six weekend possession periods across the construction period. Works may also be undertaken during controlled signal blocks (CSBs), which typically occur during low demand periods e.g. early mornings.

During standard hours it is estimated that only one crew would be operating (5-10 workers), with minimal plant i.e. 5tonne excavator and tipper. During weekend possession works, to ensure works are completed within the limited periods available, there would be additional crews with additional plant and equipment.

Out of hours works would be undertaken in accordance with ARTC's existing Environmental Protection License 3142 (EPL) or any other relevant Environmental Protection License which applies to the works.

3.7. SITE COMPOUNDS

Site compounds are required for the proposal. Proposed site compound locations are adjacent to the Swinbourne Street access gate, near the McPherson Street access gate, in between Banksia Street and Stephen Road Bridge (which may be utilised concurrently by the BRD project), and adjacent to Botany Road Bridge. Figure 3-1, Figure 3-2, Figure 3-3 and Figure 3-4 show the locations of these potential sites.

These proposed site compounds will be utilised for temporary material storage, temporary machinery staging, workforce parking and site offices. Operation of the compounds would last throughout construction i.e. intermittently over a period of approximately 36 months and include standard construction hours and six rail possessions.

Compound operation generally has no requirement for noise intensive equipment.

3.8. PROPERTY REQUIREMENTS

Property acquisition is not expected for this proposal. If the potential site compound location adjacent to Botany Road (refer to Figure 3-1) is required, ARTC would seek agreement from Transport for NSW (TfNSW) (formerly Roads and Maritime Services) as the owner of the land prior to commencement of activities at this site.

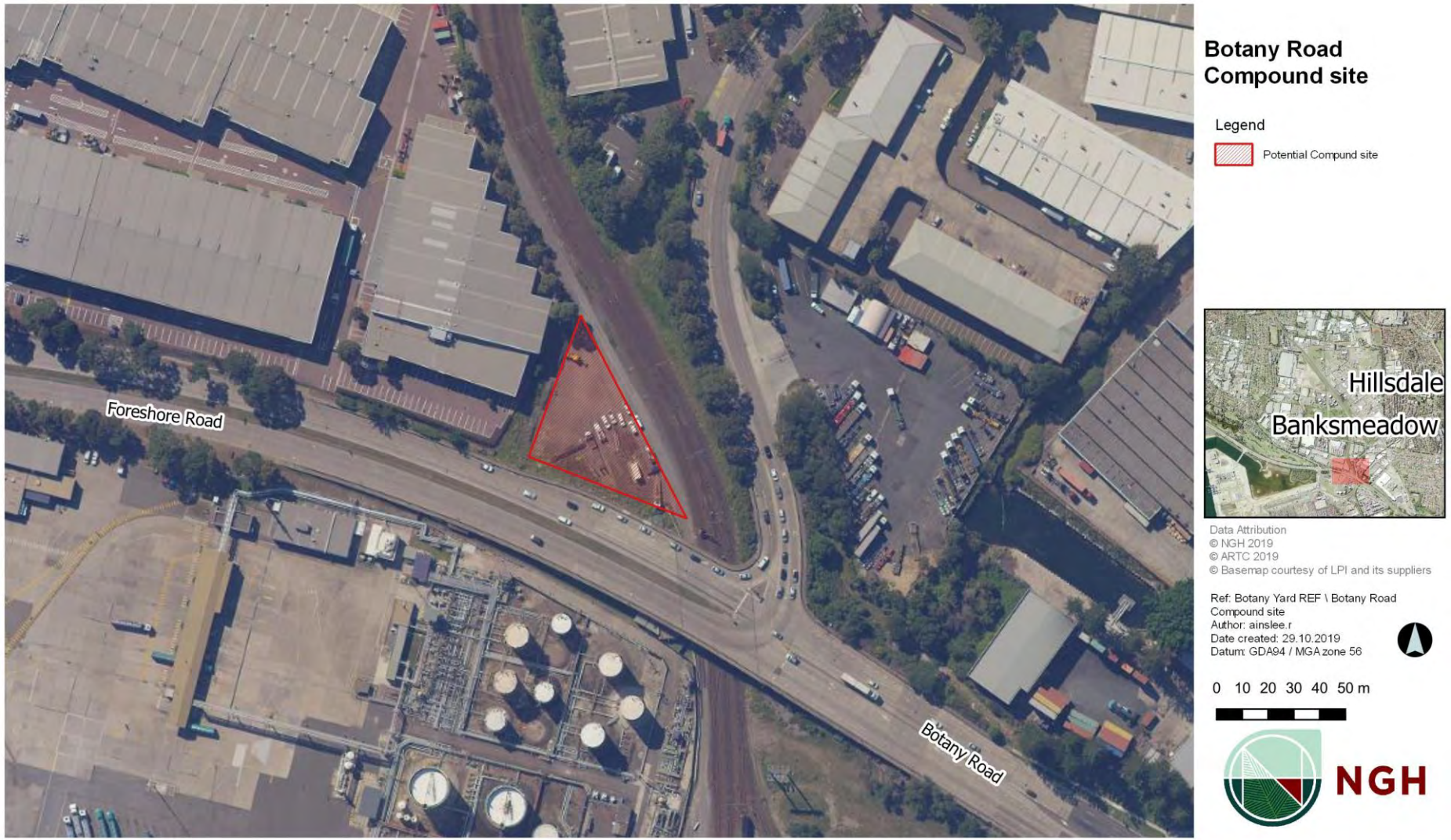

Figure 3-1 Potential Ancillary site adjacent to Botany Road

Figure 3-2 Potential Ancillary site near McPherson Street access gate

Figure 3-3 Potential Ancillary site near Swinbourne Street access gate

Figure 3-4 Potential Ancillary site near Banksia Street access gate (would may used concurrently by BRD project)

4. LEGAL AND POLICY REQUIREMENTS

4.1. PLANNING APPROVAL PROCESS

The Planning Approval process is summarised here and the legal permissibility of the project and around that process is further detailed in Section 4.2 below.

Part 5, Division 5.1 of the EP&A Act imposes environmental assessment obligations on determining authorities, which are usually public authorities and statutory state-owned corporations, but also include other specified agencies such as local government authorities. Part 5, Division 5.1 applies to activities (as defined in Section 5.1) that:

- are to be carried out by a Minister or public authority; or
- are to be carried out on behalf of a Minister or public authority; or
- which require the approval of a Minister or public authority.

Schedule 3 of *State Environmental Planning Policy (State and Regional Development) 2011* clarifies that development for the purpose of rail infrastructure by or on behalf of ARTC is State significant infrastructure (SSI) if the development has a capital investment value of more than $50 million. The capital investment of this Proposal is approximately $18 million, well below the $50 million threshold, and is therefore not SSI.

This Proposal is permitted without development consent under Clause 79 of the Infrastructure SEPP and as such the Proposal is assessed under Part 5, Division 5.1 of the EP&A Act. Accordingly, ARTC is both the proponent and the determining authority.

Under Section 5.5 of the EP&A Act, ARTC is responsible for assessing the impacts of its activities. This REF presents an assessment of the potential environmental impacts associated with the Proposal. Clause 228 (2) of the EP&A Regulation identifies the factors that must be considered. These factors are summarised in Appendix D. As per the Code of Practice (Australian Rail Track Corporation, 2016), this proposal falls within a class 4 assessment, triggering the requirement for the preparation of an REF.

4.2. LEGAL PERMISSIBILITY

The following section identifies the applicable local and regional planning instruments, the relevant State and Commonwealth environment and planning legislation, and discusses the relevant planning approval process applicable to the Proposal.

Law, Policy or Regulation	Objective	Requirement for the proposal
State Law		
Environmental Planning and Assessment Act 1979 **(EP&A Act)**	Provides for a co-ordinated approach to development ensuring the proper management, development and conservation of natural and cultural resources and promoting social and economic welfare and a better environment.	ARTC is prescribed as a public authority in relation to development for the purposes of rail infrastructure facilities, development in or adjacent to rail corridors and development for prescribed railways or railway projects that is permitted without consent by a public authority under the Infrastructure SEPP. ARTC is a public authority for the purpose of rail infrastructure facilities as per clause 277 of the EP&A Regulation and clause 5 of the Infrastructure SEPP. This REF has been completed under Part 5, Division 5.1 of the EP&A Act and aims to address ARTC's duty in respect to considering the environmental impact of the proposed activities under Section 5.5 of the EP&A Act and Section 228 of the Environmental Planning and Assessment Regulation 2000. **ARTC is both the proponent and the determining authority for this proposal.**
Environmental Planning and Assessment Regulation 2000	The Regulation supports the NSW planning system by guiding processes, plans, public consultation, impact assessment and decisions made by local councils, Department of Planning, Industry and Environment and other agencies.	Under clause 244(f) ARTC was required to prepare a Code and make an application to the Planning Secretary for approval of the Code. The resulting document, 'Code of Practice for Environmental Impact Assessment of Development Proposals in NSW' (Australian Rail Track Corporation, 2016) has been referenced in the preparation of this REF.
State Environment Planning Policy (Infrastructure) 2007 **(ISEPP)**	The ISEPP aims to facilitate the effective delivery of infrastructure across the State. The ISEPP includes provisions for developments which may be carried out by, or on behalf of, a public authority without the requirement for consent.	Under Clause 79(2) of Division 15 of ISEPP, development for the purpose of the railways and rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. The proposal meets the definition of 'railway infrastructure facilities' under clause 79 of the ISEPP.

Law, Policy or Regulation	Objective	Requirement for the proposal
		ARTC is a public authority for the purpose of rail infrastructure facilities as per clause 277 of the EP&A Regulation and clause 5 of the Infrastructure SEPP.
State Environment Planning Policy (State Significant Precincts) 2005 **(State Significant SEPP)**	The State Significant SEPP (formerly the State Environmental Planning Policy (Major Development) 2005) aims to; a) facilitate the development, redevelopment or protection of important urban, coastal and regional sites of economic, environmental or social significance to the State to facilitate the orderly use, development or conservation of those State significant precincts for the benefit of the State; b) facilitate service delivery outcomes for a range of public services and to provide for the development of major sites for a public purpose or redevelopment of major sites no longer appropriate or suitable for public purposes.	The Botany Bay Local Environmental Plan 2013 lists part of the proposal site as residing within a Major Development SEPP zoned area. The Major Development SEPP has now been replaced with the State Significant SEPP, and the area is not zoned under this SEPP. **Therefore, no assessment is required under this SEPP.**
State Environmental Planning Policy – (Koala Habitat Protection) 2019 (Koala Habitat Protection SEPP)	This SEPP encourages the conservation and management of natural vegetation that provides habitat for Koalas. Koalas are listed under the BC Act as a vulnerable species. The Koala Habitat Protection SEPP applies to each local government area listed in Schedule 1. Activities assessed under Part 5 of the EP&A Act are not subject to the Koala Habitat Protection SEPP. Koalas and their habitats are assessed under the BC Act.	**The Bayside (formerly Botany Bay) local government area is not listed under Schedule 1 of Koala Habitat Protection SEPP.**
Biodiversity Conservation Act 2016	The purpose of the *Biodiversity Conservation Act 2016* is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. This Act was enacted on 25 August 2017.	A search of the OEH BioNet database was undertaken in October 2019. The potential for the proposal to impact threatened species, populations and endangered ecological communities is assessed in section 6.2 and the Biodiversity Assessment Appendix A. The assessment determined that the proposal would not have a significant impact on threatened species or ecological communities, and an EIS or SIS is not required. **Section 6.2 and the Biodiversity Assessment in Appendix A addresses impacts relating biodiversity.**
Biosecurity Act 2015	The primary object of the *Biosecurity Act 2015* is to provide a framework for the prevention, elimination and minimisation of	ARTC has a general biosecurity duty under Part 3 of this Act.

Law, Policy or Regulation	Objective	Requirement for the proposal
	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. The biosecurity framework and tools safeguard our economy, environment and community and Any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about.	**Section 6.2 and the Biodiversity Assessment in Appendix A addresses impacts relating to priority weeds.**
Heritage Act 1977	The *Heritage Act 1997 p*rovides for the protection of non-indigenous heritage. Section 148 requires notification to the Heritage Branch of any discovery of relics.	No permits under the Heritage Act are required for the proposal. **Section 6.8 addresses impacts associated with non-Aboriginal heritage.**
National Parks and Wildlife Act 1974	The objectives of the *National Parks and Wildlife Act 1974* (NPW Act) are to conserve and preserve nature; conserve objects, places or features (including biological diversity) of cultural value within the landscape; foster public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation; and provide for the management of land reserved under this Act.	**Section 6.7 of this REF assesses the potential for the proposal to impact on Aboriginal heritage.**
Roads Act 1993	The objectives of this Act are to; (a) to set out the rights of members of the public to pass along public roads, and (b) to set out the rights of persons who own land adjoining a public road to have access to the public road, and (c) to establish the procedures for the opening and closing of a public road, and (d) to provide for the classification of roads, and (e) to provide for the declaration of RMS and other public authorities as roads authorities for both classified and unclassified roads, and (f) to confer certain functions (in particular, the function of carrying out road work) on RMS and on other roads authorities, and (g) to provide for the distribution of the functions conferred by this Act between RMS and other roads authorities, and (h) to regulate the carrying out of various activities on public roads.	The proposal is likely to generate a negligible temporary increase in local traffic during the construction phase. In the operational phase, there will be no increase in local traffic compared to the current condition.

Law, Policy or Regulation	Objective	Requirement for the proposal
Protection of the Environment Operations Act 1997	The POEO Act is the primary legislation regulating pollution control and waste disposal in NSW. It establishes a structure for regulating polluting activities through Environment Protection Licences (EPLs). Activities listed under Schedule 1 of the POEO Act are scheduled activities which require an EPL. Railway systems activities, including site upgrade works, is listed as a scheduled activity under Schedule 1 of the POEO Act.	Schedule 1 of the POEO Act describes activities for which an EPL is required. ARTC currently holds EPL 3142 for the scheduled activity of railway systems activities.
Water Management Act 2000	The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of the State's water for the benefit of both present and future generations. The Act controls the extraction and use of water, the construction of water bodies such as weirs and dams and any activity that is in or near water sources in NSW. Construction that is located within the 40m prescribed distance of waterfront land requires a controlled activity approval.	ARTC have an exemption from Controlled Activity Approval (CAA) under Schedule 4, Part 2, clause 37 of the Water Management (general) Regulation 2018. The proposal site is not within 40 metres of prescribed waterfront land.
Contaminated Land Management Act 1997	The objectives of this act are; • to set out accountabilities for managing contamination if the EPA considers the contamination is significant enough to require regulation under Division 2 of Part 3, and • to set out the role of the EPA in the assessment of contamination and the supervision of the investigation and management of contaminated sites, and • to provide for the accreditation of site auditors of contaminated land to ensure appropriate standards of auditing in the management of contaminated land, and • to ensure that contaminated land is managed with regard to the principles of ecologically sustainable development.	The proposal is located within an area of known contamination due to its historical and current uses as a rail yard and being located adjacent to the Botany Industrial Park (BIP). **Section 6.1 of this REF addresses contamination associated with the proposal.**
Work Health and Safety Regulation 2017	The *Work Health and Safety Regulation 2017* sets out a framework for managing asbestos in the workplace including;	Chapter 8 of the act informs the regulations and procedures for working with asbestos. The Kellogs siding is registered on the ARTC

Law, Policy or Regulation	Objective	Requirement for the proposal
	• Training for workers who are likely to come into contact with asbestos, • Removing asbestos materials, • Requirements under licensing for asbestos assessors and removal, and • Managing naturally occurring asbestos	contaminated land database as being in an area with potential asbestos containing materials. Section 6.1 of this REF addresses contamination associated with the proposal.
Commonwealth Law		
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) regulates the assessment and approval of activities that would have or is likely to have a significant impact on Matters of National Environmental Significance (MNES), activities by Commonwealth government agencies and activities by any person on Commonwealth land. Currently MNES include: • World Heritage properties • National Heritage places • Wetlands of international importance (listed under the Ramsar Convention) • Nationally listed threatened species and ecological communities, migratory species (protected under international agreements) • Commonwealth marine areas • Great Barrier Reef Marine Park • Nuclear actions (including uranium mines) A water resource, in relation to coal seam gas development and large coal mining development.	An EPBC Act protected matters search was undertaken in October 2019. An assessment of the impacts of the proposal determined that the proposal does not constitute an activity which may have a significant adverse impact on any MNES nor commonwealth land. **A referral under the EPBC Act is therefore not required.**
Airports Act 1996	The objects of this Act are; 1. to promote the sound development of civil aviation in Australia;	Under section 183(1) of the Airports Act 1996, a person must not; a) carry out a controlled activity in relation to prescribed airspace; or

Law, Policy or Regulation	Objective	Requirement for the proposal
	2. to establish a system for the regulation of airports that has due regard to the interests of airport users and the general community; 3. to promote the efficient and economic development and operation of airports; 4. to facilitate the comparison of airport performance in a transparent manner; 5. to ensure majority Australian ownership of airports; 6. to limit the ownership of certain airports by airlines; 7. to ensure diversity of ownership and control of certain major airports; 8. to implement international obligations relating to airports.	b) cause to be carried out a controlled activity in relation to prescribed airspace; unless: c) carrying out the activity is in accordance with an approval granted under regulations made for the purposes of this Division; or d) the activity is declared by the regulations to be exempt from this Division. **The proposal works require the use of a crane (a controlled activity) within prescribed airspace, and therefore a crane permit to operate would be required if the crane infringes the obstacle limitation surface.**
Airports (Protection of Airspace) Regulations 1996	The object of these Regulations is to establish a system for the protection of airspace at, and around, airports in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of airports.	Under section 7(1) of the *Airports (Protection of Airspace) Regulations* 1996, the proponent of a controlled activity must obtain approval of the secretary. The application for approval must be given to; a) if there is an airport-operator company for the airport—the company; b) if there is no airport-operator company for the airport—the Secretary. Use of a crane is a controlled activity in a prescribed airspace and as such approval is required from the airport-operator company.
Local Law		
Botany Bay Local Environmental Plan 2013 (Botany Bay LEP)	The Botany Bay LEP aims to; • to recognise the importance of Botany Bay as a gateway to Sydney, given its proximity to Sydney (Kingsford Smith) Airport and Port Botany, • to encourage sustainable economic growth and development,	The proposal is located within the Botany Bay LGA on land to which the Botany Bay LEP applies. The proposal would be within land zoned SP2 – Infrastructure, IN1 – General Industrial and SP2 – Infrastructure (Appendix C). Under Clause 79(2) of Division 15 of the Infrastructure SEPP, development for the purpose of the railways and rail infrastructure facilities may be carried out by or on behalf of a public authority without

Law, Policy or Regulation	Objective	Requirement for the proposal
	• to provide direction concerning growth and change in Botany Bay, • to identify and conserve those items and localities that contribute to the local built form and the environmental and cultural heritage of Botany Bay, • to protect and enhance the natural and cultural landscapes in Botany Bay, • to create a highly liveable urban place through the promotion of design excellence in all elements of the built environment and public domain, • to protect residential amenity.	consent on any land. This proposal is being assessed and determined under Part 5, Division 5.1 of the EP&A Act.
Randwick Local Environmental Plan 2012 (Randwick LEP)	The Randwick LEP aims to; • to foster a liveable city that is accessible, safe and healthy with quality public spaces and attractive neighbourhoods and centres, • to support a diverse local economy and business and employment opportunities for the community, • to support efficient use of land, vibrant centres, integration of land use and transport, and an appropriate mix of uses, • to achieve a high standard of design in the private and public domain that enhances the quality of life of the community, • to promote sustainable transport, public transport use, walking and cycling, • to facilitate sustainable population and housing growth, • to encourage the provision of housing mix and tenure choice, including affordable and adaptable housing, that meets the needs of people of different ages and abilities in Randwick, • to promote the importance of ecological sustainability in the planning and development process,	The proposal is located within the Randwick LGA at the southern extent of the proposal, on land to which the Randwick LEP applies. The proposal would be within land zoned SP2 – Infrastructure, IN1 – General Industrial and SP1 – Special Activities (Appendix C). Under Clause 79(2) of Division 15 of the Infrastructure SEPP, development for the purpose of the railways and rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. This proposal is being assessed and determined under Part 5, Division 5.1 of the EP&A Act.

Law, Policy or Regulation	Objective	Requirement for the proposal
	• to protect, enhance and promote the environmental qualities of Randwick, • to ensure the conservation of the environmental heritage, aesthetic and coastal character of Randwick, • to acknowledge and recognise the connection of Aboriginal people to the area and to protect, promote and facilitate the Aboriginal culture and heritage of Randwick, • to promote an equitable and inclusive social environment, • (m) to promote opportunities for social, cultural and community activities.	

4.3. ARTC ENVIRONMENT PROTECTION LICENCE 3142

EPL 3142 authorises ARTC to carry out the scheduled activity of 'railway systems activities' on the rail network except for;

- the construction of new track in the network in the metropolitan area greater than 3 kilometres in length, including associated ancillary works; and
- the construction of new track in any other area greater than 5 Kilometres in length, including associated ancillary works.

As the proposal does not involve the construction of new track greater than 3 kilometres in length, EPL 3142 applies to this proposal If another EPL applies to the proposal, the provisions of the relevant EPL would prevail.

5. CONSULTATION

5.1. COMMUNITY CONSULTATION

The approach to consultation for the Proposal aims to encourage stakeholder and community involvement and foster interaction between stakeholders, the community and the project team. The following consultation approach, having regard to the requirements of the planning process ensures that stakeholders, customers and the community are informed of the Proposal and have the opportunity to provide input.

The objectives of consultation are to:

- provide information about the Proposal and REF process to relevant stakeholders
- raise awareness of the various components of the Proposal and the specialist environmental investigations
- ensure that the directly impacted community is aware of the REF and consulted where appropriate
- provide opportunities for stakeholders and the community to express their view about the Proposal
- understand and access valuable local knowledge from the community and stakeholders
- record the details and input from community engagement activities .

Consultation with the community and stakeholders was undertaken on this REF in accordance with the Code of Practice (Australian Rail Track Corporation, 2016). The REF was publicly displayed for a period of 14 days from Monday 18 May 2020 to midnight Sunday 31 May 2020.

In light of the current Government COVID-19 restrictions in place at the time of preparing this REF, display of this REF in a public location and face-to-face information sessions was not possible. Additionally, local newspapers have ceased operating.

The following consultation mechanisms were adopted during display of the REF:

- Notification flyer delivered to almost 4,000 properties around the proposal site. A copy of the notification flyer is shown inFigure 5-1, Figure 5-2, Figure 5-3 and Figure 5-4.
- Notification email to Bayside Council, Randwick Council and NSW Ports
- Project webpage available with project information, details on the call back service and the virtual drop-in community session and how to provide feedback (http://www.artc.com.au/projects/botany-yard-signalling-project/)
- Information on the project available in the Port Botany Community Consultative Committee Community Report (May 2020) – this was provided as an email update in lieu of community meeting due to COVID-19 restrictions
- Information on the project available on the Bayside Advocacy webpage (https://haveyoursay.bayside.nsw.gov.au/advocacy-hub?page=1)
- Call back service available from Monday-Wednesday between 8am and 5:30pm
- Virtual community drop in session (via Zoom) on Wednesday 27 May from 4pm to 6:30pm

During the display period feedback from the community was also able to be submitted in the following ways:

- Mail: GPO Box 14, Sydney 2001
- Email: enviroline@artc.com.au

Outcomes of the display period were;

- No community members requested the call back service
- One community member attended the virtual community drop in session
- Four community members requested to be registered for ARTC's Project E-News which will provide project updates

- Four submissions were received from the community via email

ARTC will take into account the feedback received during the public display period prior to determination of the Proposal.

Following determination, the community and interested stakeholders will be kept informed of the Proposal's progress.

Botany Yard Bi-Directional Signalling

ARTC

We want to hear from you

Botany Line viewed towards the Banksia Street pedestrian bridge

The amount of freight passing through Port Botany is scheduled to significantly increase over the coming years. Investment in both road and rail around Port Botany is required to support this growth. The Botany Yard Bi-Directional Signalling Project is just one of the Australian Government initiatives to improve the movement of freight on Sydney's rail freight network.

Port Botany, New South Wales' largest container port by volume, is a key transport asset that provides essential international connectivity to businesses and the wider community. Ambitious targets are in place to increase the percentage share of freight moved by rail. Using rail, together with trucks, to move the goods for all Sydneysiders who rely on containerised freight for our everyday needs will reduce the growth of trucks on Sydney's road network.

The ability to move freight by rail to and from Port Botany is constrained by a number of issues. The Botany Yard Bi-Directional Signalling is just one of the projects aiming to improve the operational efficiency of train movements on the Botany Line.

The proposal

The Australian Rail Track Corporation (ARTC) manages the freight rail line through Port Botany and seeks to undertake signal and track works, referred to as 'the proposal'.

Key features of the proposal include:

- New signalling infrastructure to accommodate bi-directional train movements including new cable routes, signal huts and signal posts
- Removal of an existing dis-used siding connection
- Motorising manual points at Gelco siding.

The location of the proposal is between Banksia Street, Botany, and Port Botany, as shown overleaf.

View the Review of Environmental Factors

You can view the document online at artc.com.au/projects/botany-yard-signalling-project/

To view a hard copy of the document, please phone or email us using the details overleaf.

Community Notification | May 2020

Figure 5-1 Community consultation flyer page 1

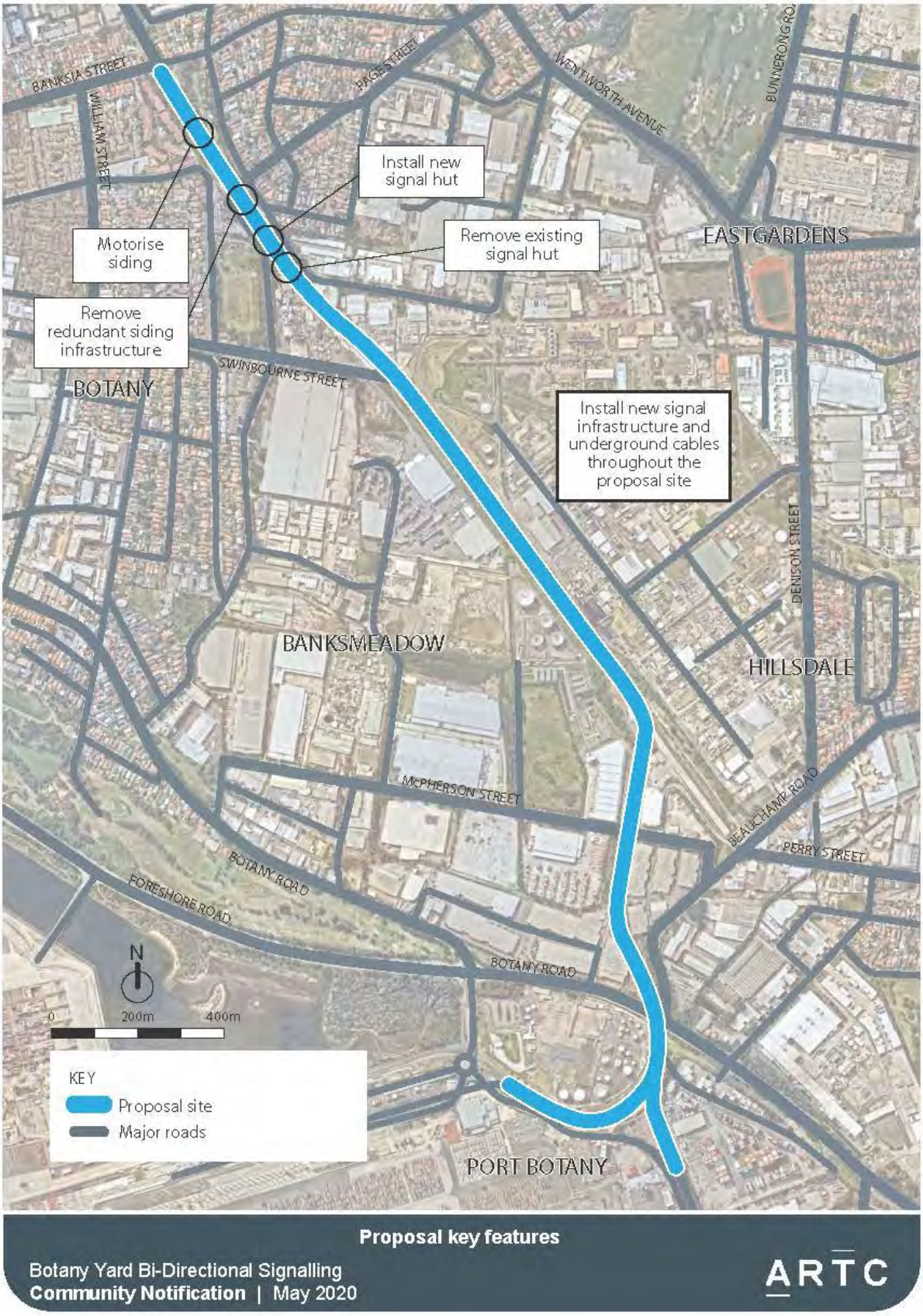

Figure 5-2 Community consultation flyer page 2

ARTC

Protecting our environment

A Review of Environmental Factors (REF) has been prepared to assess the potential environmental impacts of the proposal. The REF is now on display for public information and comment. The REF explains the proposed work, options considered, potential impacts and the management measures to minimise potential impacts.

Above - The planning approval process

ARTC is seeking feedback on the Botany Yard Bi-Directional Signalling Project REF. See details overleaf on where to view the report and how to provide your feedback.

How will the project be delivered?

Construction is anticipated to start in 2022 and intermittently take around three years to complete. Work would be carried out infrequently across this period, when trains either aren't operating over a few weekends a year, or when freight traffic demand is low, for example early morning.

Where possible, work would occur during the following standard construction hours:

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

However, work outside of these hours would also be required to maintain freight movements to and from Port Botany, while protecting our workers and infrastructure. The REF includes proposed mitigation measures to minimise impacts during construction. We will provide advanced notice of any out of hours work.

Above - Botany Yard, facing the Port connection

Community Notification | May 2020

Figure 5-3 Community consultation flyer page 3

ARTC

We want to hear from you

The Review of Environmental Factors is on public display from Monday 18 May to Sunday 31 May 2020. We invite you to provide feedback during this consultation phase.

Feedback received during the public display will help ARTC understand what is important to the community, and help in preparing plans for managing impacts during construction.

Please provide your feedback in writing via:

- Email to enviroline@artc.com.au
- Post to GPO Box 14, Sydney 2001

Please provide feedback by **midnight on Sunday 31 May 2020**.

Want to know more?

We are hosting virtual community information sessions with a drop-in session and call back service to provide you with an opportunity to ask the project team questions about the project and the REF.

Virtual drop-in session

Please join us virtually on –

Wednesday 27 May 2020 between 4pm and 6:30pm.

Please phone or email us before the above time to receive the dial-in details.

Call back

Schedule a call back by visiting

https://calendly.com/botanyyard

Please be sure to leave your name and phone number so we can call you. Calls can be scheduled between Monday and Wednesday 8am to 5:30pm, during the public display period.

Despite the COVID-19 outbreak, we are continuing to plan for the future, and we have needed to make changes to our normal engagement process. While we are unable to hold an in person information session or provide a copy of the REF in a public location, we have members of the project team available to address any questions you have via the above methods or our contact details.

Above - Siding point proposed to be motorised

What happens next?

We will review and assess all feedback received during the public display period prior to determining whether or not to proceed with the proposal. Should the proposal proceed to construction, we will keep you informed throughout the construction period.

Contact us

If you have any questions, would like to view a hard copy of the REF, or would like to receive project updates, please contact:

1300 550 402

enviroline@artc.com.au

artc.com.au/projects/botany-yard-signalling-project/

Interpreter

If you need help understanding this information, please contact the Translation and Interpreting Service on 131 450 and ask them to call us on 1300 550 402.

Community Notification | May 2020

Figure 5-4 Community consultation flyer page 4

5.2. ISEPP CONSULTATION

The ISEPP requires consultation with Council or other authorities on the proposal in certain circumstances, including where Council or other authority infrastructure is affected. As identified in Table 5-1, there are no consultation requirements under the ISEPP that apply to the proposal.

Table 5-1 Assessment of items of Clauses 13 to 16 of the ISEPP

Item	Response
Clause 13 – Developments with impacts on council-related infrastructure or services	
Substantial impact on stormwater management services provided by a council?	The proposal would not have substantial impacts on council stormwater infrastructure.
Likely to generate traffic to an extent that will strain the capacity of the road system in a local government area?	The proposal would not generate substantial traffic that would strain the capacity of the road system.
Involve connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council?	The proposal does not involve connection to any part of a sewerage system owned by council.
Involve connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council?	The proposal does not involve connection to or use of substantial volume of water from a water supply system owned by council.
Involve the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor?	The proposal would not involve the installation of temporary structures or enclosing of public places under council's management. The proposal site is not accessed by the public, and as such will not disrupt pedestrian or vehicular traffic.
Involve excavation of the surface of, or a footpath adjacent to, a road for which a council is the roads authority that is not minor or inconsequential?	The proposal would not involve excavation of any footpaths or roads for which council is the roads authority.
Clause 14 Consultation with councils—development with impacts on local heritage	
Is likely to affect the heritage significance of a local heritage item, or of a heritage conservation area, that is not also a State heritage item, in a way that is more than minor or inconsequential, and is development that this Policy provides may be carried out without consent?	The proposal would not affect any items of local heritage, conservation area nor State heritage. No Statement of Heritage Impact (SOHI) is required. Notification is not required.
Clause 15 Consultation with councils—development with impacts on flood liable land	
Involves development on flood liable land and will they alter flooding patterns more than to a minor extent?	The proposal would not substantially alter flooding patterns on any flood liable land.

Item	Response
Clause 16 Consultation with public authorities other than councils	
Involves development adjacent to land reserves under the National Parks and Wildlife Act 1974 – The Department of Environment and Climate Change (now OEH)?	The proposal is not adjacent to land reserves under the NPW Act.
Involves development adjacent to a marine park declared under the Marine Parks Act 1997 – The Marine Parks Authority?	The proposal is not adjacent to a marine park declared under the MP Act.
Involves development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 - the Department of Environment and Climate Change (DPI Fisheries)?	The proposal is not adjacent to an aquatic reserve declared under the FM Act.
Involves development comprising a fixed or floating structure in or over navigable waters—the Maritime Authority of NSW?	The proposal does not involve any development in or over navigable waters.

6. ENVIRONMENTAL ASSESSMENT & MITIGATION MEASURES

6.1. SOIL, WATER AND CONTAMINATION

6.1.1. Methodology

Soil

Database searches were undertaken to identify the soil types and presence of potential acid sulfate soils (PASS) within the proposal site. These databases included ASS mapping, the EPA contaminated land record of notices for Botany Bay LGA and Randwick LGA, the NSW Government planning portal and the eSPADE database for soil profiles within the proposal area.

Water

Desktop review of publicly available information was undertaken to identify waterways within or adjacent to the proposal site, water catchments and pipelines. This included environmentally sensitive land mapping within the Botany Bay LEP, the NSW Government planning portal and aerial mapping.

Contamination

A review of the updated *Site Management Plan, Botany Rail Yards, Botany NSW* ((AECOM, 2018) (the SMP) was undertaken to assess the risk of contaminated soil and groundwater being encountered during construction and operation of the proposal.

The SMP was prepared for ARTC maintenance work only and does not include non-routine work such as this proposal. It is also noted that the SMP does not include a portion of the proposal site. However, the scope of works is similar to the activities described in section 4.2 of the SMP.

Desktop searches of the CLM Act registers and the POEO public register were also undertaken.

6.1.2. Existing environment

Soils

The proposal site crosses two soil landscapes: 'Tuggerah' at the southern end up to Swinbourne Street, and 'Disturbed Terrain' at the northern end. These soil profiles are supplied in Appendix C.4, with an overview of these two soil landscapes is provided in Table 6-1.

Table 6-1 Soil landscapes within the proposal site

Soil Landscape	Landscape Features
Tuggerah	**Landscape**: gently undulating to rolling coastal dunefields. Local relief to 20 metres, slope gradients generally 1-10%, but occasionally up to 35%. North-south oriented dunes with convex narrow crests, moderately inclined slopes and broad gently inclined concave swales. Extensively cleared open-forest and eucalypt/apple woodland.

Soil Landscape	Landscape Features
	Soils: deep (>200 centimetres) Podzols (Uc2.31, Uc2.32, Uc2.34) on dunes and Podzols/Humus Podzol intergrades (Uc2.23, Uc2.21, Uc2.3, Uc4.33) on swales. **Limitations:** extreme wind erosion hazard, non-cohesive, highly permeable soil, very low soil fertility, localised flooding and permanently high watertables.
Disturbed Terrain	**Landscape:** level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance, removal or burial of soil. Local relief <10 metres, slopes <30%. Landfill includes soil, rock, building and waste materials. Original vegetation completely cleared, replaced with turf or grassland. **Soil:** turfed fill areas commonly capped with up to 40 centimetres of sandy loam or up to 60 centimetres of compacted clay over fill or waste materials. **Limitations:** dependent on nature of fill material. Mass movement hazard, unconsolidated low wet strength materials, impermeable soil, poor drainage, localised very low fertility and toxic material.

Class 4 and 5 PASS are mapped within the rail corridor at the northern end of the proposal site (Appendix C.3). In a Class 4 area, any acid sulfate soils that may be present are likely to be found beyond 2 metres below the natural ground surface. Acid sulfate soils are not typically found in Class 5 areas.

Water

The proposal site is not within a drinking water catchment.

Wetlands are present within Sir Joseph Banks Park (approximately 1250 metres south-west of the proposal site) and adjacent to Mill Pond Drive (approximately 500 metres north/north-west of the proposal site). Under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP), the proposal site is adjacent to 'Coastal Environment Areas' and 'Coastal Use Areas' at the southern end of the proposal site. As the proposal site does not intersect these areas, no further assessment under the Coastal Management SEPP is required.

Waterways and waterbodies surrounding the proposal site are shown in Figure 6-1. The closest waterways (other than wetlands) are;

- Port Botany approximately 380 metres south-west.
- Mill Stream approximately 670 metres north of the proposal site

Drainage channels exist within the rail corridor to capture runoff from the track formation.

Contamination

The proposal is located within an area of known contamination due to its historical and current uses as a rail yard and being located adjacent to the Botany Industrial Park (BIP). Previous contamination investigations and management plans have been conducted at the proposal site by GHD (GHD, 2008) and AECOM (AECOM, 2009a, 2009b, 2009c, 2009d).

A contamination and exposure risk assessment was completed by AECOM (AECOM, 2018) which involved intrusive investigations in order to re-assess the contamination status of the area included in the updated Botany Yard Site Management Plan (SMP) and assesses the potential risks from contamination to ARTC workers and personnel using the site, which were used to inform the updated SMP.

The SMP identifies Contaminants of Potential Concern (CoPC) that have the potential to be present within the Botany Yard site due to historic and current land uses, including Monocyclic Aromatic Hydrocarbons

(BTEXN), petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), phenols, Volatile Organic Compounds (VOCs), heavy metals, pesticides, Polychlorinated Biphenyls (PCBs) and asbestos

In the AECOM (2018) investigation, concentrations of CoPCs in soils were reported at less than the Investigation Levels (ILs). Asbestos in sediments were detected above the ILs. The Kellogg Siding Removal Works are located within an area reported as containing asbestos contamination in soils. Intrusive works within the rail corridor may encounter asbestos containing materials (ACM) in filled areas such as embankments, as it is noted that sources of asbestos contamination are common on rail corridors due to fill material of unknown composition, illegal dumping of waste material, deterioration of old maintenance infrastructure and historical degradation of train brake pads. Given previous investigations of the project site has identified areas of potential asbestos containing fill, it is recommended that asbestos handling and disposal procedures are in place during intrusive works.

Groundwater is shallow (up to 0.5 m bgl), tidally influenced and susceptible to change quickly following rainfall. Concentrations of CoPCs in groundwater samples were reported at less than the ILs, where collected. However, concentrations of some volatile CoPCs (e.g. VOCs) were reported at greater than adopted screening criteria at one location in the central / southern area of the site (location MW03 as shown the SMP), consistent with the area of known contaminated groundwater plumes emanating from the BIP site. Additional database searches were undertaken in January 2020 (refer to Appendix C.5). A search of the NSW EPA section 60 register identified 16 registered sites in Banksmeadow and Botany. Of these sites, the following are currently regulated under the CLM Act;

- Nuplex Resins – 49-61 Stephen Road, Botany.
- Orica Botany Groundwater Project – 16-20 Beauchamp Road, Banskmeadow.
- Orica Botany (Pre-2003 Regulation) – Port Feeder Road, Banksmeadow.
- Orica Former Chior Alkali Plant (same site as Orica Botany Groundwater Project).
- Pacific National Rail Siding – 1 Beauchamp Road, Banksmeadow.

One site is currently regulated under the POEO Act;

- Caltex Terminal – 1-3 Penrhyn Road, Banksmeadow.

A search of the NSW EPA section 58 register found five sites within Banksmeadow and one site within Botany;

- Nuplex Resins – 49-61 Stephen Road, Botany.
- Discovery Cove, Former Ampol Rail Terminal – 1801 Botany Road, Banksmeadow.
- Former Mobil Banksmeadow Terminal – Coal Pier Road, Banksmeadow.
- Orica Botany (Pre-2003 Regulation) – Port Feeder Road, Banksmeadow.
- Orica Botany Groundwater Project – 16-20 Beauchamp Road, Banksmeadow.
- Section of ICI Southlands – McPherson Street and Nant Street, Banksmeadow.

The POEO public register identified penalty notices for five separate sites within Banksmeadow and Botany;

- Allnex Resins Australia Pty Ltd – 49-61 Stephen Road, Botany.
- Air Liquide Australia Milited – 21 Baker Street, Banksmeadow.
- Botany Buliding Recyclers Pty Limited – 38 McPherson Street, Banksmeadow.
- DGL (Aust) Pty Ltd – 2 Greenfield Street, Banksmeadow.
- United Initiators Pty Limited – 20-22 McPherson Street, Banksmeadow.

Figure 6-1 Waterways surrounding the proposal site

6.1.3. Potential impacts

Soil

Construction

Potential impacts to soils and landforms would primarily be associated with shallow excavation/trenching (1-1.5 metres for cabling and three metres for signal bases only) required to install new cable services route (CSR). The proposed excavation aims to have a cut/fill balance, whereby no excess soil would be generated, and all reusable soil would be utilised progressively as fill onsite as the CSR is installed.

Removal of groundcover associated with excavation activities and installation of signalling infrastructure would expose soils to erosive forces including water and wind for short periods of times, which can increase the risk of erosion and sedimentation and the potential for sediment laden water to migrate offsite..

Encountering PASS is possible during ground disturbance works at the northern end of the site. As per the Acid Sulfate Soil Management Advisory Committee's 'Acid Sulfate Soil Manual', any excavation in areas mapped as potentially having acid sulfate soils would require an acid sulfate soil management plan to identify if the area meets the geomorphic or site criteria for acid sulfate soils and analysis of soil and water indicators such as soil and water pH levels, waterlogged soil and presence of shell. This would form part of the construction environmental plan (CEMP).

The proposed activities are unlikely to produce large scale disturbance and exposure of soils due to the minor nature of ground disturbance activities associated with the proposal.

Signage within the rail corridor opposite Gaiarine Gardens (Figure 6-2) also indicates the proposal is located near high pressure pipelines and may be subject to the requirements under clause 66C of ISEPP should the pipeline have a license number as per clause 66C(3)a of ISEPP.

Operation

During early stages of operation there is potential for increased surface water runoff following residual soil compaction from the construction phase. Impacts are expected to be minimal given the small spatial extent of the works and stabilisation of disturbed areas following construction.

Water

Construction

Manmade drainage channels may be impacted by construction works altering the drainage formation, resulting in increased sedimentation into drainage lines. Any required ancillary drainage works would be undertaken as part of the proposal to establish new drainage lines where required.

Simultaneous construction of the proposal and the BRD project may result in collective impacts on the surrounding waterways. This is discussed in section 7.1.1.

Operation

During early stages of operation there is potential for increased surface water runoff following residual soil compaction from the construction phase. Impacts are expected to be minimal given the small spatial extent of the works and stabilisation of disturbed areas following construction.

Contamination

Construction

In the AECOM (2018) investigation, concentrations of CoPCs except for asbestos in soils were reported at less than the ILs adopted for the protection of ARTC workers and personnel based on ongoing land use. Therefore, the exposure pathways were considered incomplete and the risks to ARTC workers and personnel were assessed as low.

Asbestos was reported in a sediment sample collected from the drain within the proposal area in the form of asbestos cement debris and therefore is not ruled out that asbestos containing materials (ACM) may be present in the vicinity of the drains within the proposal area. Should ACM be identified or suspected, the ACM is to be appropriately removed and disposed of in accordance with the waste disposal safeguards and mitigation measures discussed below. There were no discernible trends in lateral, vertical and / or temporal concentrations of CoPCs in soil and therefore it should be assumed that the maximum reported concentrations of CoPCs are representative of the site.

Given that concentrations of some CoPCs were detected above the laboratory limits of reporting (LORs) in multiple samples throughout the site, there remains the potential for CoPCs to be present which could in the future exceed the ILs and these risks should be managed by appropriate controls. Appropriate measures to reduce risks associated with encountering contamination have been identified in Section 6.1.4.

Groundwater is shallow (up to 0.5 m bgl) and potentially contaminated from the Botany Industrial Park. The proposed excavation works are likely to extend to depths beyond 0.5m and are likely to intercept groundwater. Although an existing human health risk assessment for groundwater (EnRiskS 2017) indicates potential risks are low and acceptable to intrusive workers carrying out shallow excavation in the area of the main plumes associated with former Orica operations, the management measures of the SMP must be implemented.

Operation

There would be negligible impacts from contaminated soil and groundwater during operation of the proposal associated with maintenance activities within the rail corridor as these activities would be managed in accordance with the SMP.

Figure 6-2 Signage within rail corridor indicating high pressure pipeline

6.1.4. Safeguards and Mitigation Measures

Impact	Safeguards and Mitigation Measures	Timing
Asbestos	• Areas of identified or known potential asbestos containing material will require asbestos controls during intrusive works. Asbestos works shall be completed in accordance with the Code of practice for the safe removal of asbestos and site management procedures for asbestos handling and disposal shall include at a minimum asbestos air monitoring, removal of asbestos by a NSW SafeWork licenced asbestos removalist and removalist to provide an Asbestos Removal and Control Plan (ARCP). Asbestos management procedures shall be included in the site-specific Environmental Work Method Statement or Contaminated Land Management Plan for intrusive works. • NSW Safework Licenced Asbestos Assessor (LAA) to provide an Asbestos Clearance Certificate following the completion of removal.	During construction After construction
Exposure to Contaminants	• The Botany SMP should be used as a guide to prepare a site-specific Environmental Work Method Statement or Contaminated Land management plan for the scope of works including intrusive works (excavations and managing groundwater). The management plan should address: o PPE requirements o Training o Personal hygiene o Containment o Waste classification o Spoil disposal or reuse options • Potential reuse of materials is to be assessed in accordance with the National Environment Protection Measure • If previously unidentified contamination is identified the works should cease and the area be isolated so that the potential contamination can be sampled and identified by an Environmental Consultant' so this doesn't capture known contamination dealt with the Contaminated Land Management Plan or Environmental Work Method Statement. • Delineate and sign the known areas of contamination as no go zones (if contamination remains in-situ).	During construction
Soil Erosion and Sedimentation	• The proposal is to be undertaken in accordance with the requirements of Landcom's "Managing Urban Stormwater: Soils and Construction", Volume 1, 4th Edition, March 2004 (the Blue Book). • Temporarily segregate and store excavated topsoil material for reuse during site stabilisation and backfilling. • Ensure any stockpiles of excavated material or ballast and other construction materials are not stored or temporarily placed within drainage lines. and provide appropriate containment measures around the stockpiles, to prevent impact from any contaminated runoff. • Install sediment controls on the downslope side of any disturbed areas including excavated, graded and stockpile sites where erosion may result in impact to the surrounding area. • Where possible, work areas and stockpile sites and access tracks should be established in already disturbed, un-vegetated areas. • Restrict the height of stockpiles to two metres. • Temporary stockpiles shall be stabilised to prevent wind and water erosion where they are located for an extended period of time (i.e. 2 weeks). • Minimise works during and after periods of high rainfall to minimise site disturbance and sedimentation.	During construction

Impact	Safeguards and Mitigation Measures	Timing
	• Maintain and monitor erosion and sediment controls until the site is no longer at risk of erosion or sedimentation. • All disturbed areas are to be appropriately stabilised following completion of the works to prevent risk of erosion or sedimentation after construction. • At the end of each working day inspect site access locations for mud tracking and remove/clean up if present.	
Drainage	• Any negative impacts observed during construction and operation to the natural drainage system via track patrols and during works in the corridor will be reported to the Project Manager. • Do not discharge water or wastewater to stormwater, creeks, and drainage channels or into surrounding land.	During construction
Pollution	• Concrete washout, refuelling or other chemical use is to be conducted within a sign posted, designated and bunded area, and where possible, a minimum 40 metres from a watercourse or drainage channel. • Do not perform maintenance of equipment or vehicles on site. If unavoidable, conduct within a designated area and use drip trays or catch trays beneath equipment / vehicles being maintained. • Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	During construction

6.2. BIODIVERSITY

6.2.1. Methodology

A Biodiversity Assessment (Appendix A) was prepared to assess the impacts of the proposal on the surrounding biodiversity.

Background searches were undertaken including Commonwealth and State databases to determine whether any threatened flora and fauna species, populations, ecological communities, migratory species and Areas of Outstanding Biodiversity Value (AOBVs) as detailed in State and Commonwealth legislation occur or are likely to occur within the proposal site. The results are provided in the Biodiversity Assessment (Appendix A).

Table 6-2 Database searches for threatened species and communities.

Resource	Target	Search date	Search area
OEH BioNet Atlas	Threatened flora and fauna species, populations and ecological communities listed under the BC Act.	10/10/2019	10 km radius of the study area
EPBC Act Protected Matters Search	Threatened flora and fauna, endangered populations and ecological communities and migratory species.	10/10/2019	10 km radius of the study area
DPI Weed Wise	Priority weeds declared in the Hunter Region which	10/10/2019	Greater Sydney

Resource	Target	Search date	Search area
	encompasses Botany Bay and Randwick LGA.		
Bureau of Meteorology National Atlas of Groundwater Dependant Ecosystems	Vegetation communities that are likely to rely on groundwater.	10/10/2019	Locality
OEH vegetation information system (VIS) database and Vegetation Types Database	Plant Community Type (PCT) identification.	10/10/2019	Study area
DPI Fisheries NSW Spatial Data Portal	Threatened fish and freshwater fish community status.	10/10/2019	Locality

6.2.2. Field survey

A daytime site assessment of the proposal site was undertaken on the 11th of October 2019 by an NGH Ecologist, NGH Environmental Consultant and ARTC representatives. A random meander search (Cropper, 1993) was used to allow inspection of all available habitat types within the proposal site.

Criteria recorded during the site survey included:

- Native flora species and vegetation communities present
- Potential for threatened species presence identified during background searches with targeted transect surveys undertaken where suitable habitat is present
- Opportunistic fauna sightings
- Weed species present and their abundance.

6.2.3. Limitations

A thorough search of areas to be affected by the proposal was undertaken. As the flora field surveys were undertaken in early October, the flora species lists reflect plant species usually detectable during Spring. There is the potential for some flora species that were not in flower at the time of the survey to have gone undetected. However, the lists are considered sufficient to identify vegetation communities present within the proposal site and therefore to evaluate the probability of threatened flora species to occur.

Detailed habitat assessments were made within the proposal site so local occurrence of fauna could be predicted. A precautionary approach has been taken as to the likelihood of the presence of threatened species so fauna species unlikely to be detected during the time of the survey are assessed.

6.2.4. Flora

A total of 58 flora species were recorded within the study area, including 48 exotic species (83%). No threatened flora species were identified. All species recorded are included in the Biodiversity Assessment (Appendix A).

A review of existing vegetation mapping (OEH 2016) was ground-truthed using floristic data gathered within the study area. No native Plant Community Types (PCTs) are considered to occur within the proposal site due to the highly modified structure and composition of the vegetation present. Approximately 1.40 ha of

Urban/Exotic Vegetation occurs within the study area including environmental weeds and sparse regrowth of native coloniser species.

A search of the NSW BioNet database undertaken 10/10/2019 identified 26 TECs with potential to occur within the locality. Due to the lack of native PCTs within the study area, no TECs are considered present.

A search of the NSW BioNet database undertaken 10/10/2019 identified 8 threatened flora species with potential to occur within the locality. The closest threatened flora recorded in the locality is Coast Groundsel *Senecio spathulatus* which has been recorded within 5 km from the southern end of the study area.

No threatened flora species were recorded in the study area during the site survey nor are any considered to have a moderate to high likelihood of occurring.

Five (5) priority weed listed under the Greater Sydney Strategic Weed Management Plan recorded in the study area are;

- Bitou Bush
- Green Cestrum
- Fireweed
- Lantana
- Pampas Grass.

The *Biosecurity Act* dictates that all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any land managers or authorities who deal with any plant has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

A search of the Bureau of Meteorology's National Atlas of Groundwater Dependent Ecosystems (GDEs) undertaken 10/10/2019 found that vegetation within the locality has no potential for groundwater dependent interaction. This reflects the highly modified urban/industrial landscape of the locality.

A search of DPI Fisheries NSW Spatial Data Portal undertaken 10/10/2019 found that no freshwater fish habitat or threatened freshwater fish species are located in the study area or locality. Estuarine macrophytes including mangroves, saltmarsh and Zostera are mapped approximately 1 km west of the southern end of the study area. The proposed works will not have any direct or indirect impacts on these.

6.2.5. Fauna

The study area contains minimal fauna habitat due to the highly modified nature of the site and lack of native vegetation. The only fauna observed were common, highly mobile birds including Superb Fairy-wren *Malurus cyaneus* and House Sparrow *Passer domesticus** which were utilising Lantana thickets adjacent to the rail corridor. No hollow bearing trees, stags, or other habitat features are present within the study area. Potential habitat for microchiropteran bats (microbats) is present within the scuppers of the bridge towards the southern end of the study area (see Figure 4-3 above). The study area is located in a highly modified urban landscape and there is poor connectivity to vegetation outside of the rail corridor.

A NSW BioNet database search undertaken 10/10/2019 identified 48 threatened fauna species with potential to occur within the study area. The closest threatened fauna recorded in the locality are migratory shorebirds including Curlew Sandpiper *Calidris ferruginea* and Red Knot *Calidris canutus* which have been recorded within 100m of the southern end of the study area.

No threatened fauna species were recorded during the site survey. Mobile threatened species including microbats and migratory shorebirds may occasionally visit the study area to investigate potential foraging opportunities. Threatened species evaluations have been undertaken in the Biodiversity Assessment (Appendix A).

6.2.6. Potential Impacts

Construction

The proposal does not require the removal of any mature trees. Minor grubbing work may be required at previously maintained or disturbed areas. These impacts are considered negligible as only groundcover vegetation, most of which is exotic, is likely to be temporarily disturbed.

No TEC's or threatened flora species were detected during the site survey and as discussed in the Biodiversity Assessment (Appendix A) none are considered likely to occur or be impacted. Given this, no Tests or Assessments of Significance under the BC Act and/or EPBC Act have been prepared for threatened flora species.

As the proposed works will not require the removal of any significant vegetation or habitat features, habitat loss is considered negligible. The potential microbat habitat under the bridge towards the southern end of the study area will not be affected by the proposed works.

Fauna habitats to be temporarily affected during construction generally comprise common foraging resources which occur widely within the surrounding landscape and are not unique to the proposal site. Given this, no Tests or Assessments of Significance under the BC Act and/or EPBC Act have been prepared for threatened fauna species.

Wildlife injury or death could occur during the construction phase of the proposed works. Grubbing works may result in injury or death to resident fauna. Species at risk include ground dwelling snakes, lizards, and small mammals. There is also the risk of displaced fauna succumbing to predation or stress induced by competing with existing resident populations for resources including shelter habitat. This is considered a minor impact due to the lack of suitable habitat within the proposal site.

The existing rail corridor may provide a corridor for mobile fauna which utilise weed infestations on either side. The proposed works will not increase the distance between vegetation either side of the rail corridor. No further fragmentation is anticipated as a result of the proposed works.

Operation

Upon completion of the proposal, routine maintenance activities within the rail corridor would be undertaken to keep the rail corridor in a condition considered satisfactory for rail operations. This may include minor slashing of vegetation that grows within the rail corridor. Routine maintenance activities are not expected to create any cumulative flora and fauna impacts.

6.2.7. Safeguards and Mitigation Measures

Impact	Safeguards and Mitigation Measures	Timing
Clearing and prevention of over-clearing	• If clearing of vegetation is required outside the proposal site these areas will need to be assessed by an ecologist for potential impacts to TECs, threatened species and their habitats. • Trees to be retained, including trees adjacent but outside of the proposal site, require an adequate tree protection zone (TPZ) for the duration of works. Details for calculating TPZs are provided within Australian Standard 4970-2009 – Protection of trees on development sites. • If the TPZ cannot be avoided during works, the Structural Root Zones (SRZ) of trees will be retained. Details for calculating the SRZs are	During construction

Impact	Safeguards and Mitigation Measures	Timing
	provided within *Australian Standard 4970-2009 – Protection of trees on development sites*.	
Direct impact to threatened fauna	• Do not disturb fauna. Avoid fauna until it has relocated away from the site.	During construction
Direct impact to TEC and to threatened flora	• Toolbox talks will identify threatened flora that may be encountered onsite. Where unexpected threatened flora species are suspected by construction crew within the worksite the following actions would take place: o All work within the vicinity would stop and the ARTC Environmental Officer contacted. o The area containing the threatened species would be surveyed by an ecologist who would determine appropriate actions to protect any individuals if required (e.g. translocation).	During construction
Introduction and spread of noxious weeds and pathogens	• Priority weeds identified in Table 4-1 (Bitou Bush, Green Cestrum, Fireweed, Lantana, Pampas Grass) will be eliminated and prevented from spreading from the proposal site so far as is reasonably practicable. All priority weed waste will need to be disposed of at a registered waste management facility. Management and disposal of weeds, including the priority weeds will be conducted in accordance with the *Biosecurity Act 2015* and the *NSW Weed Control Handbook* (Department of Primary Industries, 2018). • All machinery (e.g. bulldozers, excavators, trucks, loaders etc.) will be cleaned prior to entering and exiting work sites. All plant material containing seed heads, weeds that have allelopathic properties, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, will be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth. • Pesticide application will be undertaken in accordance with ARTC's Pesticide Application procedure	During construction
Disturbance to woody debris and litter and bush rock	• Any fallen timber and dead wood encountered on site will be left in situ wherever possible or relocated to a suitable place nearby. Rock will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	During construction

6.3. TRAFFIC AND ACCESS

6.3.1. Existing Environment

The proposal site can be accessed from the following access gates and tracks:

- Banksia Street access gate
- Swinbourne Street access gate
- McPherson Street access gate
- Penrhyn Road access gate
- Ocean Street access gate

All access gates are located along local roads managed by Bayside Council. No residential driveways or access paths occur in the proposal site.

The existing road network in vicinity of the proposal site consists of local roads utilised by residents and industrial businesses. These local roads connect to Botany Road, Wentworth Avenue and Foreshore Road which link to Southern Cross Drive as a motorway connecting to other motorways within the Sydney area.

Traffic counts from Transport for NSW (Transport for NSW, 2019) in 2019 identified that an average of 51,712 vehicles use Wentworth Avenue near Southern Cross Drive daily.

6.3.2. Potential Impacts

Construction

Construction would take place across a 36-month period. During this time construction vehicles would contribute to a minor increase in traffic along local roads from the arrival and departure of workers (typically between 5-10 workers during standard working hours), particularly Banksia Street, Swinbourne Street, McPherson Street, Penrhyn Road and Ocean Street where access to site is available, potentially causing disruptions for local traffic. These increases would be a result of deliveries of materials and equipment, movement of workers to and from site during standard working hours throughout the week and on weekends during possessions.

A large portion of construction materials and equipment would be kept in site compounds on site to reduce the amount of construction traffic each day. No requirements for road closures or detours have been identified for the proposal.

Construction for the BRD project and this proposal will occur concurrently, and may include the shared use of the Banksia Street compound, creating potential for additional impact on the local road network utilised for construction vehicles associated with both projects. A discussion of cumulative impacts from the construction of both projects is provided in section 7.1.3.

During construction there may be a slightly increased risk of vehicle accidents resulting from collision with construction machinery and other traffic. This impact is manageable through ARTC's fatal and severe risk program and worker training.

During weekend rail possessions, the line will be closed to perform works that cannot be conducted on an active rail line for worker and infrastructure safety reasons. Any works to occur outside of possessions will be undertaken with safe working in place such as a track occupancy authority (TOA) or controlled signal blocking (CSB). These works will be planned so as to limit impacts to train schedules. There may be a more noticeable increase in vehicle movements on local roads during these times as larger work crews will be required to ensure the full program of works can be completed during the possession period.

Overall, impacts to traffic and access are considered to be low given during standard working hours there will be between 5-10 workers arriving and departing from the site and infrequent deliveries using existing access gates and routes. Potential traffic and access impacts are considered highly manageable with the implementation of the environmental safeguards and mitigation measures detailed below.

Operation

It is anticipated that ARTC maintenance vehicles would be required to access the site on an ongoing basis throughout the operational life of the Botany Line. Potential impacts associated with maintenance vehicles are considered to be low as the vehicles would be travelling along existing access roads and routes. No other impacts to access are expected during operation as a result of the proposal.

6.3.3. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Traffic	• All heavy vehicles will travel within daylight hours where feasible. For road safety purposes, it will be necessary to undertake some deliveries out of hours. Additional measures for heavy vehicles will include: o Administrative controls to limit truck activities during peak periods. o Implement radio communication and designated truck idling areas to minimise impact of truck queuing on public roads o Temporary traffic controls. • When on site, vehicles will park within designated areas or cleared areas without vegetation. • Provide suitably designed construction site access which will consider: o Road design guidelines o Visible temporary regulatory, warning and guide signs o Use of accredited traffic controllers where appropriate	Pre-construction/ construction

6.4. NOISE AND VIBRATION

A noise and vibration assessment was completed by SLR Consulting (SLR) for the proposal in April 2020 and is summarised below. Refer to Appendix D for details including the SLR assessment methodology.

6.4.1. Existing Environment

Existing noise levels in the vicinity of the project site are generally dominated by transportation noise, with road, rail and aircraft noise affecting most locations during the daytime. During the evening and night-time ambient noise levels typically decrease due to a reduction in road traffic volumes on the surrounding road network. There is also a curfew on flights at Sydney Airport from 11 pm to 6 am.

The SLR assessment applied six Noise Catchment Areas (NCAs) that reflect the land uses in the study area. These are shown in Figure 6-3 and described in Table 6-3 below.

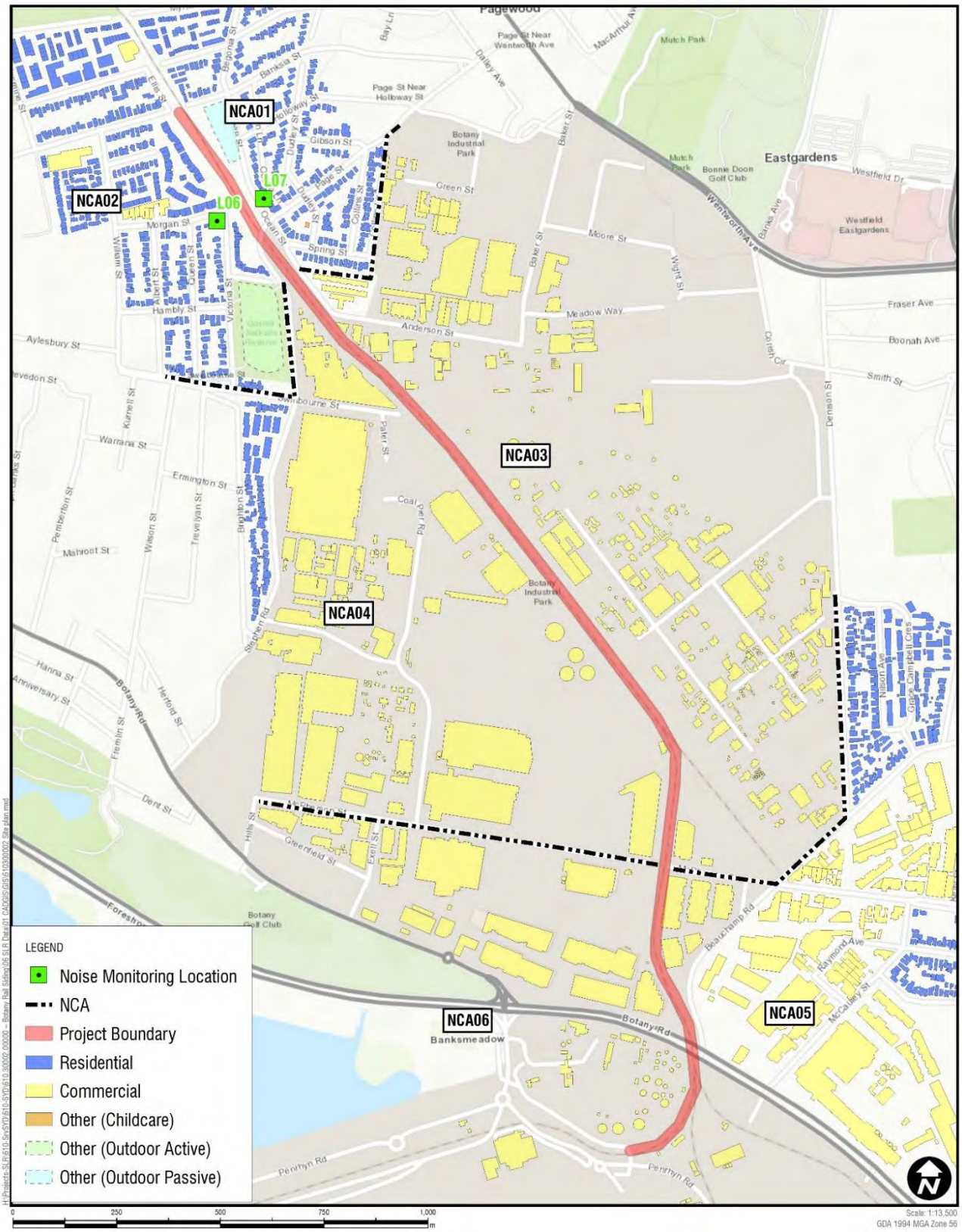

Figure 6-3 Project location, receivers and monitoring locations

Table 6-3 NCAs and surrounding land uses (SLR, 2020)

NCA	Description
NCA01	Located to the east of the rail corridor in Pagewood. This catchment is generally residential with the nearest receivers being adjacent the project on Myrtle Street, Banksia Street and Ocean Street.
NCA02	Located to the west of the rail corridor in Botany. This catchment is mainly residential with the nearest receivers being adjacent the project on Ellis Street, Morgan Street and Victoria Street.
NCA03	Located to the east of the project in Banksmeadow. This catchment is entirely commercial or industrial use.
NCA04	Located to the west of the project in Banksmeadow. This catchment is entirely commercial or industrial use.
NCA05	Located to the south of the project in Hillsdale, Matraville and Banksmeadow. This catchment is mostly commercial or industrial, with distant residential receivers in Hillsdale and Matraville.
NCA06	Located to the south-west of the project in Banksmeadow. This catchment is entirely commercial or industrial use associated with Port Botany.

Table 6-4 Nearby non-residential sensitive receivers (SLR, 2020)

NCA	Description	Address	Type
NCA01	Kiddie Cloud Early Learning Centre	1A Dudley Street, Pagewood	Child care
	Gaiarine Gardens	Ocean Street, Pagewood	Outdoor passive
NCA02	Garnet Jackson Reserve	Victoria Street, Botany	Outdoor active

As can be seen in Figure 6-3, the majority of the project to the south is located in commercial and industrial receiver areas, which do not require rating background level (RBL) monitoring as noise criteria for industrial and commercial are absolute levels. The project area inclusive of residences, schools and other potentially sensitive areas is heavily urbanised being located in close proximity to a number of major existing road and rail transportation corridors, including Sydney Kingsford Smith Airport which is located to the south west of the project.

To establish background noise levels, noise monitoring was undertaken by SLR in the BRD study area in June 2018 as part of the adjoining Botany Rail Duplication project. Two previously logged monitoring locations were deemed representative for this project as per Figure 6-3. Refer to Table 6-5 for the results of unattended noise monitoring.

Table 6-5 Summary of unattended noise monitoring results from 19 June to 2 July 2018 (SLR, 2020)

ID	Address	Measured Noise Level (dBA)[1]					
		Background Noise (RBL)			Average Noise Level (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L06	13 Morgan Street, Botany	39	39 (41 actual)[2]	37	56	53	51
L07	38 Ocean Street, Pagewood	46	46	43	58	54	54

Note 1: Daytime is 7.00 am to 6.00 pm, evening is 6.00 pm to 10.00 pm and night-time is 10.00 pm to 7.00 am.

Note 2: The monitored evening level was found to be higher than the daytime, therefore the NPfI requires that the evening level be reduced to match the daytime level.

Results from Table 6-5 indicate that the ambient noise environment at the monitoring locations are influenced by distant road traffic and industrial noise. Frequent light-vehicle pass-bys on Morgan and Ocean Street and aircraft flyovers also contribute to the noise levels at these locations.

Measurements from unattended monitoring were generally found to be consistent with the results of the unattended monitoring (Table 6-5) and show that existing noise levels are typically dominated by transportation sources including road, rail and air noise, depending on location and time of day.

6.4.2. Approach

Guidelines used to assess construction impacts as a result of the project are listed in Table 6-6 and summarised below.

Table 6-6 Construction noise and vibration guidelines relevant to the project

Guideline/Policy Name	Where Guideline Used
Interim Construction Noise Guideline **(DECC, 2009) (ICNG)**	Assessment of airborne noise and ground-borne noise impacts on sensitive receivers
Assessing Vibration: a technical guideline **(DEC, 2006)**	Assessment of vibration impacts on sensitive receivers
Road Noise Policy **(DECCW, 2011) (RNP)**	Assessment of construction traffic impacts
BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2**, BSI, 1993**	Assessment of vibration impacts (structural damage) to non-heritage sensitive structures
DIN 4150:Part 3-2016 Structural vibration – Effects of vibration on structures**, Deutsches Institute fur Normung, 1999**	Screening assessment of vibration impacts (structural damage) to heritage sensitive structures, where the structure is found to be unsound

Residential Receivers

The NSW *Interim Construction Noise Guideline* (DECC, 2009) (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated. The ICNG approach for determining NMLs at residential receivers is shown in Table 6-7 below.

Table 6-7 ICNG NMLs for residential receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm	RBL + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises 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.

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
No work on Sundays or public holidays	Highly Noise Affected 75 dBA	• The Highly Noise Affected (HNA) 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 restructuring the hours that the very noisy activities can occur, taking into account: o Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences. o If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Standard Construction Hours	RBL + 5 dB	• 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. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

Works are recommended to be completed during Standard Construction Hours where possible. More stringent requirements are placed on works that are required to be completed outside of Standard Construction Hours (ie during the evening or night-time) which reflects the greater sensitivity of communities to noise impacts during these periods.

Sleep Disturbance

Major infrastructure projects in urban areas often require certain works to be completed during the night-time due to a range of constraints. Where night works are located close to residential receivers there is potential for sleep disturbance.

The ICNG lists five categories of works that might be undertaken outside of Standard Construction Hours:

- The **delivery of oversized equipment or structures** that require special arrangements to transport on public roads
- **Emergency work** to avoid the loss of life or damage to property, or to prevent environmental harm
- **Maintenance and repair of public infrastructure** where disruption to essential services or considerations of worker safety do not allow work within standard hours
- **Public infrastructure works** that shorten the length of the project and are supported by the affected community
- Works where a proponent demonstrates and justifies **a need to operate outside the recommended standard hours**.

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed.

A method for assessing sleep disturbance is contained in the NPfI. Although the NPfI sleep disturbance criteria relates to industrial noise, they are considered relevant for reviewing potential impacts from construction noise. The NPfI defines external sleep disturbance criteria as being:

- 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is the greater.

For this assessment, the existing background level plus 15 dB approach has been used. As per the NPfI, the assessment should consider several factors contributing to sleep disturbance including the number of times the criterion is exceeded, the distribution of high noise events across the night-time period and early-morning shoulder periods.

Summary of Residential NMLs

The residential NMLs for the project are determined using the results from the unattended ambient noise monitoring (refer to Table 6-5) and the project RBL, noise management levels (NMLs) have been derived for each NCA as shown in Table 6-8 below.

Table 6-8 Residential receiver construction NMLs

NCA	Representative Background Monitoring Location	NML (LAeq(15minute) – dBA)				Sleep Disturbance Screening Criteria (RBL +15 dB)
		Standard Construction (RBL +10 dB)	Out of Hours (RBL +5 dB)			
		Daytime	Daytime[1]	Evening	Night-time	
NCA01	L07	56	51	51	48	58
NCA02	L06	49	44	44	42	52
NCA03[2]	-	-	-	-	-	-
NCA04	L06	49	44	44	42	52
NCA05	L06	49	44	44	42	52
NCA06[2]	-	-	-	-	-	-

Note 1: Daytime out of hours is 7am to 8am and 1pm to 6pm on Saturday, and 8am to 6pm on Sunday and public holidays.
Note 2: NCA has no residential receivers.

Other Sensitive Receivers

A number of non-residential land uses have been identified in the study area and some of these 'other sensitive' uses are considered sensitive to potential noise impacts. The ICNG NMLs for 'other sensitive' receivers are shown in Table 6-9 below.

Table 6-9 ICNG NMLs for other sensitive receivers

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (Applied when the property is in use)
Classrooms at schools and other education institutions	Internal noise level 45 dBA[1]
Hospital wards and operating theatres	Internal noise level 45 dBA[1]
Places of Worship	Internal noise level 45 dBA[1]
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants)	External noise level 65 dBA

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (Applied when the property is in use)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion)	External noise level 60 dBA
Community centres	Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses
Commercial	External noise level 70 dBA

Note 1: The criteria is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation. Hospital wards are assumed to have fixed windows with 20 dB higher external levels.

Ground-borne Construction Noise

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. Ground-borne noise caused, for example, by underground works such as tunnelling can be more noticeable than airborne noise. The following ground-borne noise levels for residences indicate when management actions should be implemented. These levels recognise the temporary nature of construction and are only applicable when ground borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

- Evening $L_{Aeq(15minute)}$ 40 dB(A)
- Night $L_{Aeq(15minute)}$ 35 dB(A)

Given the nature of this project, the majority of receivers are likely to be sufficiently distant from the works and ground-borne noise impacts are expected to be minimal.

Vibration – Human Exposure

Vibration goals were sourced from the NSW Department of Environment and Conservation *Assessing Vibration: a technical guideline* (Department of Environment and Conservation, 2006) which is based on guidelines contained in British Standard (BS) 6472–1992, *Evaluation of human exposure to vibration in buildings (1–80 Hz).*

Intermittent vibration is assessed using the vibration dose value (VDV), fully described in BS 6472 – 1992. Acceptable values of vibration dose are presented in Table 6-10.

Table 6-10 Acceptable VDVs for intermittent vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

Vibration – Building Damage

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to the following International Standards and Guidelines:

- British Standard BS 7385.2 - 1993 *Evaluation and Measurement for Vibration in Buildings*, Part 2 - Guide to damage levels from ground borne vibration; and
- German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: *Effects of vibration on structures*.

Unlike noise which travels through air, the transmission of vibration is highly dependent on substratum conditions between the source/s and receiver. Also dissimilar to noise travelling through air, vibration levels diminish quickly over distance, thus an adverse impact from vibration on the broader community is not typically expected. Vibration during works is considered an intermittent source associated with two main types of impact; disturbance at receivers and potential architectural/structural damage to buildings. Generally, if disturbance issues are controlled, there is limited potential for structural damage to buildings.

The BS 7385 recommended Peak Particle Velocity (PPV) guidelines for the possibility of vibration induced building damage are derived from the minimum vibration levels above which any damage has previously been encountered and are presented in Table 6-11 below.

Table 6-11 BS 7385 transient vibration guideline values for minimal risk of damage

Building Type	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

Note 1: Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%.

German Standard DIN 4150 also provides guideline vibration limits for different buildings. Damage is not expected to occur where the values are complied with and the values are generally recognised to be conservative. The DIN 4150 values for buildings and structures are shown in Table 6-12 below.

Table 6-12 DIN 4150 guideline values for short-term[1] vibration on structures

Group	Type of Structure	Guideline Values Vibration Velocity (mm/s)				
		Foundation, All Directions at a Frequency of			Topmost Floor, Horizontal	Floor Slabs, Vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 **and** are of great intrinsic value (e.g. heritage listed buildings)	3	3 to 8	8 to 10	8	20[2]

Note 1: Short-term is defined in DIN 4150 as vibration that does not occur often enough to cause material fatigue and whose development over time and duration is not suitable for producing a significant increase in vibration due to resonance in the particular structure.

Note 2: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

Heritage buildings and structures should be considered on a case-by-case basis but as noted in BS 7385 should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive following investigation by a structural engineer, the more stringent DIN 4150 Group 3 guideline values in Table 6-12 can be applied.

There are no known heritage/building structures within the affected area that would need to be considered for the proposal.

Ground Vibration – Minimum Working Distances from Sensitive Receivers

The Transport for NSW Construction Noise and Vibration Strategy (CNVS) (Transport for NSW, 2019) provides guidance for minimum working distances. As a guide, minimum working distances from sensitive receivers for typical items of vibration intensive plant are listed in Table 6-13.

Table 6-13 Recommended minimum safe working distances for vibration intensive plant from sensitive receiver

Plant Item	Rating / Description	Minimum Distance Cosmetic Damage		Minimum Distance Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1-2 tonne)	5m	11m	15m to 20m
	<100 kN (2-4 tonne)	6m	13m	20m
	<200 kN (4-6 tonne)	12m	15m	40m

Plant Item	Rating / Description	Minimum Distance Cosmetic Damage		Minimum Distance Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
	<300kN (7-13 tonne)	15m	31m	100m
	>300kN (13-18 tonne)	20m	40m	100m
	>300kN (>18 tonne)	25m	50m	100m
Small Hydraulic Hammer	300kg (5 to 12 t excavator)	2m	5m	7m
Medium Hydraulic Hammer	900kg (12 to 18 t excavator)	7m	15m	23m
Large Hydraulic Hammer	1600kg (18 to 34 t excavator)	22m	44m	73m
Vibratory Pile Driver	Sheet Piles	2m to 20m	5m to 40m	20m
Pile Boring	≤ 800mm	2m (nominal)	5m	4m
Jack Hammer	Hand Held	1m (nominal)	3m	2m

The minimum distances are quoted for both “cosmetic” damage (refer to BS 7385 and DIN 4150) and human comfort (Department of Environment and Conservation, 2006) are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Where works are within the minimum working distances and considered likely to exceed the cosmetic damage objectives, construction works should not proceed unless:

- A different construction method with lower source vibration levels is used, where feasible
- Attended vibration measurements are undertaken at the start of the works to determine the risk of exceeding of the vibration objectives.

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions.

Rail Infrastructure Noise and Vibration

The guidelines used for assessing the potential operational rail impacts from the project are listed in Table 6-14**.** The guidelines aim to protect the community and environment from excessive noise and vibration impacts from the long-term operation of the project.

Table 6-14 Operational rail noise and vibration guidelines

Guideline/Policy Name	When Guideline is Used
Rail Infrastructure Noise Guideline **(EPA, 2013) (RING)**	Assessment of operational airborne and ground-borne noise impacts on sensitive receivers.
Noise Prediction and Mitigation Guideline **(ARTC, 2018)**	Provides guidance on the assessment and design of mitigation for ARTC rail projects. This is an ARTC internal document that forms part of the ARTC Environmental Management System.
Assessing Vibration: a technical guideline **(DEC, 2006)**	Assessment of vibration impacts on sensitive receivers.
AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors	Provides recommended design sound levels for internal areas of occupied spaces.

Operational Airborne Rail Noise

The NSW *Rail Infrastructure Noise Guideline* (EPA, 2013) (RING) is used to assess and manage potential airborne noise impact from new and redeveloped railway projects. The guideline provides non-mandatory 'trigger levels' for residential and other sensitive land uses.

Where a project results in rail noise levels which are predicted to be above the trigger levels, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

The RING uses the following scenarios to assess the impacts from rail projects:

- **'Without project'** – the assessment scenario used to predict noise levels if the project were not to go ahead
- '**With project**' – the assessment scenario used to predict noise levels with the project.

The difference between the 'Without project' and the 'With project' noise levels is used to determine the noise level increase from the project.

The project is a redevelopment of an existing rail line and the relevant airborne noise trigger levels for residential receivers are shown in Table 6-15 below.

Table 6-15 Airborne heavy rail noise trigger levels for residential receivers

Sensitive Land Use	Noise Trigger Level dB(A) (External)	
	Day (7am – 10pm)	**Night (10pm – 7am)**
	Development increases existing LAeq(period)[1] rail noise levels by 2 dB or more, or existing LAmax rail noise levels by 3 dB or more ***and*** predicted rail noise levels exceed:	
Residential	65 LAeq(15hour) or 85 LAmax[2]	65 LAeq(15hour) or 85 LAmax[2]

Note 1: $L_{Aeq(period)}$ refers to average noise level in the period. $L_{Aeq(15hour)}$ is the daytime and $L_{Aeq(9hour)}$ is the night-time.

Note 2: L_{Amax} refers to the maximum noise level not exceeded for 95% of rail pass-by events.

A number of 'other sensitive' non-residential land uses have been identified in the study area. The noise trigger levels for these receivers are shown in Table 6-16 below. The RING does not consider commercial and industrial receivers as being sensitive to operational airborne rail noise impacts.

Table 6-16 RING airborne rail noise trigger levels for other sensitive receivers

Sensitive Land Use	Noise Trigger Level (dBA) (when in use)
Schools, educational institutions and child care centres	45 $L_{Aeq(1hour)}$ Internal[1]
Places of worship	45 $L_{Aeq(1hour)}$ Internal[1]
Hospital wards	40 $L_{Aeq(1hour)}$ Internal[1]
Hospital other uses	65 $L_{Aeq(1hour)}$
Open space – passive use (eg parkland, bush reserves)	65 $L_{Aeq(15hour)}$
Open space – active use (eg sports field, golf course)	65 $L_{Aeq(15hour)}$

Note 1: The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

Operational Ground-borne Rail Noise and Vibration

Ground-borne vibration from passing trains can cause perceptible vibration impacts to occupants of nearby buildings. Ground-borne vibration can also result in audible impacts inside buildings in the form of a low frequency rumble if the vibration is sufficient to cause floors or walls of the structure to vibrate. The integrity of building structures are unlikely to be comprised by passing trains.

The RING provides operational ground-borne noise and vibration criteria for rail infrastructure projects which apply only where internal ground-borne noise levels are higher than noise transmitted through the air. The ground-borne noise trigger levels for residential and 'other sensitive' receivers are shown in Table 6-17 below.

Table 6-17 RING ground-borne noise trigger levels

Sensitive Land Use	Time of Day	Internal Noise Trigger Level (dBA)
		Development increases existing rail noise levels by 3 dBA or more ***and*** resulting rail noise levels exceed:
Residential	Day (7am to 10pm)	40 L_{ASmax}
	Night (10pm to 7am)	35 L_{ASmax}
Schools, educational institutions, places of worship	When in use	40 - 45 L_{ASmax}

The RING refers to the previously discussed DEC's *Assessing Vibration: a technical guideline* (DEC, 2006) for vibration criteria for rail projects, which are sources of intermittent vibration. The 'preferred' and 'maximum' VDVs for human comfort are previously shown in Table 6-10.

6.4.3. Methodology

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the project. The assessment used 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that is likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

Key scenarios have been categorised into 'Peak' and 'Typical' works.

- The 'Peak' works represent the noisiest stage of the works and can require noise intensive equipment such as concrete saws. While 'Peak' works would be required at certain times in most locations, the highest noise impact works would only last for relatively short periods of the overall works duration.
- The 'Typical' works represent typical noise emissions from the project when noise intensive equipment is not in use. These scenarios are shown in Table 6-18 together with a high-level description of each works activity below.

Table 6-18 Project construction scenario descriptions

ID	Scenario	Description
01	Site Establishment	Site establishment would be undertaken prior to construction, outside of weekend possessions, and would include the setup of the four compound areas (site office, toilet etc). Other activities would include establishing environmental controls including erosion and sediment controls, signage and fencing and stockpiling of rail infrastructure. These works generally have no requirement for noise intensive equipment, however, they are required to be completed relatively close to residential receivers, particularly at the Banksia Street Compound.
02	Compound Operation	The four proposed compound sites are: - Banksia Street compound (also being utilised for Botany Rail Duplication) - McPherson Street compound - Swinbourne Street compound - Botany Road compound. Operation of the compounds would last throughout construction and would include deliveries, storage of equipment and materials, and typical worker activities. Compound operation generally has no requirement for noise intensive equipment.

03	Trackworks - Peak	Track works would be undertaken during and outside of weekend possessions and would include:
		- Removal of redundant ARTC rail infrastructure associated with the Kelloggs siding (during and outside of possession) involving:
		  - Cutting of existing dis-used track into smaller portions
		  - Removal of dis-used track using lifting equipment
		  - Removal of old sleepers.
		These works would require noise intensive equipment such as concrete/rail saws and a ballast tamper at certain stages of the works. The works are, however, only required in one location at the Kelloggs siding, which is to the south of Banksia Street.

04	Trackworks - Typical	
05	Signal Works - Peak	Signal works would be undertaken outside of weekend possessions, including: - Removal and installation of signalling equipment:

ID	Scenario	Description
06	Signal Works - Typical	- Installation of Signalling Equipment Room foundations and Signal foundations outside the danger zone with excavator - Installation of prefabricated sandwich panel Signalling Equipment Rooms with crane. - Enabling/reconfiguration of equipment within Signalling Equipment Room (hand tools and light vehicles) - Cable installation in existing and new Combined Services Route - Signal equipment removal – decommissioning of signal equipment, physical removal of signal assets by use of an excavator, and concrete breaker for foundations. - New cable routes to be installed to enable new signal infrastructure: - Survey mark out of new Signal route to be installed - Excavation of trench (approx. 1 m deep) - Lay plastic PVC conduits in place (housing for new signal cables) - Install pre-fabricated concrete pits at designated locations, connecting the PVC conduits - Backfill the trenches with approved materials - Minor drainage works to accommodate signal infrastructure. These works are required across the full project area. They generally have no requirement for noise intensive equipment.
07	Site Rehabilitation/ De-commissioning	Decommission works are required after the main construction works are complete and could include: - Removal of fencing, waste and environmental controls - Site rehabilitation - Removal of site amenities.

Note: Equipment lists for each scenario and sound power level data are provided in Appendix C of the SLR assessment (Appendix D).

The locations of the various work scenarios are shown in Figure 6-4.

Construction scenarios were assessed within the anticipated duration of each activity summarised in Table 6-19.

Table 6-19 Project construction scenario working hours and indicative durations

ID	Scenario	Duration	Hours of Works			
			Day	Day OOH[1]	Evening	Night-time
W01	Site Establishment	2 weeks	x	-	-	-
W02	Compound Operation	36 months standard hours and 6 possessions	x	x	x	x
W03	Trackworks - Peak	6 possessions in 36-month period	x	x	x	x
W04	Trackworks - Typical		x	x	x	x
W05	Signal Works - Peak	6 possessions in 36-month period	x	x	x	x
W06	Signal Works - Typical		x	x	x	x

ID	Scenario	Duration	Hours of Works			
			Day	Day OOH[1]	Evening	Night-time
W07	Site Rehabilitation/Decommissioning	2 weeks	x	-	-	-

Note 1: OOH = out of hours

The works generally have minimal requirement for vibration intensive equipment. Jackhammers may be occasionally used, and a ballast tamper would be required for trackworks to the south of Banksia Street.

Jackhammers only result in vibration impacts to localised works area and vibration from ballast tampers would be expected to be consistent with vibration levels from existing rail maintenance activities which are currently performed on the rail line. As such, the potential vibration impacts from the works are considered low and have not been considered further in this assessment.

Refer to section 4 of the SLR assessment (Appendix D) for detailed methodology.

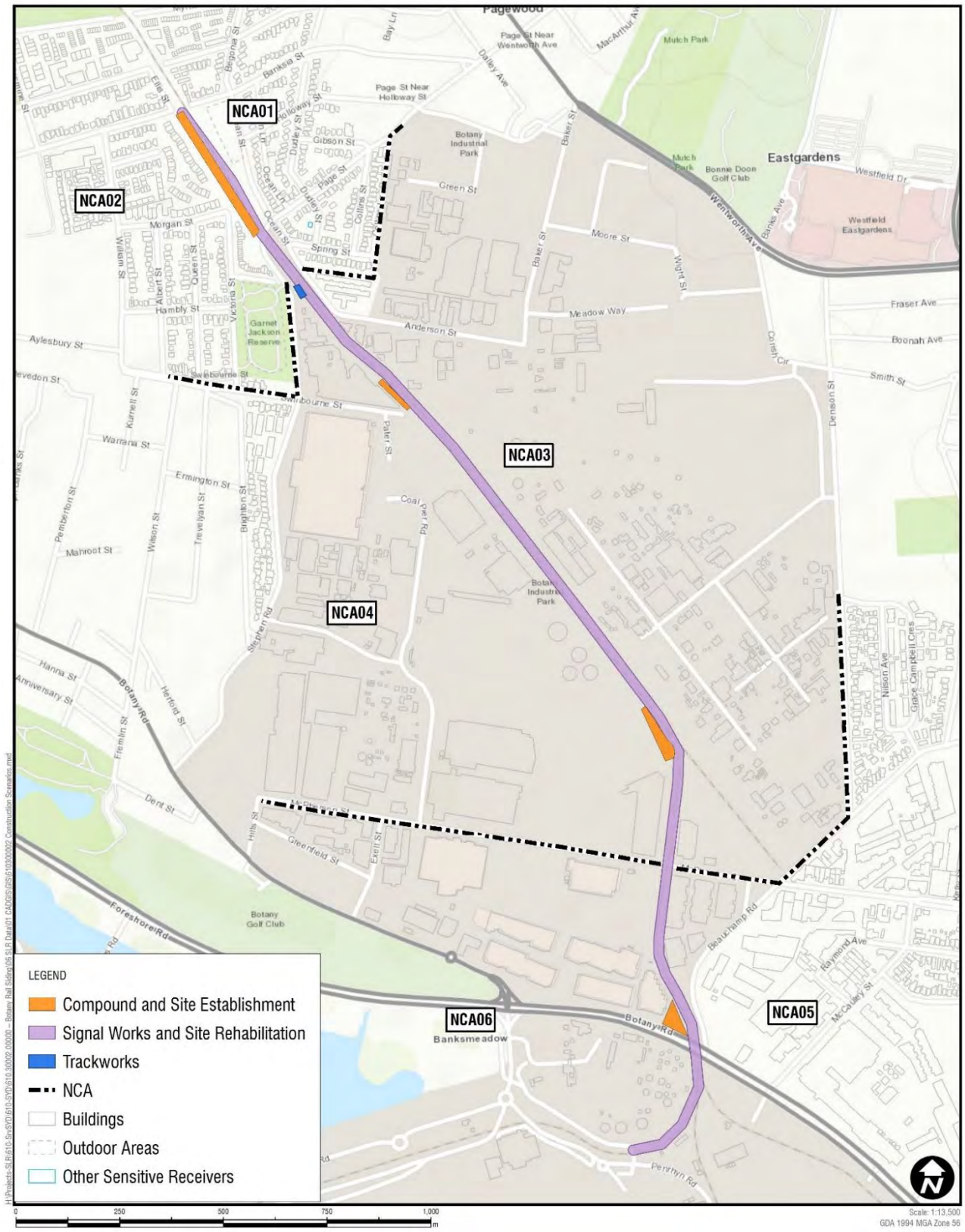

Figure 6-4 Construction works locations

6.4.4. Potential Impacts

Construction Noise

Construction will take approximately 36 months to complete. Construction is not formally staged, although works will move progressively along the rail corridor.

Low impact signal/cabling work will be ongoing for 12 months during standard construction hours, however some track and civil work must be carried out during weekend rail possessions to minimise risk to worker safety and rail operations.

Rail possessions occur over a 48-hour period from 2:00am Saturday morning to 2:00am Monday morning. It is anticipated that track and civil work for the new crossover, removal of Kelloggs siding and motorising of the Gelco siding would be carried out during 4 rail possessions over the 12-month construction period.

There would be no significant earthworks associated with the project. Minor trenching (i.e. 1-1.5 metres for cabling and three metres for signal bases only) would be required to install new cabling along the corridor to connect to new signalling equipment. Excavated soil would be backfilled into the trenches once cabling work has been completed. This would generally occur progressively during cable works.

The following assessment shows the predicted noise impacts based on the exceedance of the NML, as per the three categories in Table 6-20. The likely subjective response of people affected by the impacts is also shown in the table, noting that the subjective response would vary and depends on the period in which the impacts occur (i.e. people are generally less sensitive to impacts during the daytime and more sensitive in the evening and night-time).

Table 6-20 NML Exceedance Bands and Corresponding Qualitative Response to Impacts

Exceedance of NML	Symbol	Likely Subjective Response
Compliance	·	Barely noticeable
1 to 10 dB	●	Marginal to minor
11 dB to 20 dB	◆	Moderate
>20 dB	■	High

The predicted construction noise impacts are presented for the most affected receiver. Receivers which are further away from the works and/or shielded from view would have substantially lower noise impacts. The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

A summary of the predicted construction noise impacts in each NCA for residential receivers is shown in Table 6-21. Detailed noise level predictions and summaries of the number of receivers predicted to have ‘minor’, ‘moderate’ and ‘high’ impacts in each NCA are provided in Appendix C of the SLR assessment (Appendix D).

Table 6-21 Predicted construction noise exceedances for residential receivers

Period	ID	Scenario Activity	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06
Daytime	01	Site Establishment	●	■	·	·	·	·
	02	Compound Operation	·	◆	·	·	·	·
	03	Trackworks - Peak	◆	■	·	●	·	·
	04	Trackworks - Typical	·	●	·	·	·	·
	05	Signal Works - Peak	●	◆	·	·	·	·
	06	Signal Works - Typical	·	●	·	·	·	·
	07	Site Rehabilitation/Decommissioning	●	◆	·	·	·	·
Evening	01	Site Establishment	n/a	n/a	n/a	n/a	n/a	n/a
	02	Compound Operation	●	◆	·	·	·	·
	03	Trackworks - Peak	◆	■	·	◆	·	·
	04	Trackworks - Typical	·	●	·	·	·	·
	05	Signal Works - Peak	◆	■	·	●	·	·
	06	Signal Works - Typical	●	◆	·	·	·	·
	07	Site Rehabilitation/Decommissioning	n/a	n/a	n/a	n/a	n/a	n/a
Night-time	01	Site Establishment	n/a	n/a	n/a	n/a	n/a	n/a
	02	Compound Operation	●	■	·	·	·	·
	03	Trackworks - Peak	■	■	·	◆	·	·
	04	Trackworks - Typical	●	●	·	·	·	·
	05	Signal Works - Peak	◆	■	·	●	·	·
	06	Signal Works - Typical	●	◆	·	·	·	·
	07	Site Rehabilitation/Decommissioning	n/a	n/a	n/a	n/a	n/a	n/a

Key to Impacts ● Marginal to minor (1 to 10 dB) ◆ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Note: Cells with no coloured shape represent noise levels are either compliant or there are no residential receivers in the catchment.

The impacts at residential receivers are generally limited to NCA01 and NCA02 due to residential receivers being adjacent to the rail corridor in these areas. NCA03, NCA05 and NCA06 either have no residential receivers or they are sufficiently distant for noise levels to be compliant with the criteria.

Some of the highest noise levels are seen when noise intensive equipment is used, such as during *Trackworks – Peak*, which requires a ballast tamper and concrete saw. These noise intensive works would, however, only be required for relatively short periods and noise levels and impacts during *Trackworks – Typical* that do not require noise intensive equipment are significantly lower. It is also noted that *Trackworks* are only required in one location (to the south of Banksia Street Bridge at the Kelloggs siding) meaning the number of affected receivers is relatively small and limited to the receivers surrounding the works.

During the daytime, 'high' impacts are seen during the noisiest scenarios, including *Site Establishment* and *Trackworks – Peak*, at the most affected receivers are in NCA02. 'Moderate' worst-case daytime impacts are seen at the nearest receivers in NCA01, with 'minor' daytime impacts in NCA04 during one scenario.

During the night-time, 'high' impacts are seen at the nearest receivers in NCA01 and NCA02 during noisy works, with 'moderate' or 'minor' impacts during less noisy works. 'Moderate' worst-case impacts are seen at the closest receivers in NCA04 with compliant noise levels predicted during less noisy works.

The predicted **night-time** impacts during *Trackworks* are shown in Figure 6-5 and Figure 6-6.

The predicted **daytime** impacts during *Signal Works* are shown in Figure 6-7 and Figure 6-8.

The predicted **night-time** impacts during *Signal Works* are shown in Figure 6-9 and Figure 6-10.

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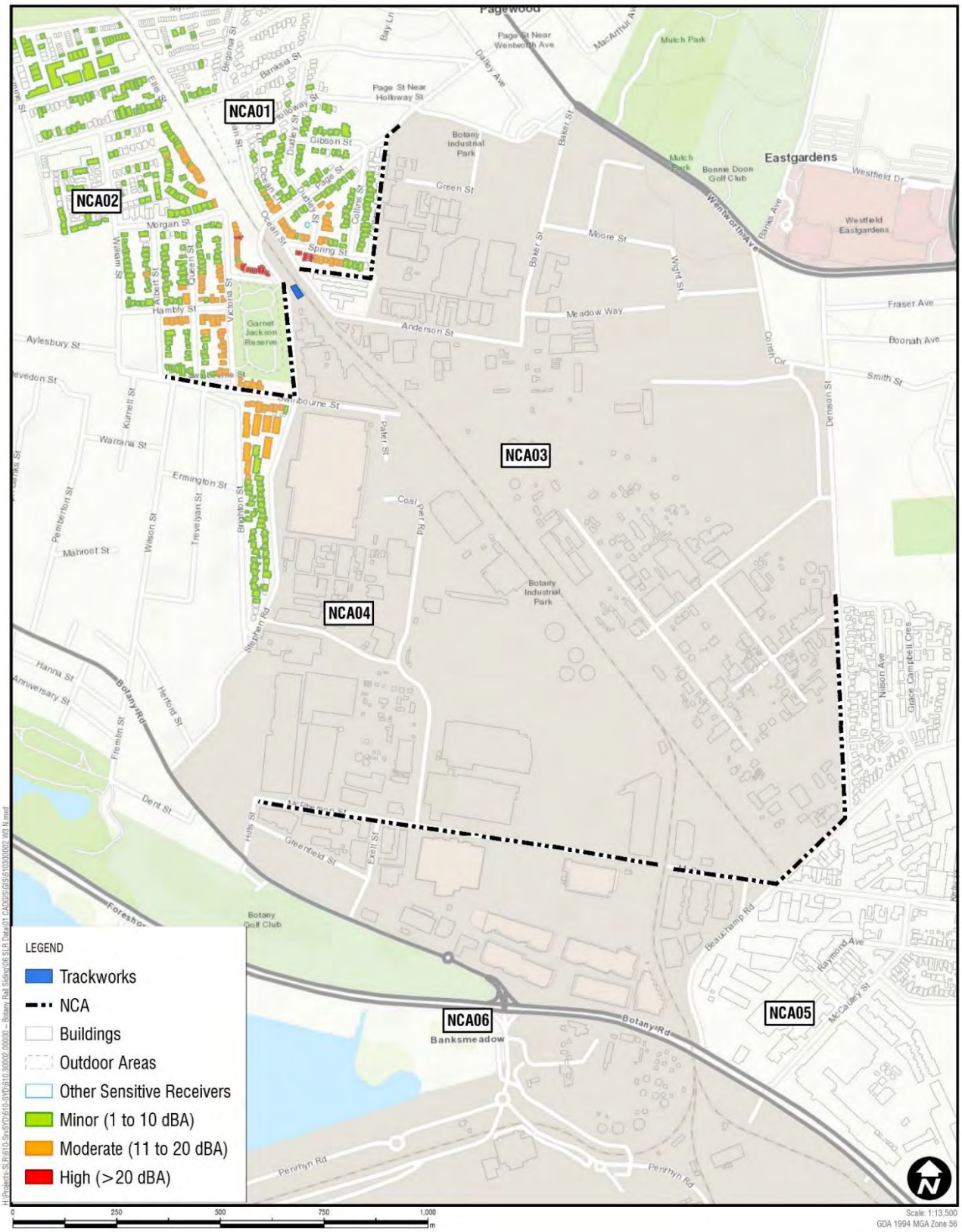

Figure 6-5 Predicted impacts for Trackworks – Peak (night-time) (SLR, 2020)

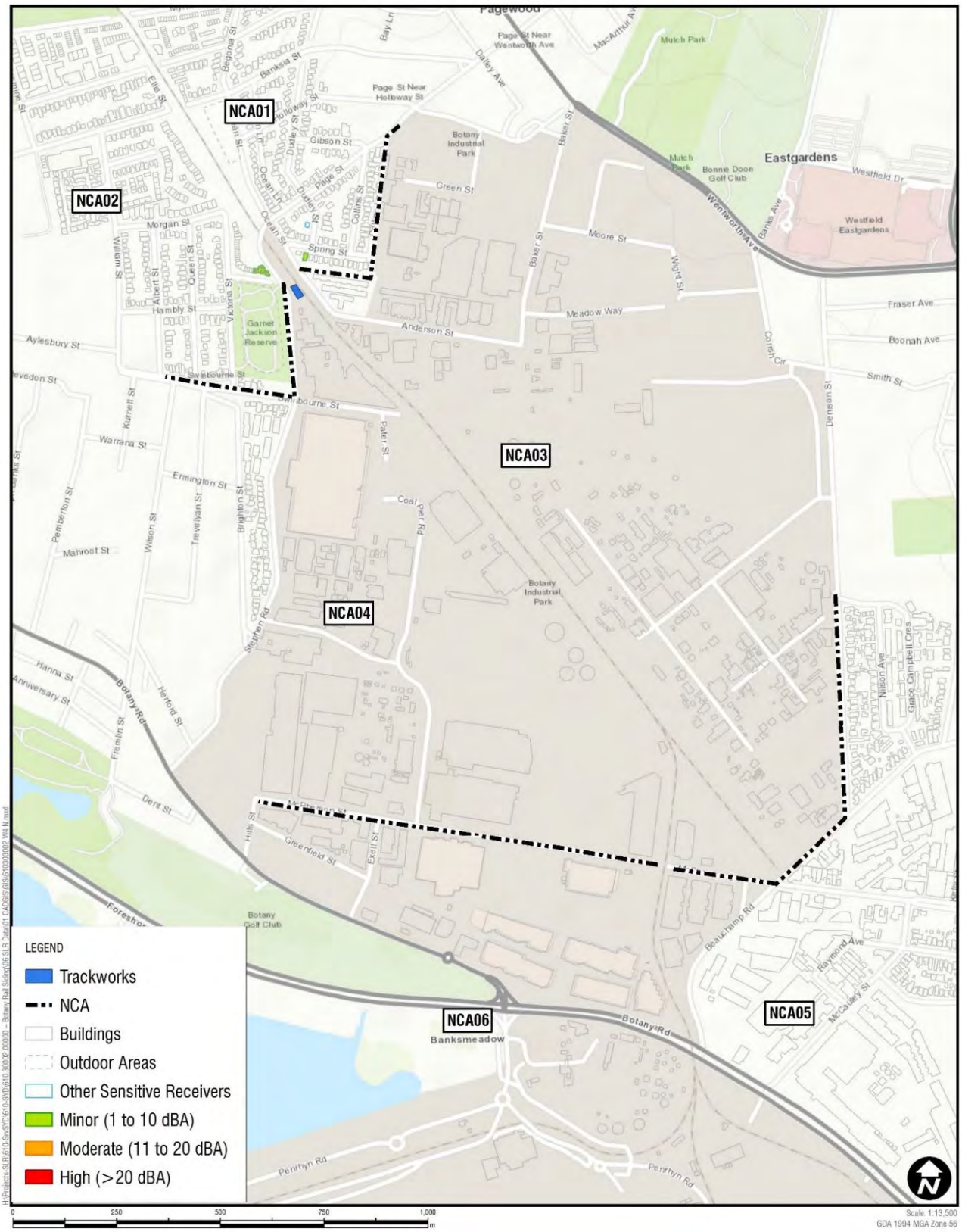

Figure 6-6 Predicted impacts for Trackworks – Typical (night-time) (SLR, 2020)

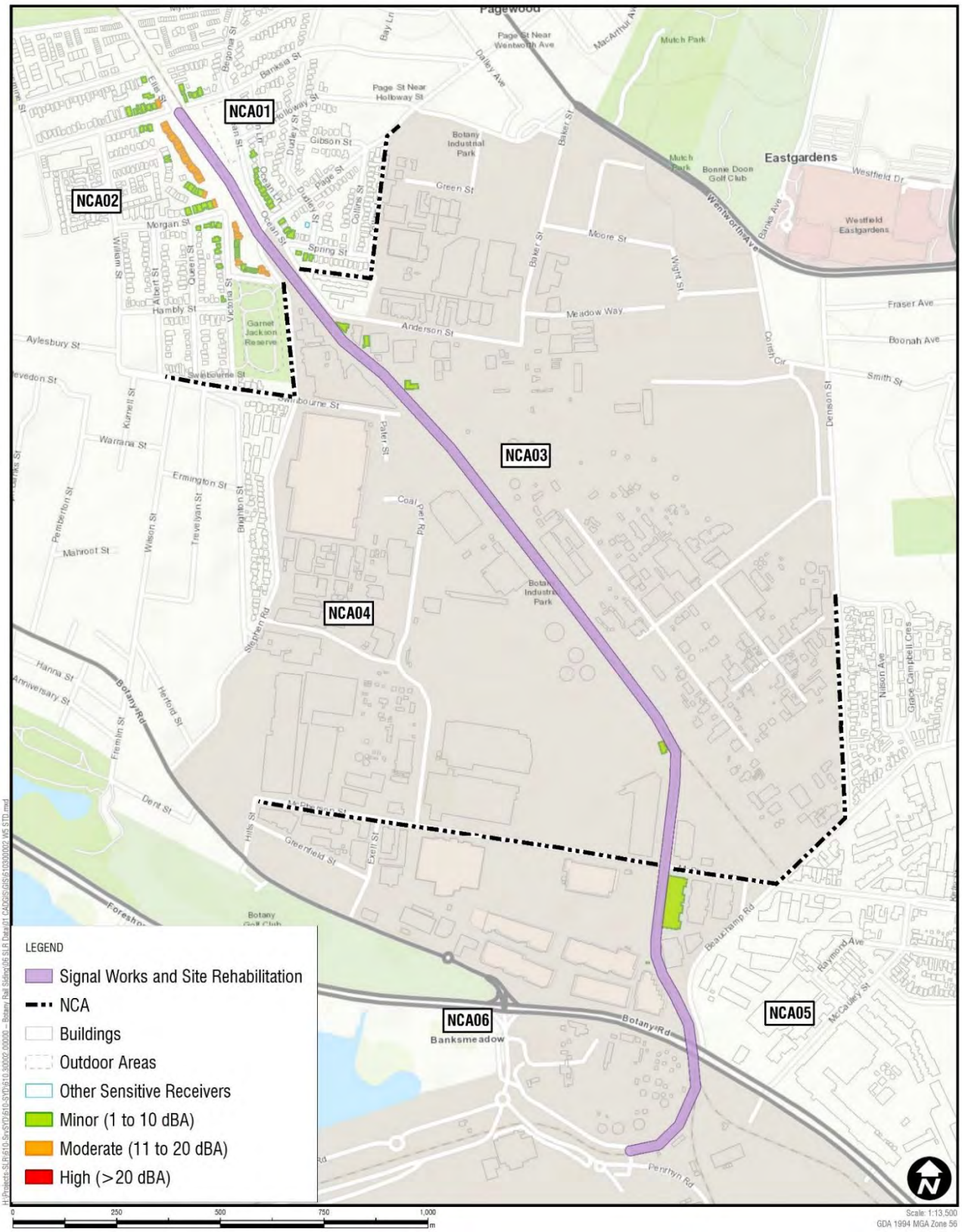

Figure 6-7 Predicted impacts from Signal Works – Peak in all locations (daytime) (SLR, 2020)

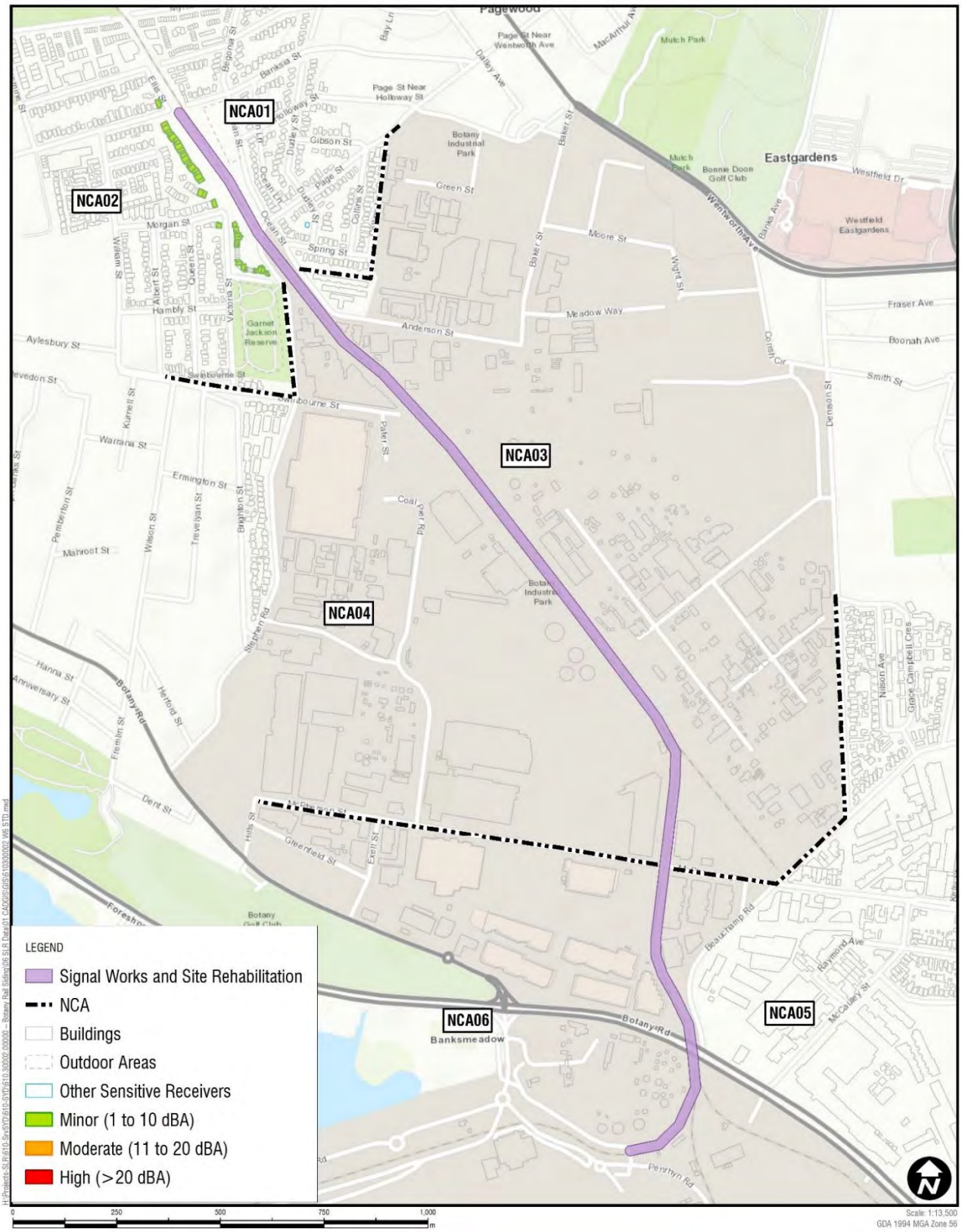

Figure 6-8 Predicted impacts from Signal Works – Typical in all locations (daytime) (SLR, 2020)

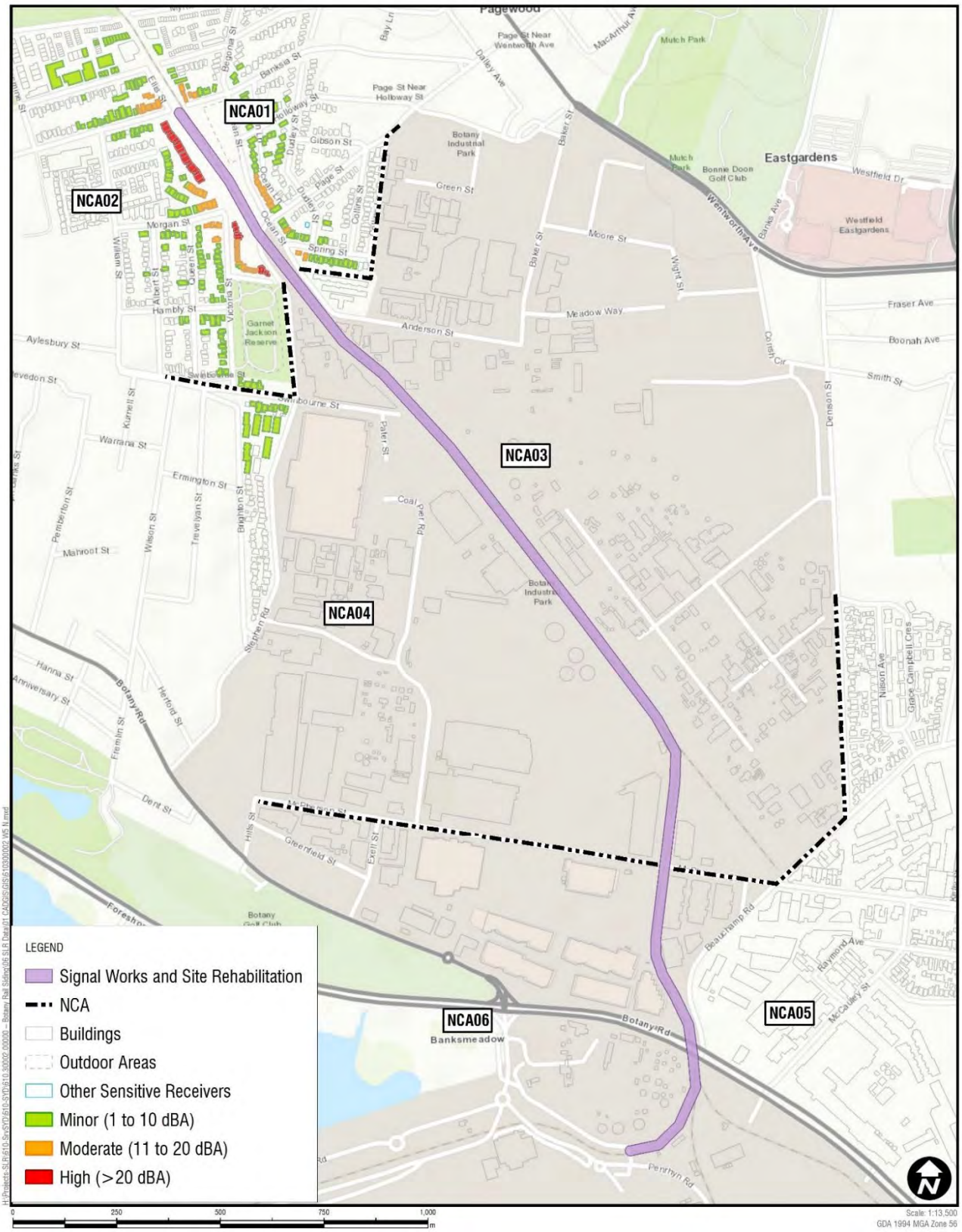

Figure 6-9 Predicted impacts from Signal Works – Peak in all locations (night-time) (SLR, 2020)

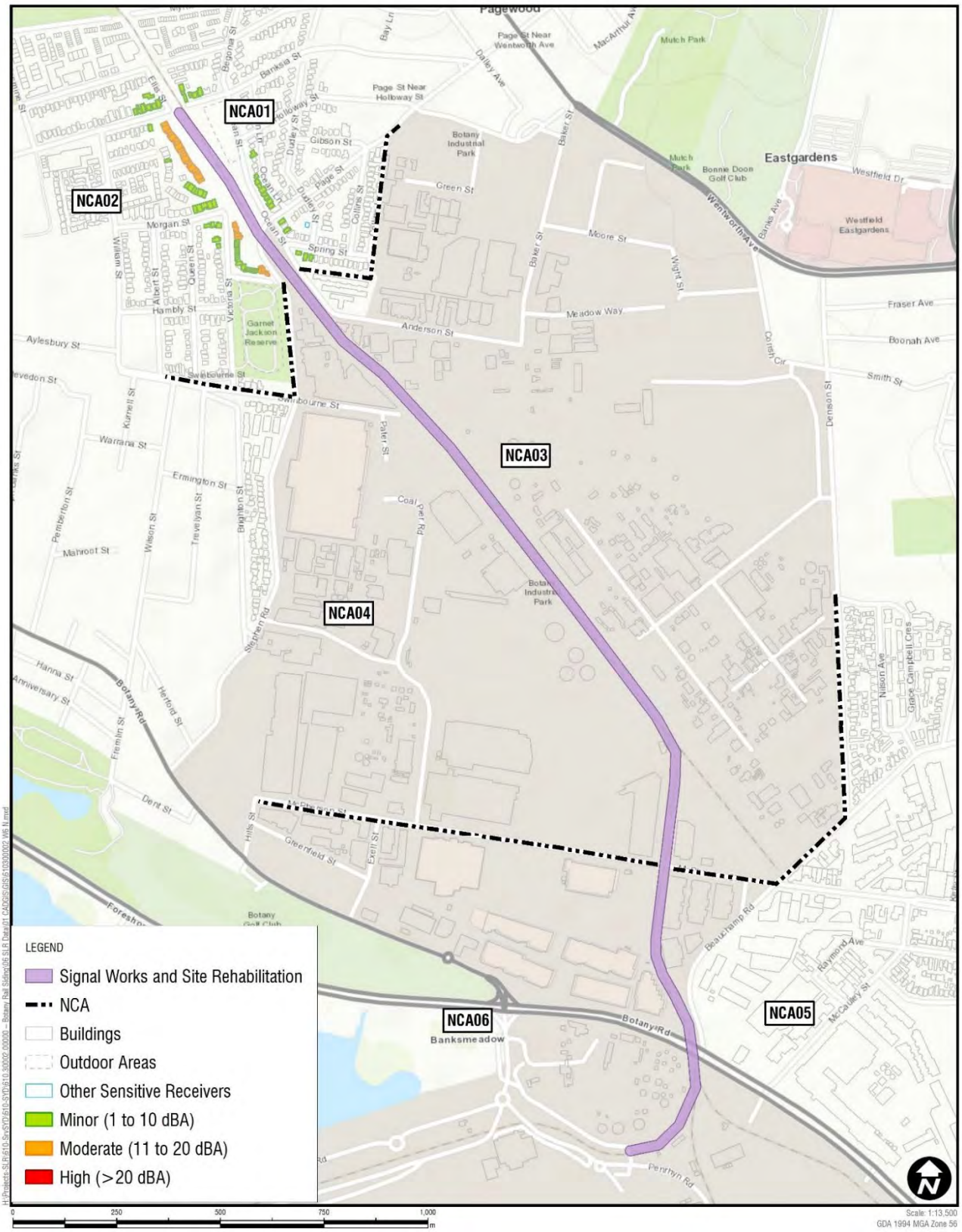

Figure 6-10 Predicted impacts from Signal Works – Typical in all locations (night-time) (SLR, 2020)

The following sections provide a detailed discussion of the key construction impacts at all receivers which are associated with:

- *Trackworks*, which is the scenario with the predicted **worst-case noise levels** during the night-time
- *Signal Works*, which is the scenario with the **longest duration** and over the largest area.

The use of noise intensive equipment in *Trackworks – Peak* (refer to Figure 6-5) 'high' impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Moderate' or 'minor' impacts are predicted at receivers which are further away from the works. The worst-case impacts would, however, only occur when the noisiest equipment such as concrete saws or a ballast tamper are in use.

When noise intensive equipment is not being used during *Trackworks – Typical* (refer to Figure 6-6), the noise levels would be lower and the impacts are substantially reduced. 'Minor' impacts are seen at a small number of the nearest receivers, with receivers beyond predicted to be compliant with the NMLs.

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would frequently be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur.

The longest duration works scenario is *Signal Works*. Noisy activities would be required during some stages of the works and could include the use of equipment such as cranes, super suckers or trucks.

For daytime works during *Signal Works – Peak* (see Figure 6-7), 'moderate' worst-case impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Minor' impacts, or noise levels that are compliant with the NMLs, are predicted at receivers which are further away.

When less noisy equipment is being used during *Signal Works – Typical* (see Figure 6-8), the noise levels would be lower and the daytime impacts are substantially reduced. 'Minor' impacts are seen at receivers adjacent the works in NCA02.

A small number of commercial receivers which are adjacent to the rail corridor in the other NCAs are predicted to have 'minor' worst-case impacts during the daytime.

For night-time works during *Signal Works – Peak* (see Figure 6-9), 'high' worst-case impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Moderate' or 'minor' impacts are predicted at receivers which are further away.

When less noisy equipment is being used during *Signal Works – Typical* (see Figure 6-10), the noise levels would be lower and the night-time impacts are substantially reduced. 'Moderate' or 'minor' impacts are seen at the nearest receivers in NCA01 and NCA02, with receivers beyond those nearest receivers predicted to be compliant with the NMLs.

Receivers in other parts of the study area are generally predicted to not be impacted by *Signal Works*, except for some isolated 'minor' impacts at commercial receivers close to the rail corridor.

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would frequently be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur. The impacts would also be lower than predicted when works are occurring in distant parts of the study area or where they are screened from view of the nearest receivers.

No receivers are predicted to be Highly Noise Affected (HNA) during the works.

For other sensitive receivers and nearby commercial receivers, the predicted NML exceedances are shown in Figure 6-11 below.

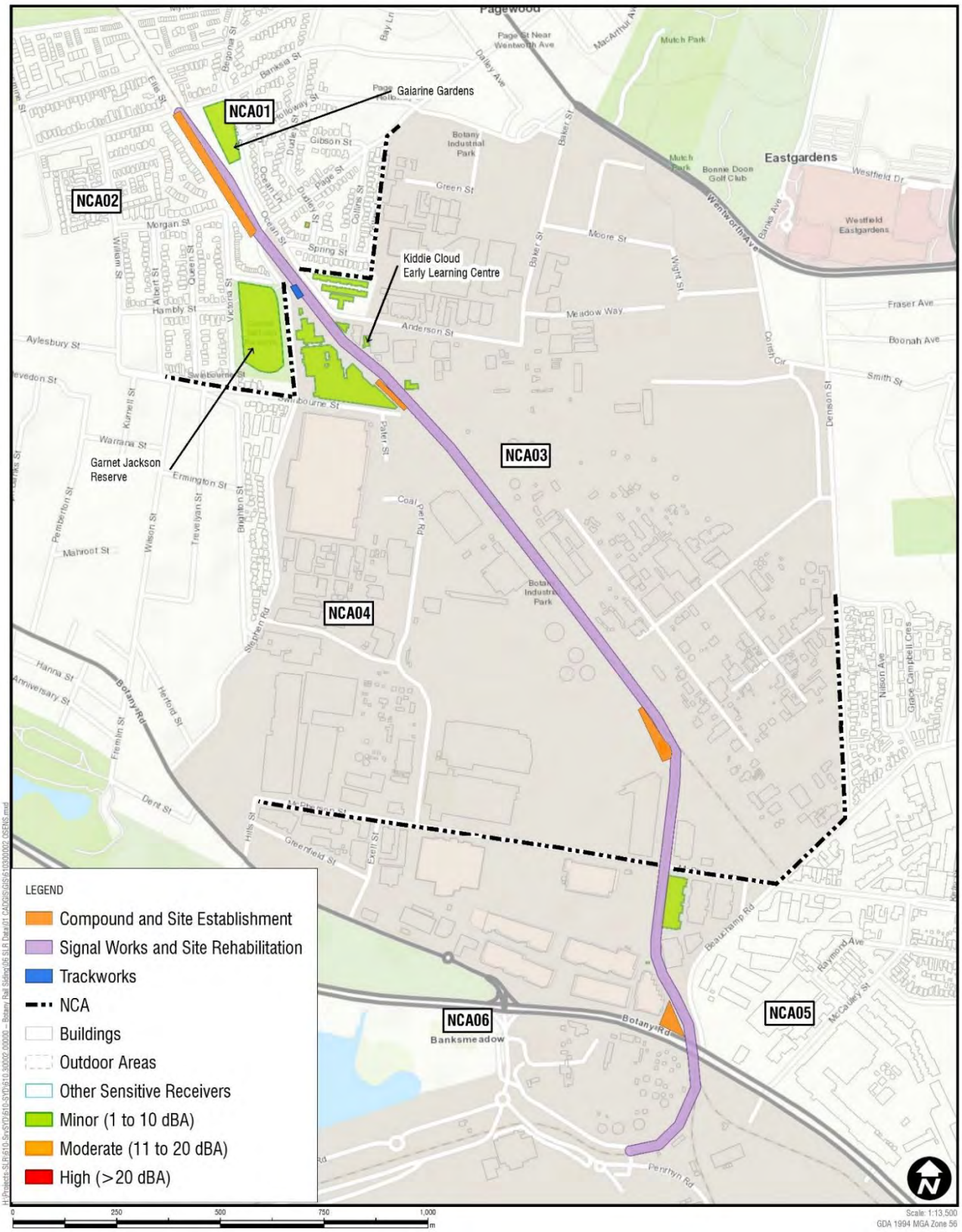

Figure 6-11 Predicted worst-case noise impacts for other sensitive and commercial receivers (SLR, 2020)

The majority of commercial receivers are predicted to be subject to construction noise levels which comply with the NMLs, however, 'minor' impacts are predicted at some of the nearest commercial receivers to the works when noisy works are nearby.

Sleep Disturbance

A sleep disturbance screening assessment has been completed for the construction works and is contained in the assessment tables in Appendix C of the SLR assessment (Appendix D). Review of the predictions shows that the sleep disturbance screening criterion is likely to be exceeded when night works are occurring near to residential receivers.

The receivers which would potentially be affected by sleep disturbance impacts are generally the same receivers where 'high' night-time impacts have been predicted (refer to Table 6-21).

Construction Ground-borne Noise

The receivers are sufficiently distant from the works for ground-borne noise impacts to be minimal. Where residential receivers are located near to construction works, airborne noise levels would typically be dominant over the ground-borne component.

Construction Traffic Noise

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are on construction routes.

Construction traffic would access the site via the following roads:

- Banksia Street and Swinbourne Street in NCA01
- Ocean Street in NCA02
- McPherson Street in NCA04
- Penrhyn Road in NCA06.

Existing and proposed construction haulage traffic volumes are currently unknown. The following qualitative comments are made regarding the potential impacts:

- McPherson Street and Penrhyn Road are routes through commercial areas with low sensitivity to potential changes in road traffic noise due to construction vehicles.
- Banksia Street, Swinbourne Street and Ocean Street, however, have adjacent residential receivers and existing traffic volumes on these roads are likely to be relatively low. Construction traffic using these haulage routes may therefore result in noticeable increases in road traffic noise, especially if they are used during the evening or night-time period.

Operation Noise

Operational rail noise impacts have been predicted for all identified sensitive receivers in the study area.

Residential Receivers

The predicted rail noise levels at residential receivers are summarised in Table 7-5 for the 2024 at-opening and 2034 future design scenarios (refer to section 7.1.4).

The impacts from the proposal are predicted to be greatest in the 2034 future design scenario due to this timeframe generally having more trains than in 2024 at project opening if the Botany Rail Duplication project is approved. Receivers are generally most affected by the proposal in the night-time in 2034 and this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation (if any).

The results from Table 7-5 show the following:

- Existing rail noise levels in the study area are already relatively high in NCA01 and NCA02 where receivers are close to the tracks.
- The proposal is not predicted to substantially increase rail noise levels in the study area for the 2024 '*At-Opening*' scenario. Increases in daytime and night-time noise levels are predicted for residential receivers in NCA06 but the predicted noise levels are far below the background noise level in this NCA and over 55 dB below the RING absolute trigger level.
- Minor increases are predicted at receivers in NCA04, NCA05 and NCA06 for the 2034 '*Design Year*' scenario. Worst-case increases of around 1 dB are predicted for daytime and night-time L_{Aeq} noise levels due a higher volume of trains with the proposal.
- Signalling and track upgrades are predicted to result in a reduction in locomotive idling noise from trains in the Gelco Siding of around 5 dB at receivers in NCA01 and NCA02. This reduction in idling noise levels does not influence the overall rail noise levels for receivers in this region, however, which are controlled by train passby noise.
- No residential receivers are predicted to exceed both the RING absolute and increase trigger levels meaning there is no requirement to consider airborne noise mitigation for residential receivers.

Other Sensitive Receivers

The predicted noise levels for the identified 'other sensitive' receivers are shown in Table 6-22 for the controlling 2034 scenario.

Table 6-22 Predicted noise levels for the identified 'other sensitive' receivers

NCA	Receiver	Noise Level (dBA)[1]					
		Predicted Level			Change in Noise from Project (With Project minus Without Project)		
		Day	Night	Max	Day	Night	Max
Passive Recreation Areas							
Criteria – Redeveloped[3]		65	n/a	n/a	2.0	n/a	n/a
NCA01	Gaiarine Gardens	67	-	-	-0.9	-	-
Active Recreation Areas							
Criteria – Redeveloped[3]		65	n/a	n/a	2.0	n/a	n/a
NCA02	Garnet Jackson Reserve	64	-	-	-0.6	-	-
Educational							
Criteria – Redeveloped[2,3]		55	n/a	n/a	2.0	n/a	n/a
NCA01	Kiddie Cloud Early Learning Centre	58	-	-	-0.7	-	-

Note 1: The results represent the facade of the receiver with the highest noise level increase.
Note 2: Criteria is the corresponding external level.
Note 3: Criteria is an LAeq(1hour) Gaiarine Gardens.

The results above show the following:

- The proposal is not expected to substantially alter existing rail noise levels at 'other sensitive' receivers.
- Daytime average noise levels are predicted to reduce slightly (by less than 1 dB) which is due to the proposal removing nearby turnouts.
- Freight locomotive idling noise is predicted to be reduced by up to 5 dB for these receivers, however, the overall rail noise levels do not reduce by this amount as noise levels are controlled by train passby noise.
- No 'other sensitive' receivers are predicted to exceed the RING trigger levels and consideration of airborne noise mitigation is not required.

6.4.5. Safeguards and mitigation measures

Item	Discussion and Recommendations	Timing
Project Specific Measures		
Construction Noise and Vibration Management Sub-Plan	A CNVMP will be prepared as a sub plan to the CEMP before any construction works begin. This will include: • Identification of nearby sensitive receivers • Description of works, construction equipment and hours of work • Criteria for the proposal and any relevant licence and approval conditions • Any requirements for noise and vibration monitoring • Details of how community consultation and notification would be completed • Procedures for handling complaints • Details on how respite would be applied where ongoing high impacts are seen at certain receivers. The CNVMP will also consider cumulative construction impacts and define a suitable management approach.	Pre-construction
Noise Impacts during out of hours work	• Out of hours work would be undertaken in accordance with the requirements of an applicable Environmental Protection Licence (EPL) and/or Conditions of Approval, including any notification procedures.	Pre-construction
Construction Noise Exceedances	• The assessment has identified that high impacts are likely when works are close to residential receivers in NCA01 and NCA02, particularly when noise intensive equipment such as concrete saws or ballast tampers are in use during evening and night-time periods. • Where noisy works are required near to sensitive receivers in NCA01 and NCA02, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions and restrictions on working hours during these periods are generally not feasible.	Construction
Sleep Disturbance	• The need for consecutive night-time works and likelihood for sleep disturbance impacts will be reviewed during detailed design. Where impacts are considered likely, appropriate noise mitigation will be applied which takes into consideration factors such as the existing facade performance of affected residential receivers.	Pre-construction

Item	Discussion and Recommendations	Timing
	• Appropriate respite would be provided to affected receivers to limit impacts from night-time works in the same location, as required by the conditions of approval. Unless subject to an Environment Protection Licence, an Out-of-Hours Work Protocol would be prepared and be included as part of the CNVMP for main construction works. It will identify a process for the consideration, management and approval of works which are outside standard hours. The protocol would be prepared	
Compounds with Long Term Works	• Hoarding, or other shielding structures, will be used where receivers are near to compounds (such as the Banksia Street Compound) or worksites with long term works. To provide effective noise mitigation, the hoarding should break line-of-sight from the nearest receivers to the works, noting that some affected receivers are multi-storey, and be of solid construction with minimal gaps. Hoarding for construction sites is typically around 3 m in height.	Construction
Compound layout	• Noise generating items in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound.	Construction
Compound between Banksia Street and Stephen Road	• Noise impacts are predicted for the Banksia Street compound due to the proximity of the nearest receivers. The use of this compound site during out of hours works will be avoided as far as practicable. • It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use this compound.	Construction
Monitoring	• Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the measurements should be to confirm their effectiveness.	Pre-construction Construction
Construction traffic	Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches: • Vehicle movements will be away from sensitive receivers and during less sensitive times, where possible • The speed of vehicles will be limited and will avoid the use of engine compression brakes • On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times • Restriction of heavy vehicles idling near to residential receivers.	Pre-construction Construction
Community preference	• In locations where 'moderate' or 'high' impacts are predicted, engagement with the affected communities will be undertaken during detailed design to determine their preference for mitigation and management measures.	Pre-construction
Operation	• Within six months of commencement of operation, validation noise monitoring should be undertaken to confirm the operational noise predictions and impacts'.	Operation

Item	Discussion and Recommendations	Timing
General Project Measures		
Implement community consultation measures	Community consultation measures will be included in the CNVMP, including: • Periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.	Pre-construction
Site inductions will be included in the CNVMP	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.	Pre-construction Construction
Behavioural practices	• No swearing or unnecessary shouting or loud stereos/radios/phone calls on speaker on site. • No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.	Construction
Construction hours and scheduling	• Where feasible and reasonable, construction will be carried out during Standard Construction Hours. Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, where possible.	Construction
Equipment selection	• Use quieter and less vibration emitting construction methods where feasible and reasonable. • For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts.	Construction
Use and siting of plant	• Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. • The offset distance between noisy plant and adjacent sensitive receivers will be maximised. • Plant used intermittently will be throttled down or shut down. • Noise-emitting plant will be directed away from sensitive receivers, where possible.	Construction
Plan worksites and activities to minimise noise and vibration	• Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.	Construction
Non-tonal reversing alarms	• Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.	Construction

Item	Discussion and Recommendations	Timing
Minimise disturbance arising from delivery of goods to construction sites	• Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. • Site access points and roads will be selected to as possible away from sensitive receivers. • Dedicated loading/unloading areas will be shielded if close to sensitive receivers. • Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.	Construction
Silencers on Mobile Plant	Where possible noise from mobile plant will be reduced through additional: • Residential grade mufflers • Damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced.	Construction
Shield stationary noise sources such as pumps, compressors, fans, etc	• Stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. • Appendix F of AS 2436: 1981 lists materials suitable for shielding.	Construction
Shield sensitive receivers from noisy activities	• Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings would be unlikely to benefit.	Construction

6.5. COMMUNITY AND SOCIO-ECONOMIC

6.5.1. Existing Environment

The northern end of the proposal site is situated within a predominantly residential area of Botany, with sensitive receivers on either side of the rail corridor. From Swinbourne Street and southward, the surrounding environment is industrial.

The suburb of Botany has 10,817 residents according to the 2016 Census (Australian Bureau of Statistics, 2019) with an even split of males and females. Most residents are married (47.9%), followed by never married (36.6%). The most common occupation for Botany residents is professionals (21.3%), followed by clerical and administrative workers (17.3%) and managers (14.6%). Most residents travel to work via car as a driver or passenger (64.1%), followed by bus (8.5%) and train (4.4%).

6.5.2. Potential impacts

Construction

The following potential socio-economic impacts have been assessed in the following sections:

- Noise and vibration, including sleep disturbance (section 6.4 and cumulative section 7.1.4)
- Traffic and access (section 6.3 and cumulative section 7.1.3)
- Visual impact (section 6.6 and cumulative section 7.1.6).

During construction, adjacent residences and businesses may be affected by elevated noise levels, increased road traffic and visual changes. As all works area confined to the rail corridor, and traffic disruptions considered minimal, the impact to residents and commercial activities is minimal. Additional environmental safeguards and mitigation measures are recommended in Section 6.5.3 to further minimise potential socio-economic impacts.

No delays in transport, disruption to working hours of adjacent businesses, increased traffic or restrictions on access to private property or commercial property is expected as a result of the proposal.

Operation

The proposal wouldn't negatively impact the community during operation and would improve the operational efficiency. Rail traffic and maintenance schedules would not be increased as a result of the proposal.

6.5.3. Safeguards and mitigation measures

Impact	Environmental safeguards	Timing
Socio-economic	• Existing access for nearby and adjoining properties is to be maintained at all times during the works unless otherwise agreed to by the affected property owner.	Construction
Complaints	• A project information board will be displayed at all entrances to the site. A contact phone number/ email address for Enviroline would be on display. Complaints would be managed in accordance with ARTC procedure.	Construction
	• A complaint handling procedure and register will be included in the CEMP. • The complaints register will be maintained throughout construction.	Pre-construction and construction
Communication	• Start of Work letters would be distributed one week (minimum 5 working days) before commencement of works.	Detailed design / pre-construction
	• Targeted communication with Bayside Council regarding timing of the most intrusive noise intensive works and changed traffic conditions that may affect public spaces and transport routes within the LGA.	Detailed design/ pre-construction

6.6. VISUAL IMPACTS

6.6.1. Existing environment

The existing visual environment in the vicinity of the proposal can be summarised as follows:

- Located within a highly urban landscape where the visual landscape is dominated by the built environment;
- Surrounded by a mixed-use region consisting of residential, commercial and heavy industrial;
- Residential communities have direct line of site to the rail corridor in some instances.

Refer to Figure 1-1for a map of the proposal site and surrounding uses.

6.6.2. Potential Impacts

Construction

The visual character of the rail yard is heavy industrial, and as such the sensitivity to change is negligible. The proposal would involve temporary and reversible changes to the landscape during construction through the presence of stockpiles and construction equipment and machinery. The magnitude of change is negligible given works would be limited to the rail corridor, where maintenance activities are carried out on a regular basis.

Residents directly adjacent to the proposal site would have direct line of site to the proposal site, however the proposed daytime works and activities would have a negligible impact on the landscape character as the works would be temporary.

Night works would require temporary lighting, and light spill may be experienced by nearby sensitive receivers. In the absence of appropriate mitigation measures, the visual impact would be moderate during night works. However, with the implementation of the environmental safeguards and mitigation measures in Section 6.6.3, visual impacts associated with light spill are considered low.

Operation

Replacement signalling equipment will be similar in dimension and material as the existing equipment, and as such would not visibly alter the landscape. Once operational, surrounding residential receivers would not be subject to any permanent changes.

6.6.3. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Visual impacts	• Construction areas will be maintained in a tidy manner.	Construction
Light Spill	• Any lights required will be directed onto the site, with a maximum position angle of 30º from vertical, and back spill shields, therefore minimising any unwanted light spill and impacts at night. • Lighting should not cause reflected glare.	Construction

6.7. ABORIGINAL HERITAGE

6.7.1. Approach

The Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010 – 'Due Diligence Code') was referred to during the preparation of this REF. The Due Diligence Code sets out the reasonable and practicable steps which individuals and organisations need to take in order to:

- Identify whether or not Aboriginal objects are, or are likely to be, present in the area
- Determine whether or not their activities are likely to harm Aboriginal objects (if present)
- Determine whether an Aboriginal Heritage Impact Permit (AHIP), application is required.

Database Search

A search of relevant heritage registers for Aboriginal sites and places provides an indication of the presence of previously recorded sites. The search will indicate whether any sites are known within or adjacent to the locality. The Aboriginal Heritage Information Management System (AHIMS) is maintained by OEH and provides a database of previously recorded Aboriginal heritage sites. A search provides basic information about any sites previously identified within a search area. The results of the search are able to be relied upon for 12 months for the purposes of a due diligence level assessment.

A basic search of the study area including utilising a 50 m buffer on the AHIMS database was undertaken on 23 July 2019 (Appendix C). No Aboriginal heritage sites or places was recorded in or near the location of the proposal site. One Aboriginal site and no Aboriginal places were identified in the wider search area (200 metre buffer), with the closest sites being located 350 metres away and outside the rail corridor.

A search of the Native Title database did not identify any claims of native title within the proposal site.

The proposal site and surrounding study area does not include any landscape features that would be associated with Aboriginal objects. Such landscape features would be:

- Land within 200m of waters
- Land within a sand dune system
- Land located on a ridge top, ridge line or headland
- Land located within 200m below or above a cliff face
- Land within 20m of or in a cave, rock shelter or a cave mouth.

Although some sandstone platforms were observed within the rail corridor, the landscape does not meet any of the above criteria. Furthermore, the works would occur land that has been heavily disturbed by the original construction of the Botany Line, surrounding industrial areas, roads and residential properties. As such, no sensitive landscapes as per the definitions of the Due Diligence Code are noted within the proposal site.

6.7.2. Potential Impacts

Construction

The Due Diligence Code of Practice states that if, after the desktop research and visual inspection is completed, it is evident that harm would occur to Aboriginal objects or heritage places, then further and more detailed assessment is required.

Results of the desktop and visual assessment have highlighted the absence of Aboriginal Cultural Heritage sites within the proposal site and have identified no potential impact upon any Aboriginal Cultural Heritage as a result of the proposed works. It has been determined that works are able to proceed, following the recommendations outlined below.

Operation

There are no expected impacts to Aboriginal Heritage during operation of the proposal as the operational activities would be restricted to existing disturbed areas.

6.7.3. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Unexpected finds	• All ground disturbance activities shall be confined to within the rail corridor, as this will eliminate the risk of harm to Aboriginal objects that may be located beyond this area. Should the parameters of the proposal extend beyond the assessed area, then further archaeological assessment may be required. • An unexpected finds procedure will be prepared and included in the CEMP. The procedure will include requirements for: o Protecting any unexpected finds (including Aboriginal heritage items and human skeletal remains) encountered during construction activities o Procedures to manage reporting and investigation when unexpected finds are encountered	Construction

6.8. NON-ABORIGINAL HERITAGE

6.8.1. Approach

A search of the Australian Heritage Database (DEE 2018a), NSW Heritage Register and s170 Register (OEH 2018d) and the Botany Bay LEP was undertaken on the 23rd July 2019 and updated on the 8th May 2020 to identify any listed heritage items in the study area (Appendix C). None of the searches identified any heritage listings within the study area.

6.8.2. Potential Impacts

Construction

The desktop assessment identified did not identify any heritage items in the study area. There would be no impact on heritage values as a result of the development and further assessment of heritage impacts relating to the proposed works is not warranted as a significant impact is not likely, in accordance with the NSW *Heritage Act 1977*, and the *Environmental Planning and Assessment Act 1979*.

Operation

There would be no impacts to non-Aboriginal heritage during operation.

6.8.3. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Harm to a non-Indigenous heritage item	• An unexpected finds procedure will be established and implemented in the case of unexpected non-Aboriginal heritage finds.	Construction

6.9. WASTE

ARTC is committed to the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the *Waste Avoidance and Resource Recovery Act 2001*. These resource management hierarchy principles, in order of priority are:

Avoidance of unnecessary resource consumption

Resource recovery (including reuse, reprocessing, recycling and energy recovery)

Disposal

Other objectives of the Act include:

To encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,

To provide for the continual reduction in waste generation,

To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste,

To ensure that industry shares with the community the responsibility for reducing and dealing with waste,

To ensure the efficient funding of waste and resource management planning, programs and service delivery,

To achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis,

To assist in the achievement of the objectives of the *Protection of the Environment Operations Act 1997*.

By adopting the above principles, ARTC aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in accordance with the principles of ecologically sustainable development (ESD).

6.9.1. Potential Impacts

Construction

Materials required for the works are not rare or in short supply. Other projects occurring locally such as the BRD project would also generate demand for resources needed for construction and the need for resource recovery, recycling and disposal, however as construction materials are not in short supply, and there are abundant facilities licensed to accept waste from this proposal and other projects, impacts are considered negligible.

Fuel to operate machinery would be consumed during the construction phase of the project. In the long term, the proposal would not require any additional input of resources. Natural resource impacts are minor.

The main waste streams from the proposal would include:

- General construction waste
- Potential contaminated spoil material (refer to 6.1 above)
- Rail track, sleepers and associated infrastructure

Excess material would be reused where appropriate to achieve subgrade of the proposal site prior to laying capping.

Small quantities of waste are likely to be generated from the construction of the proposal including general construction waste, timber and metal. It is not likely that there would be any problems associated with the disposal of these wastes.

Any contaminated waste generated from the works would need to be disposed of in accordance with SafeWork NSW guidelines and the Waste Classification guidelines.

Operation

There are unlikely to be any significant operational impacts to waste as current ARTC procedures manage waste onsite during maintenance activities.

6.9.2. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Waste generation	• General waste and recycling receptacles will be provided onsite and waste collected from site regularly. • All waste will be managed in accordance with the *Protection of the Environment Operations Act 1997.* A licensed waste contractor must be used for the collection and transport of all non-domestic/ commercial wastes for either offsite processing and/or disposal to a licensed facility. • Segregate and stockpile reusable and recyclable wastes such as ballast, sleepers, troughing, pallets, bridge transoms, drums, jewellery, cables and other scrap metal for salvage where possible. • All excavated natural, non-contaminated soil, aggregate or rock should be stockpiled separately and re-used onsite where possible.	Construction
Waste Disposal	• All material proposed to be removed from the work site, for recycling or disposal or otherwise, must be waste classified using the Waste Classification Guidelines (NSW EPA, 2014) and segregated to ensure opportunities for reuse, recovery and recycling of wastes are optimised. Waste needs to be assessed for contamination due to the nature of the site.	During/After construction

6.10. CLIMATE AND AIR QUALITY

6.10.1. Existing Environment

The closest Bureau of Meteorology weather monitoring site in the vicinity of the proposal is Sydney Airport AMO (ID 066037). The recorded mean maximum temperature for 2019 in the area varies from 17.2^{0}C to 26.7^{0}C and the recorded mean minimum temperature for 2019 varies from 7.3^{0}C to 19.1^{0}C (Bureau of Meteorology, 2019). The area had an annual rainfall of 830.2mm (Bureau of Meteorology, 2018) in 2018. Highest risk periods of heavy rain and localised flooding is February to June.

Within the Botany Bay locality, the major air emissions and pollutant sources arise from existing industrial activities, airport activities and the operational rail line.

A search of the National Pollution Inventory (Department of the Environment and Energy, 2018) identified facilities within two kilometres of the proposal site (Appendix C.5). The closest facilities to the proposal site include the Kellogg Botany Plant, Orica Groundwater Treatment Plant, the Allnex Resins Botany, and the Caltex Banksmeadow Terminal. Emissions data for these sites has been included in Appendix C.5, with exceedances of thresholds as per the National Pollution Inventory (Department of Agriculture, Water and the Environment, 2019) detailed in Table 6-23.

Table 6-23 NPI threshold exceedances

Facility	Exceedance for 2017/2018	Threshold
Allnex Resins Botany	Total Volatile Organic Compounds – 85 tonnes	25 tonnes per year

Facility	Exceedance for 2017/2018	Threshold
Caltex Banksmeadow Terminal	Total Volatile Compounds – 110 tonnes	25 tonnes per year
Orica Groundwater Treatment Plant	No exceedances for 2017/2018	
Kellogg Botany Plant	No exceedances for 2017/2018	

Air quality data sourced from DPIE's air quality monitoring station at Randwick for 2019 is presented in Table 6-24. The monitoring station at Randwick is the closest station to the proposal.

Table 6-24 Air quality data for Randwick 2019

Pollutants	Sulfur dioxide SO2	Nitrogen Oxide NO	Nitorgen Dioxide NO2	Ozone 1hr average	Ozone 4hr average	Particles PM10	Particles PM2.5	Visibility NEPH
Measurement	pphm	pphm	pphm	pphm	pphm	µg/m³	µg/m³	bsp
January	0.1	0.1	0.2	2.2	2.2	28	9.6	0.38
February	0.1	0.2	0.3	2	1.9	23.6	8	0.2
March	0.1	0.4	0.5	2	2	22.9	8.1	0.25
April	0.1	0.8	0.7	1.8	1.7	20.6	8.8	0.25
May	0.1	1.1	1.2	1.4	1.4	19	9.9	0.28
June	0.1	1.2	1.1	1.3	1.3	14	7.6	0.21
July	0.1	1	1.1	1.5	1.5	15.2	7.1	0.16
August	0.1	0.7	1	1.9	1.9	17.9	7.9	0.18
September	0.1	0.3	0.6	2.3	2.3	19.6	8.5	0.18
October	0.1	0.3	0.5	2.6	2.6	25.8	13.3	0.38
November	0.1	0.1	0.4	2.7	2.6	39.9	19.2	0.70
December	0.1	0	0.2	2.7	2.6	42.4	25.5	1.1

Exceedances above Air National Environment Protection Measures (NEPM) standards are highlighted in red. Nitrogen dioxide and both ozone levels exceeded the NEPM standards for every month of 2019.

6.10.2. Potential Impacts

Construction

Atmospheric pollutants created during the construction phase would include dust from ground disturbance activities and exhaust emissions from construction vehicles and machinery. Dust production can be increased during dry and windy days. High levels of dust can impact sensitive receivers near the works if not managed appropriately on site through dust suppression practices. Given the limited nature of ground disturbance works, it is not expected that construction of the proposal would result in significant dust impacts. Given the nature of works, negative air quality impacts from construction are likely to be low and manageable with the implementation of mitigation measures.

Cumulative impacts from concurrent construction works of the proposal and the BRD project are discussed in section 7.1.9.

Construction activities involve several factors that can impact on global climate through the release of greenhouse gas emissions and reduction of the ability of the environment to take up carbon dioxide. These include:

- Burning of fossil fuels used in construction equipment
- Greenhouse gas emissions associated with the extraction or production of resources used in construction
- Generation of waste products that can release greenhouse gas emissions (depending on waste type and treatment)
- Disturbance of soils can result in the release of greenhouse gases that would otherwise be fixed in soil organic matter.

The contribution of the activity to air quality in the region is considered to be a very small part of a much wider issue; climate change is a result of the cumulative effect of millions of similar activities. Identifying ways to effectively manage this problem on a project by project basis is justifiable. Any potential impacts would be minimised through the implementation of the mitigation measures below.

Operation

The proposal would not change the current operations of the rail yard. Any air quality impacts associated with ARTC's maintenance activities would be managed in accordance with standard operating procedures..

6.10.3. Safeguards and Mitigation Measures

Impact	Safeguards and mitigation measures	Timing
Air Pollution	• Works likely to generate dust will be avoided where possible during strong winds or weather conditions where high levels of dust is likely. • Activities involving excavation or disturbance of soils or vegetation must implement controls to prevent and/or minimise the generation of dust as required (i.e water carts or apply soil binders for dust suppression as required). • Minimise vehicle movement and speed on unsealed tracks and access paths. • All plant and equipment must be serviced regularly to ensure exhaust emissions generated are within the specified plant and equipment standards. • If dust is observed migrating offsite, additional dust controls such stopping works in high wind conditions or use of water carts, water sprays or application of dust suppression polymers. • Machinery must not be left running idle when not in use.	Construction

7. CUMULATIVE IMPACTS

When a project is assessed in isolation, the environmental impacts and benefits may not be considered large. However, when combined with other projects, the resultant cumulative effects may result in a greater extent, magnitude or duration of impact. Identifying the potential for cumulative impacts assists in guiding the development of appropriate mitigation measures.

The selection of proposed developments assessed as part of this cumulative impact assessment was based on a number of criteria including:

- The proximity of the project to the Proposal

- The likelihood of the project being constructed during a similar time as the Botany Rail Duplication project
- The size of the project and the potential to result in substantial changes to identified key issues (such as traffic, air quality noise and vibration etc) or substantial changes to the existing land use of the area.

Other projects with the potential for cumulative impacts with the Botany Rail Duplication project were identified during internal workshop discussions, consultation with technical specialists and a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government, 2019)
- Bayside Council – Development Application search tool (Bayside Council, 2019)
- Australian Government – Department of Environment and Energy, EPBC Public notices list (Australian Government, 2019).

7.1. BOTANY RAIL DUPLICATION

The Botany Rail Duplication (BRD) project is part staged improvements to the Botany Line proposed by ARTC under a Program of Works funded by the Federal Government. The BRD project involves duplicating a section of track within the rail corridor between Mascot and Botany where there is currently only one track. Key features of the BRD project involve:

- Track duplication: construction of a new track within the rail corridor for a distance of about three kilometres;
- Track realignment (slewing) and upgrading
- New track crossovers
- New bridge structures at Mill Stream, Southern Cross Drive, O'Riordan Street and Robey Street and reconstruction of existing bridge structures at Robey and O'Riordan Street
- Embankment/retaining structures

The BRD project is currently being assessed as State Significant Infrastructure by the Department of Planning, Industry and Environment (DPIE). The Environmental Impact Statement (EIS) was publicly exhibited by DPIE between 16 October 2019 to 13 November 2019. A Submissions Report prepared in response to submissions received during the public exhibition period was published on 4 March 2020.

If approved, the Botany Rail Duplication (BRD) project will commence construction in 2022 and take approximately three years to complete. This construction period aligns with this proposal. The construction work sites of the projects also overlap, as shown in Figure XX. The proposed Banksia Street compound site may also be used by both projects. Given the physical proximity of the projects and the consecutive construction timeframe, the cumulative environmental impacts of the proposal and the BRD project should be considered. An Environmental Impact Statement has been prepared for the BRD project, and public exhibition of the assessment ended on 12 November 2019.

In addition, a site-specific noise and vibration assessment was undertaken by SLR in May 2020 to assess the cumulative construction and operational noise and vibration impacts of the proposal in conjunction with the BRD project. Refer to section 7.1.4 and section 6.4 for details.

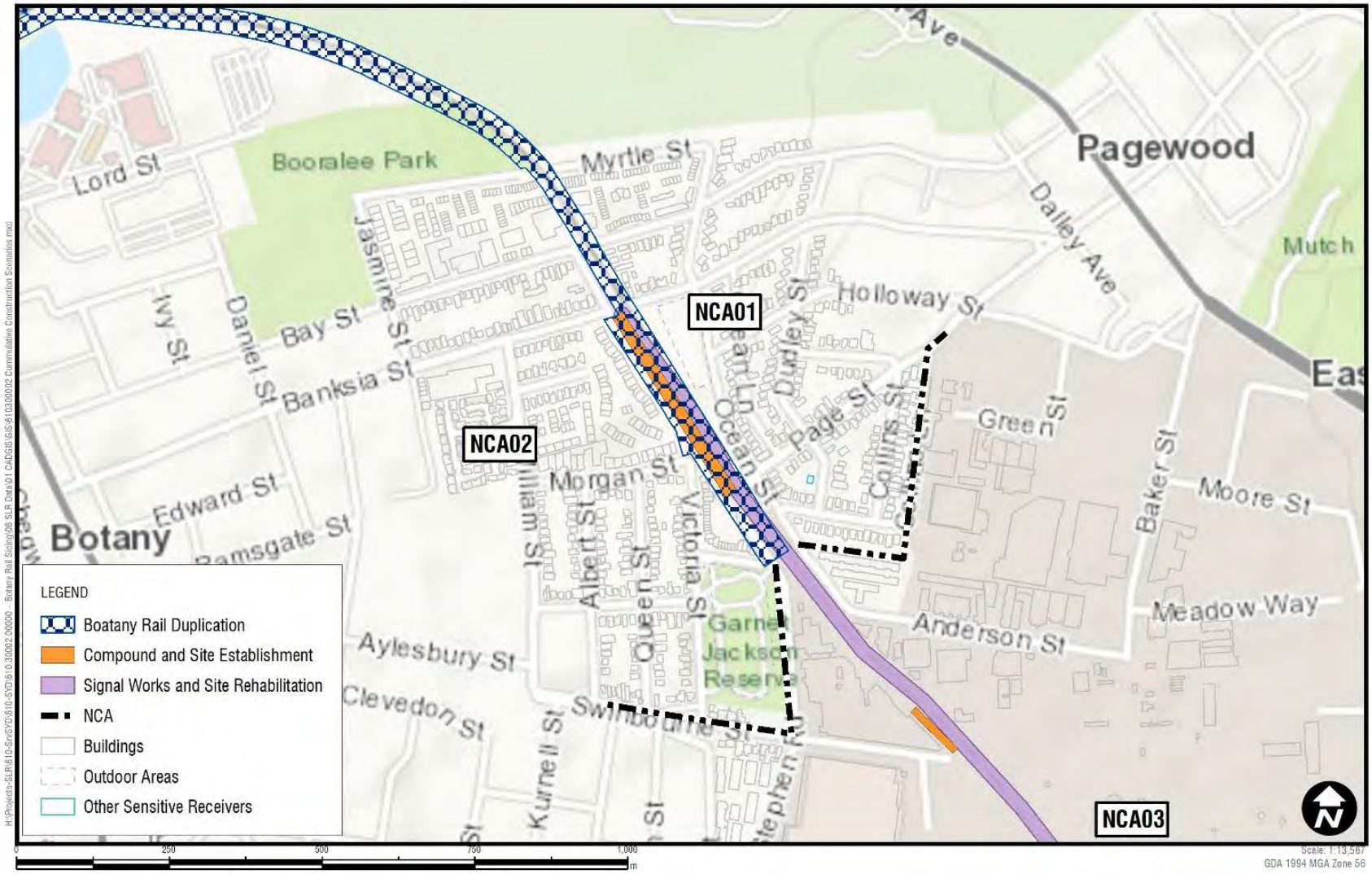

Figure 7-1 Project overlaps of BRD and Botany Yard Bi-Directional Signalling works ((SLR, 2020)

7.1.1. Soil, Water and Contamination

Construction

Simultaneous construction of the proposal and the BRD project may result in collective impacts on the surrounding waterways particularly Mill Stream and the surrounding wetlands through increased sedimentation and runoff due to an increase in exposed soils. However, there is limited excavation and ground disturbance works required for the proposal and it is expected that excavation/trenching for CSR will not be exposed for long periods and backfilled following installation of cabling. Given ground disturbance works associated with the proposal are minor, it is considered that any cumulative impacts can be suitably managed through the implementation of the mitigation measures and safeguards in section 8.2 alongside the implementation of the mitigation measures outlined in Section 8 of the BRD Submissions Report.

Potentially contaminating activities (i.e. oil spills/leaks) for both projects will be wholly contained within the rail corridor

Operation

Operation of the proposal and the BRD project are expected to have similar operating conditions to those currently in place, and the impacts to soil, water and contamination are not expected to change.

7.1.2. Biodiversity

Construction

The proposal does not involve removal of mature trees, and minor grubbing works will impact already disturbed areas of groundcover, most of which is exotic. The BRD project involves removal of small patches of highly fragmented, predominantly planted vegetation. The combined impacts of both projects would have a negligible effect on the biodiversity of the local area. As such, no additional mitigation measures to those outlined for the proposal in Section 8.2 of this REF are required.

Operation

Operation of the proposal and the BRD are expected to have similar operating conditions to those currently in place, and no cumulative impacts to biodiversity are expected. As no cumulative operational biodiversity impacts are anticipated, no additional mitigation measures are required.

7.1.3. Traffic and Access

Construction traffic associated with the BRD project was assessed in the EIS and determined to create a maximum estimated percentage increase in total traffic volume at any intersection shown in Table 7-1 of up to 2.6 percent in the AM peak at Botany Road and Mill Pond Drive (WSP Australia Pty Limited & GHD Pty Ltd, 2019).The EIS also noted that overall, the volume of construction traffic associated with the BRD project is low compared to existing traffic volumes on the local road network, and the additional construction vehicles are not expected to substantially impact the local road network.

As assessed in Section 6.3 of this REF, construction traffic generated by the proposal is expected to be limited to the small work crews working onsite during standard working hours, infrequent deliveries and possession period works. As such, the cumulative construction of the proposal and the BRD project would not contribute significant traffic volumes that would be likely to substantially impact the operation of key intersections and the overall local road network.

Where more than one project occurs in the same area consecutively, there may also be a combined effect from the increased duration of impacts on nearby receivers, with potential to impact drivers, pedestrians and cyclists who currently utilise the local road network.

Potential cumulative traffic impacts can be managed through implementing safeguards listed in section 6.3.3 and those outlined for the BRD project in Section 8 of the BRD Submissions Report. .

Table 7-1 BRD construction traffic an percentage increase (WSP Australia Pty Limited & GHD Pty Ltd, 2019)

Intersection Name	AM peak hour construction volume (veh/h*)	AM Construction traffic as percentage of background traffic	AM peak hour construction volume (veh/h)	PM Construction traffic as percentage of background traffic
Botany Road/Banksia Street	53	-**	56	-
Botany Road/Bay Street	40	-	44	-
Botany Road/Mill Pond Drive	145	2.6%	58	1.0%
General Holmes Drive/Mill Pond Drive	122	2.3%	42	0.7%
Botany Road/Wentworth Avenue	68	-	27	-
General Holmes Drive/Joyce Drive/ Construction Access	86	2.1%	37	0.9%
Joyce Drive/O'Riordan Street	52	1.0%	23	0.5%
Qantas Drive/Robey Street	55	1.0%	42	0.9%
Robey Street/O'Riordan Street	60	1.4%	21	0.5%
Botany Road/Robey Street	149	-	60	-
Botany Road/King Street	159	-	65	-

Total construction traffic (veh/h) at intersections

**- Traffic counts not available

Operation

Operation of the proposal and the BRD project are expected to have similar operating conditions to those currently in place, with maintenance vehicles accessing the corridor. It is not expected that either project will adversely impact the road network, public transport or pedestrian footpaths during operation, and therefore the impacts to traffic and access are not expected to change. As no cumulative operational traffic and access impacts are anticipated, no additional mitigation measures are required.

7.1.4. Noise and Vibration

Approach

Cumulative noise and vibration impacts were assessed by SLR in May 2020 to determine associated impacts of the BRD with the proposal. Refer to Appendix D for details regarding the assessment approach and methodology.

Construction

The indicative construction program schedules Botany Yard Signalling Works to concurrently with the Botany Rail Duplication (BRD) works. The project areas for both projects are shown in Figure 7-1.

Figure 7-1 shows that the project areas overlap near NCA01 (NCA07 in the Botany Rail Duplication EIS) and NCA02 (NCA08 in the Botany Rail Duplication EIS) meaning cumulative construction noise impacts may occur if construction on both projects is carried at the same time near this area.

The BRD EIS has been referenced to determine the worst-case construction noise impacts from that project. The residential receiver noise management levels for construction are shown in Table 7-2. Table 7-3 shows the worst-case impacts from Botany Yard Signalling Works and the BRD.

Table 7-2 Residential receiver construction noise management levels (NMLs)

NCA	Representative Background Monitoring Location	NML (LAeq(15minute) – dBA)				Sleep Disturbance Screening Criteria (RBL +15 dB)
		Standard Construction (RBL +10 dB)	Out of Hours (RBL +5 dB)			
		Daytime	Daytime[1]	Evening	Night-time	
NCA01	L07	56	51	51	48	58
NCA02	L06	49	44	44	42	52
NCA03[2]	-	-	-	-	-	-
NCA04	L06	49	44	44	42	52
NCA05	L06	49	44	44	42	52
NCA06[2]	-	-	-	-	-	-

Table 7-3 Worst-case predicted noise levels from the BRD project and the proposal (SLR, 2020)

ID	Scenario	Activity	Predicted Worst-case Noise Level (dBA)	
			NCA01/NCA07	NCA02/NCA08
Botany Rail Duplication EIS – Predicted Noise Levels				
1a	Enabling Works	Billboard Demolition	<30	<30
1b		Utilities	84	82
1c		Veg. Clearing & Property Adjust.	89	87
2a	Compounds	Establishment	61	74
2b		Operations	50	63
3a	Bridge Works	Demolition (incl. breaker)	50	51
3b		Construction	43	44
4a	Retaining Walls	Construction	42	44
5a	Trackworks	Peak	87	85
5b		Typical	65	63
6a	Signalling (incl. CSR)		74	72
6b	Testing, Commissioning & Finishing		75	73
Botany Yard Signalling Works – Predicted Noise Levels				
01	Site Establishment		63	74
02	Compound Operation		52	63
03	Trackworks - Peak		70	71
04	Trackworks - Typical		49	50
05	Signal Works - Peak		65	67
06	Signal Works - Typical		56	58
07	Site Rehabilitation/Decommissioning		58	60

Botany Rail Duplication works are expected to result in higher worst-case noise levels and impacts in NCA01 and NCA02 than Botany Yard Bi-Directional Signalling Works. The highest noise levels are seen during *Enabling Works – Vegetation Clearing and Property Adjustment* and *Trackworks – Peak* as part of Botany Rail Duplication, which is due to these works using noise intensive equipment such as concrete saws near to residential receivers in NCA01 and NCA02.

Trackworks – Peak are also required as part of Botany Yard Bi-Directional Signalling Works, however, they are only required in one location (to the south of Banksia Road). This location is not immediately adjacent to residential receivers, meaning noise levels at the nearest receivers are expected to be lower.

It is also noted that both projects propose to use the same Banksia Street compound and the noise levels predicted from *Compound – Operation* are similar for both sets of works. Residential receivers are located in close proximity to the western boundary of this compound and could be impacted by extended cumulative impacts if the compound is regularly used for a long total duration across both projects.

The worst-case impacts during all construction scenarios from both projects are shown in Figure 7-2 below.

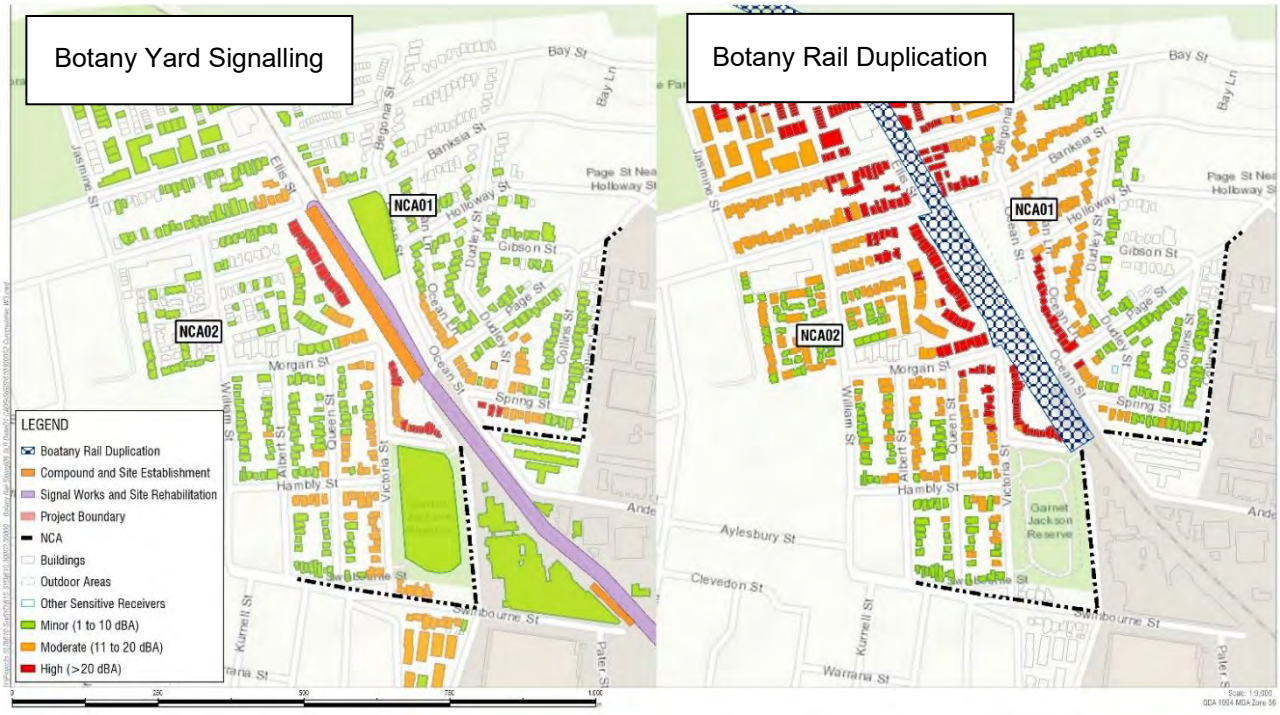

Figure 7-2 Worst-case impacts from the BRD project and the proposal (SLR, 2020)

The BRD project is generally expected to result in higher noise levels and impacts than that of the proposal. The worst-case construction impacts are expected to be controlled BRD works as the noisiest scenarios for that project are required to be undertaken closer to the nearest receivers in NCA01 and NCA02.

When less noisy works are being completed by Botany Rail Duplication at the same time and in a similar location as Botany Yard Bi-Directional Signalling Works there is potential for cumulative impacts from concurrent works on both projects. Since the construction scenarios would generally require similar items of equipment, concurrent construction could theoretically increase noise levels in this report by around 3 dB (ie a logarithmic adding of two sources of noise at the same level).

However, the likelihood of worst-case noise levels being generated by two different works at the same time is considered low. Rather than increase construction noise levels, the impact of concurrent works would generally be a potential increase in the duration, and annoyance, of noise impacts on the affected receivers. There is also potential for loss of respite where works occur for consecutive days or nights across both projects.

In practice, construction noise levels in any one location would vary and would be frequently much lower than the worst-case predictions presented in the noise and construction report due to construction phasing moving works around and, in many cases, only a few items of equipment being used at any one time.

Operation

Expected changes to freight locomotive idling in the study area from both Botany Yard Bi-Directional Signalling Works and the Botany Rail Duplication are shown in Table 7-4. The worst-case anticipated train idling events have been used in this assessment to conservatively predict the potential noise impacts. This increase in train idling numbers is the result of increased network capacity provided by the Botany Rail Duplication project.

Table 7-4 Train Idling Operations

Location	Without Project				Botany Yard Bi-Directional Signalling				Botany Rail Duplication			
	Daytime		Night-time		Daytime		Night-time		Daytime		Night-time	
	No. of trains	Idling Duration (mins)	No. of trains	Idling Duration (mins)	No. of trains	Idling Duration (mins)	No. of trains	Idling Duration (mins)	No. of trains	Idling Duration (mins)	No. of trains	Idling Duration (mins)
Gelco Siding	1	12	1	12	1	2	1	2	2	2	2	2
Botany Yard Departures	24	30	14	30	24	30	14	30	35	30	21	30
Botany Yard Arrivals	24	30	14	30	24	30	14	30	35	30	21	30

The number of trains required to idle in Botany Yard is expected to increase by approximately 50 percent as a result of the Botany Rail Duplication project. Changes to freight locomotive idling are considered mostly likely to influence potential cumulative noise levels.

The increase in the number of idling events associated with the Botany Rail Duplication would likely result in a proportionate increase in the number of wagon breaking, bunching, and stretching noise events. The potential increase in the frequency of these noise events would not, however, affect cumulative noise level impacts because these noise sources are assessed under the RING LAmax noise trigger levels[1].

Cumulative operational rail noise impacts from the operation of both the Botany Yard Bi-Directional Signalling and Botany Rail Duplication have been assessed against the requirements of the RING.

The predicted cumulative rail noise levels at residential receivers are summarised in Table 7-5 for the 2024 opening year and 2034 future design scenarios. The table shows the highest noise levels in each NCA, which is typically at receivers nearest to the alignment. Details on the number of any triggered receivers in each NCA is also provided.

[1] Assessment methodology consistent with the NSW Rail Noise Database and the ARTC Noise Modelling and Mitigation Guideline.

Table 7-5 Summary of cumulative operational rail noise levels at residential receivers in each NCA

NCA	Side	Predicted Noise Level (dba)[1]												Total Triggers[3]
		Daytime LAeq(15hour)				Night-time LAeq(9hour)				Maximum LAmax[2]				
		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		
		Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	
Criteria[4]		65	65	65	65	60	60	60	60	85	85	85	85	-
NCA01	Up	65	65	65	66	65	65	65	66	94	94	94	94	0
NCA02	Down	66	66	67	68	66	66	67	68	96	96	96	96	0
NCA03[5]	Up	-	-	-	-	-	-	-	-	-	-	-	-	-
NCA04	Down	53	54	54	55	53	54	54	55	78	78	78	78	0
NCA05	Up	42	42	42	43	42	42	42	43	69	69	69	69	0
NCA06	Down	<30	<30	<30	<30	<30	<30	<30	<30	35	35	35	35	0
Total														0

Note 1: The results are for the receiver with the highest predicted noise level in the controlling 2034 'with project' scenario in each NCA for the daytime, night-time and maximum noise levels. As such the daytime, night-time and maximum results may be for a different receiver in the same NCA. The receiver with the highest predicted 2034 'with project' noise level may not be subject to the largest increase in noise from the proposal in that NCA. The predicted increases are discussed in the following sections.

Note 2: Maximum refers to the LAmax noise level and applies to both the daytime and night-time.

Note 3: Mitigation measures should be investigated for receivers that are predicted to experience noise levels above both the RING absolute and increase trigger levels.

Note 4: RING residential noise trigger level criteria for redeveloped rail projects.

Note 5: NCA does not contain residential receivers.

Operational impacts from the proposal are as follows:

- The proposal is not expected to substantially alter existing rail noise levels at 'other sensitive' receivers.
- Daytime average noise levels are predicted to reduce slightly (by less than 1 dB) which is due to the proposal removing nearby turnouts.
- Freight locomotive idling noise is predicted to be reduced by up to 5 dB for these receivers, however, the overall rail noise levels do not reduce by this amount as noise levels are controlled by train passby noise.
- No 'other sensitive' receivers are predicted to exceed the RING trigger levels and consideration of airborne noise mitigation is not required.

Safeguards and Mitigation Measures

Item	Discussion and Recommendations	Timing
Cumulative construction impacts	• Cumulative construction impacts may affect residential receivers in NCA01 and NCA02 due to concurrent construction works with Botany Rail Duplication. It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use the Banksia Street compound and residential receivers are immediately adjacent to the western boundary of this site • The potential cumulative impacts from Botany Yard Bi-Directional Signalling Works and other major projects will be investigated further as the proposal progresses. Specific additional management and mitigation measures designed to address potential impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community. • Where works on multiple projects are occurring outside of Standard Construction Hours in similar areas there is potential for increased impacts at nearby receivers. Co-ordination will occur between the various projects to minimise concurrent works in the same areas, where possible, and to ensure appropriate respite is applied to the affected receivers. • It is noted that it could be preferred by the affected community for works to occur on both Botany Yard Bi-Directional Signalling Works and Botany Rail Duplication at the same time so that the total duration of the works from both projects is reduced.	Pre-construction

The proposal is not predicted to result in any exceedances of the RING trigger levels meaning there is no requirement to consider mitigation for the operational rail noise impacts.

7.1.5. Community and Socio-economic

Construction

Cumulative construction effects of the proposal and the BRD project have the potential to increase road delays due to combined vehicle movements and increase noise and vibration impacts on adjacent sensitive receivers, however adequate mitigation measures to minimise these impacts are proposed in Section 8.2 of this REF and Section 8 of the BRD Submissions Report.

The construction of both projects in the area may also positively impact the local area through the creation of job opportunities and increasing profitability of businesses through purchase of goods for the project and workforce expenditure at local businesses.

It is also anticipated that there may be some minor benefits in consecutive construction of both projects by minimising the potential for ‘construction fatigue’ associated with ongoing projects over a longer duration of time. As the projects will be constructed at the same time, disruption associated with construction would be experienced for a shorter duration of time.

Operation

Operation of the proposal and the BRD project would increase the efficiency of moving freight to and from Port Botany, increasing the economic benefits for the region, including industries which require these freight services, logistical businesses and the intermodal terminals. Reduced traffic congestion on local roads due to the reduced number of trucks moving freight also has the potential to reduce travel time for road users in these areas.

7.1.6. Visual Impacts

Construction

Concurrent construction of the proposal and the BRD project would increase the amount of construction activity in the rail corridor, which may be visible to receivers who have direct sight lines to the rail corridor. However, temporary visual impacts during construction would be less than if the projects were undertaken consecutively, and has potential to reduce longer time visual impacts that would occur if the projects were not constructed concurrently.

Operation

The changes to visual amenity would be confined to the rail corridor for both the proposal and the BRD project. As this environment is already dominated by rail infrastructure, the impact on the visual amenity from the two projects would be negligible.

7.1.7. Aboriginal Heritage

Construction

No Aboriginal places or objects were identified within the construction footprint for either the proposal or the BRD project, therefore cumulative impacts to Aboriginal heritage are considered unlikely.

Operation

There are no expected cumulative impacts to Aboriginal Heritage during operation of the proposal or the BRD as the operational activities would be restricted to existing disturbed areas in the rail corridor.

7.1.8. Non-Aboriginal Heritage

Construction

No non-Aboriginal heritage items were identified in the proposal area; thus the proposal would not impact on and non-Aboriginal heritage items.

Several non-Aboriginal heritage items were identified as being within the proposal site of the BRD project, however as the proposal does not impact non-Aboriginal heritage items there would be no cumulative impacts. .

Operation

There are no expected cumulative impacts to non-Aboriginal heritage during operation of the proposal or the BRD project as the operational activities would be restricted to existing disturbed areas.

7.1.9. Waste

Construction

Both the proposal and the BRD project would produce a need for resources, however as none of these resources are considered to be in short supply this will not impact on resource availability.

Through the implementation of the mitigation measures in section 6.9.2 and in the BRD EIS, no significant cumulative waste impacts are expected. A need for resource recovery, recycling and disposal is required for both projects, and as there are abundant facilities licensed to accept waste from this proposal and other projects, impacts are considered negligible.

Operation

Operational resource use and waste generation for maintenance activities following completion of the proposal and the BRD project would be minimal and no cumulative impacts are expected.

7.1.10. Climate and Air Quality

Construction

The BRD project is anticipated to have similar primary activities and emissions to the proposal. Results of the Air Quality Impact Assessment of the BRD for the worst case scenario daily construction impacts identified that impacts would be contained within the BRD proposal site. Impacts from the construction of the BRD project are expected to be temporary and confined within an area of seven metres from the boundary of the BRD proposal site, therefore will have little to no overlap with the signalling upgrade works. The signalling works would have less impact than the BRD, and therefore would not have a significant overlap with the BRD project.

Operation

The BRD project would primarily produce emissions from combustion related particles in locomotives, whilst the operation of the proposal would not produce any additional emissions from combustion as no additional carrying capacity is proposed. Air quality monitoring from operation of the BRD met air quality criteria, and therefore the flow on effect from locomotives passing through the BRD section into Botany Yard will not significantly negatively impact air quality. The operation of the proposal would have the same air quality impacts as the existing operation.

As such, it is unlikely that future cumulative air quality criteria exceedances would occur as a result of the operation of both projects with the implementation of both projects mitigation measures and safeguards.

7.2. OTHER PROJECTS

7.2.1. Existing Environment

Cumulative environmental impacts of the proposed works include the combined effect of individual impacts associated with the proposal in addition to the impacts of other activities in the area.

Additional projects within the surrounding area are listed below;

Major Project	Address	Status
Banksmeadow Waste Transfer Terminal (Mod 1)	14 Beauchamp Road, Banksmeadow	Determination
Detector Dog Facility (Mod 1)	28A McPherson Street, Banksmeadow	Determination
Orica Botany – HCB Repackaging	Lot 11 DP1039919.	Determination
Orica Botany – Carpark Remediation (Mod 7)	Denison Street, Banksmeadow	Determination
Qenos Hydrocarbon Terminal Demolition	39 Friendship Road, Port Botany	Determination
Orica Southlands Warehouse Facility (Mod 5)	Lot 9 DP 1205673	Assessment
Orica Southlands Warehouse Estate	28 McPherson Street, Banksmeadow	Exhibition
Banksmeadow Waste Facility	Lot 5 DP 1048677	Determination

7.2.2. Potential Impacts

Key adverse cumulative impacts for the proposal relate to the combined impact from proposed construction activities, namely noise and vibration. Additionally, the potential for these to coincide with other activities in the area, such as road works, is a potential negative cumulative impact. There is potential for positive impacts to local and regional businesses associated with the project from purchase of goods and workforce expenditure during construction and operation.

The proposal is located in a predominantly industrial area where noise and general infrastructure works are common due to the existing rail and industrial infrastructure. In this setting, cumulative impacts are expected to be low, as the area is already subject to excessive noise sources including the airport and associated noise sources (aircraft), industrial activity from adjacent facilities such as Kellogg's Botany Plant, high volumes of traffic (namely freight vehicles) to and from Port Botany to Port Botany, and other projects such as the BRD.

All other impacts would be minor given the nature and small scale of the works.

8. ENVIRONMENTAL MANAGEMENT

8.1. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

A construction environmental management plan (CEMP) would be prepared to manage potential environmental impacts associated with the proposal. The CEMP should provide a summary of environmental risk associated with work tasks and provide practical on the ground environmental controls to be implemented by all personnel on the work site.

The CEMP would include the preparation of Environmental Control Maps (ECMs) which outline the location of key construction activities and environmental controls during works.

The CEMP will also incorporate a Construction Noise and Vibration Management Sub-plan.

The CEMP will also include all environmental safeguards and mitigation measures identified in this REF and any conditions from licenses or approvals required by legislation.

8.2. SUMMARY OF SAFEGUARDS AND MITIGATION MEASURES

Reference	Impact	Safeguards and mitigation measures	Timing
Soil, Water and Contamination			
WQC1	**Asbestos**	• Areas of identified or known potential asbestos containing material will require asbestos controls during intrusive works. Asbestos works shall be completed in accordance with the Code of practice for the safe removal of asbestos and site management procedures for asbestos handling and disposal shall include at a minimum asbestos air monitoring, removal of asbestos by a NSW SafeWork licenced asbestos removalist and removalist to provide an Asbestos Removal and Control Plan (ARCP). Asbestos management procedures shall be included in the site-specific Environmental Work Method Statement or Contaminated Land Management Plan for intrusive works as required by WQC3	During Construction
WQC2	**Asbestos**	• NSW Safework Licenced Asbestos Assessor (LAA) to provide an Asbestos Clearance Certificate following the completion of removal.	After construction
WQC3	**Exposure to Contaminants**	• The Botany Yard SMP (AECOM, 2018) should be used as a guide to prepare a	Pre-construction

Reference	Impact	Safeguards and mitigation measures	Timing
		site-specific Environmental Work Method Statement or Contaminated Land management plan for intrusive works (excavations and managing groundwater). The management plan should address: o PPE requirements o Training o Personal hygiene o Containment o Waste classification o Spoil disposal or reuse options	
WQC4	**Exposure to Contaminants**	• Potential reuse of materials is to be assessed in accordance with the National Environment Protection Measure.	During construction
WQC5	**Exposure to Contaminants**	• If previously unidentified contamination is identified the works should cease and the area be isolated so that the potential contamination can be sampled and identified by an Environmental Consultant' so this doesn't capture known contamination dealt with the Contaminated Land Management Plan or Environmental Work Method Statement.	During Construction
WQC6	**Exposure to Contaminants**	• Delineate and sign the known areas of contamination as no go zones (if contamination remains in-situ).	During Construction
WQC7	**Soil Erosion and Sedimentation**	• The proposal is to be undertaken in accordance with the requirements of Landcom's "Managing Urban Stormwater:	During Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		Soils and Construction", Volume 1, 4th Edition, March 2004 (the Blue Book).	
WQC8	**Soil Erosion and Sedimentation**	• Temporarily segregate and store excavated topsoil material for reuse during site stabilisation and backfilling.	During Construction
WQC9	**Soil Erosion and Sedimentation**	• Ensure any stockpiles of excavated material or ballast and other construction materials are not stored or temporarily placed within drainage lines. and provide appropriate containment measures around the stockpiles, to prevent impact from any contaminated runoff	During Construction
WQC10	**Soil Erosion and Sedimentation**	• Install sediment controls on the downslope side of any disturbed areas including excavated, graded and stockpile sites where erosion may result in impact to the surrounding area.	During Construction
WQC11	**Soil Erosion and Sedimentation**	• Where possible, work areas and stockpile sites and access tracks should be established in already disturbed, un-vegetated areas.	During Construction
WQC12	**Soil Erosion and Sedimentation**	• Restrict the height of stockpiles to two metres.	During Construction
WQC13	**Soil Erosion and Sedimentation**	• Temporary stockpiles shall be stabilised to prevent wind and water erosion where	During Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		they are located for an extended period of time (i.e. 2 weeks).	
WQC14	**Soil Erosion and Sedimentation**	• Minimise works during and after periods of high rainfall to minimise site disturbance and sedimentation.	During Construction
WQC15	**Soil Erosion and Sedimentation**	• Maintain and monitor erosion and sediment controls until the site is no longer at risk of erosion or sedimentation.	During Construction
WQC16	**Soil Erosion and Sedimentation**	• All disturbed areas are to be appropriately stabilised following completion of the works to prevent risk of erosion or sedimentation after construction.	During Construction
WQC17	**Soil Erosion and Sedimentation**	• At the end of each working day inspect site access locations for mud tracking and remove/clean up if present.	During Construction
WQC18	**Drainage**	• Any negative impacts observed during construction to the natural drainage system via track patrols and during works in the corridor will be reported to the Project Manager.	During Construction
WQC19	**Drainage**	• Do not discharge water or wastewater to stormwater, creeks, and drainage channels or into surrounding land.	During Construction
WQC20	**Pollution**	• Concrete washout, refuelling or other chemical use is to be conducted within a	During Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		sign posted, designated and bunded area, and where possible, a minimum 40 metres from a watercourse or drainage channel.	
WQC21	**Pollution**	• Do not perform maintenance of equipment or vehicles on site. If unavoidable, conduct within a designated area and use drip trays or catch trays beneath equipment / vehicles being maintained.	During Construction
WQC22	**Pollution**	• Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	During Construction
Biodiversity			
B1	**Clearing and prevention of over-clearing**	• If clearing of vegetation is required outside the proposal site these areas will need to be assessed by an ecologist for potential impacts to TECs, threatened species and their habitats.	During Construction
B2	**Clearing and prevention of over-clearing**	• Trees to be retained, including trees adjacent but outside of the proposal site, require an adequate tree protection zone (TPZ) for the duration of works. Details for calculating TPZs are provided within Australian Standard 4970-2009 – Protection of trees on development sites.	During Construction
B3	**Clearing and prevention of over-clearing**	• If the TPZ cannot be avoided during works, the Structural Root Zones (SRZ) of trees will be retained. Details for	During Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		calculating the SRZs are provided within Australian Standard 4970-2009 – Protection of trees on development sites.	
B4	**Direct impact to threatened fauna**	• Do not disturb fauna. Avoid fauna until it has relocated away from the site	During Construction
B5	**Direct impact to TEC and to threatened flora**	• Toolbox talks will identify threatened flora that may be encountered onsite. Where unexpected threatened flora species are suspected by construction crew within the worksite the following actions would take place: o All work within the vicinity would stop and the ARTC Environmental Officer contacted. o The area containing the threatened species would be surveyed by an ecologist who would determine appropriate actions to protect any individuals if required (e.g. translocation).	During Construction
B6	**Introduction and spread of noxious weeds and pathogens**	• Priority weeds (Bitou Bush, Green Cestrum, Fireweed, Lantana, Pampas Grass) will be eliminated and prevented from spreading from the proposal site so far as is reasonably practicable. All priority weed waste will need to be disposed of at a registered waste management facility. Management and disposal of weeds, including the priority weeds will be conducted in accordance with the	During Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		Biosecurity Act 2015 and the *NSW Weed Control Handbook* (Department of Primary Industries, 2018).	
B7	**Introduction and spread of noxious weeds and pathogens**	• All machinery (e.g. bulldozers, excavators, trucks, loaders etc.) will be cleaned prior to entering and exiting work sites. All plant material containing seed heads, weeds that have allelopathic properties, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, will be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.	During Construction
B8	**Introduction and spread of noxious weeds and pathogens**	• Pesticide application will be undertaken in accordance with ARTC's Pesticide Application procedure	During Construction
B9	**Disturbance to woody debris and litter and bush rock**	• Any fallen timber and dead wood encountered on site will be left in situ wherever possible or relocated to a suitable place nearby. Rock will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	During Construction
Traffic and Access			
T1	**Traffic**	• All heavy vehicles will travel within daylight hours where feasible. For road safety purposes, it will be necessary to undertake	Preconstruction / during construction

Reference	Impact	Safeguards and mitigation measures	Timing
		some deliveries out of hours. Additional measures for heavy vehicles will include: o Administrative controls to limit truck activities during peak periods. o Implement radio communication and designated truck idling areas to minimise impact of truck queuing on public roads o Temporary traffic controls.	
T2	**Traffic**	• When on site, vehicles will park within designated areas or cleared areas without vegetation.	Preconstruction / during construction
T3	**Traffic**	• Provide suitably designed construction site access which will consider: o Road design guidelines o Visible temporary regulatory, warning and guide signs o Use of accredited traffic controllers where appropriate	Preconstruction / during construction

Reference	Impact	Safeguards and mitigation measures	Timing
Noise and Vibration			
N1	**Construction Noise and Vibration Management Sub-Plan**	A CNVMP will be prepared as a sub plan to the CEMP before any construction works begin. This will include: • Identification of nearby sensitive receivers • Description of works, construction equipment and hours of work • Criteria for the proposal and any relevant licence and approval conditions • Any requirements for noise and vibration monitoring • Details of how community consultation and notification would be completed • Procedures for handling complaints • Details on how respite would be applied where ongoing high impacts are seen at certain receivers. • The CNVMP will also consider cumulative construction impacts and define a suitable management approach.	Pre-construction
N2	**Noise Impacts during out of hours work**	• Out of hours work would be undertaken in accordance with the requirements of an applicable Environmental Protection Licence (EPL) and/or Conditions of Approval, including any notification procedures.	Pre-construction
N3	**Construction Noise Exceedances**	• The assessment has identified that high impacts are likely when works are close to residential receivers in NCA01 and	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		NCA02, particularly when noise intensive equipment such as concrete saws or ballast tampers are in use during evening and night-time periods. • Where noisy works are required near to sensitive receivers in NCA01 and NCA02, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions and restrictions on working hours during these periods are generally not feasible.	

Reference	Impact	Safeguards and mitigation measures	Timing
N4	**Sleep Disturbance**	The need for consecutive night-time works and likelihood for sleep disturbance impacts will be reviewed during detailed design. Where impacts are considered likely, appropriate noise mitigation will be applied which takes into consideration factors such as the existing facade performance of affected residential receivers. Appropriate respite would be provided to affected receivers to limit impacts from night-time works in the same location, as required by the conditions of approval. Unless subject to an Environment Protection Licence, an Out-of-Hours Work Protocol would be prepared and be included as part of the CNVMP for main construction works. It will identify a process for the consideration, management and approval of works which are outside standard hours. The protocol would be prepared	Pre-construction
N5	**Compounds with Long Term Works**	• Hoarding, or other shielding structures, will be used where receivers are near to compounds (such as the Banksia Street Compound) or worksites with long term works. To provide effective noise mitigation, the hoarding should break line-of-sight from the nearest receivers to the works, noting that some affected receivers are multi-storey, and be of solid construction with minimal gaps. Hoarding	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		for construction sites is typically around 3 m in height.	
N6	**Compound layout**	• Noise generating items in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound.	Construction
N7	**Compound between Banksia Street and Stephen Road**	Noise impacts are predicted for the Banksia Street compound due to the proximity of the nearest receivers. The use of this compound site during out of hours works will be avoided as far as practicable. • It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use this compound.	Construction
N8	**Monitoring**	• Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the measurements should be to confirm their effectiveness.	Pre-construction Construction
N9	**Construction traffic**	Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches:	Pre-construction Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		• Vehicle movements will be away from sensitive receivers and during less sensitive times, where possible • The speed of vehicles will be limited and will avoid the use of engine compression brakes • On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times • Restriction of heavy vehicles idling near to residential receivers.	
N10	**Community preference**	• In locations where 'moderate' or 'high' impacts are predicted, engagement with the affected communities will be undertaken during detailed design to determine their preference for mitigation and management measures.	Pre-construction
N11	**Operation**	• Within six months of commencement of operation, validation noise monitoring should be undertaken to confirm the operational noise predictions and impacts'.	Operation
N12	**Implement community consultation measures**	Community consultation measures will be included in the CNVMP, including: • Periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.	Pre-construction

Reference	Impact	Safeguards and mitigation measures	Timing
N13	**Site inductions will be included in the CNVMP**	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.	Pre-construction Construction
N14	**Behavioural practices**	• No swearing or unnecessary shouting or loud stereos/radios/phone calls on speaker on site. • No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.	Construction
N15	**Construction hours and scheduling**	• Where feasible and reasonable, construction will be carried out during Standard Construction Hours. Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, where possible.	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
N16	**Equipment selection**	• Use quieter and less vibration emitting construction methods where feasible and reasonable. • For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts.	Construction
N17	**Use and siting of plant**	• Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. • The offset distance between noisy plant and adjacent sensitive receivers will be maximised. • Plant used intermittently will be throttled down or shut down. • Noise-emitting plant will be directed away from sensitive receivers, where possible.	Construction
N18	**Plan worksites and activities to minimise noise and vibration**	• Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.	Construction
N19	**Non-tonal reversing alarms**	• Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.	Construction
N20	**Minimise disturbance arising from delivery of goods to construction sites**	• Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. • Site access points and roads will be selected to as possible away from sensitive receivers.	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
		• Dedicated loading/unloading areas will be shielded if close to sensitive receivers. • Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.	
N21	**Silencers on Mobile Plant**	Where possible noise from mobile plant will be reduced through additional: • Residential grade mufflers • Damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced.	Construction
N22	**Shield stationary noise sources such as pumps, compressors, fans, etc**	• Stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. • Appendix F of AS 2436: 1981 lists materials suitable for shielding.	Construction
N23	**Shield sensitive receivers from noisy activities**	• Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings would be unlikely to benefit.	Construction
N24	**Cumulative construction impacts**	• Cumulative construction impacts may affect residential receivers in NCA01 and NCA02 due to concurrent construction works with Botany Rail Duplication. It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use the Banksia Street compound and residential receivers are immediately	Pre-construction

Reference	Impact	Safeguards and mitigation measures	Timing
		adjacent to the western boundary of this site • The potential cumulative impacts from Botany Yard Bi-Directional Signalling Works and other major projects will be investigated further as the proposal progresses. Specific additional management and mitigation measures designed to address potential impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community. • Where works on multiple projects are occurring outside of Standard Construction Hours in similar areas there is potential for increased impacts at nearby receivers. Co-ordination will occur between the various projects to minimise concurrent works in the same areas, where possible, and to ensure appropriate respite is applied to the affected receivers. • It is noted that it could be preferred by the affected community for works to occur on both Botany Yard Bi-Directional Signalling Works and Botany Rail Duplication at the same time so that the total duration of the works from both projects is reduced.	
Community and Socio-economic			
CS1	**Socio-economic**	• Existing access for nearby and adjoining properties is to be maintained at all times during the works unless otherwise agreed to by the affected property owner.	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
CS2	**Complaints**	• A project information board will be displayed at all entrances to the site. A contact phone number/email address for community enquiries would be on display.	Construction
CS3	**Complaints**	• A complaint handling procedure and register will be included in the CEMP.	Pre-construction/ Construction
CS4	**Complaints**	• A complaints register will be established and maintained throughout construction.	Pre-construction/ Construction
CS5	**Communication**	• Start of work letters would be distributed one week (minimum 5 working days) prior to commencement of works.	Detailed design/Pre-construction
CS6	**Communication**	• Targeted communication with Bayside Council regarding timing of the most intrusive noise intensive works and changed traffic conditions that may affect public spaces and transport routes within the LGA.	Detailed design/Pre-construction
Visual Impacts			
VI1	**Visual Impacts**	• Construction areas will be maintained in a tidy manner.	Construction
VI2	**Light Spill**	• Any lights required will be directed onto the site, with a maximum position angle of 30º from vertical, and back spill shields, therefore minimising any unwanted light spill and impacts at night.	Construction
VI3	**Light Spill**	• Lighting should not cause reflected glare.	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
Aboriginal Heritage			
AH1	**Unexpected finds**	• All ground disturbance activities shall be confined to within the rail corridor, as this will eliminate the risk of harm to Aboriginal objects that may be located beyond this area. Should the parameters of the proposal extend beyond the assessed area, then further archaeological assessment may be required.	Construction
AH2	**Unexpected finds**	An unexpected finds procedure will be prepared and included in the CEMP. The procedure will include requirements for: o Protecting any unexpected finds (including Aboriginal heritage items and human skeletal remains) encountered during construction activities o Procedures to manage reporting and investigation when unexpected finds are encountered	Construction
Non-Aboriginal Heritage			
NAH1	**Harm to a non-Aboriginal heritage item**	• An unexpected finds procedure will be established and implemented in the case of unexpected non-Aboriginal heritage finds.	Construction

Reference	Impact	Safeguards and mitigation measures	Timing
Waste			
W1	**Waste generation**	• General waste and recycling receptacles will be provided onsite and waste collected from site regularly.	Construction
W2	**Waste generation**	• All waste will be managed in accordance with the Protection of the Environment Operations Act 1997. A licensed waste contractor must be used for the collection and transport of all non-domestic/ commercial wastes for either offsite processing and/or disposal to a licensed facility.	Construction
W3	**Waste generation**	• Segregate and stockpile reusable and recyclable wastes such as ballast, sleepers, troughing, pallets, bridge transoms, drums, jewellery, cables and other scrap metal for salvage where possible.	Construction
W4	**Waste generation**	• All excavated natural, non-contaminated soil, aggregate or rock should be stockpiled separately and re-used onsite where possible.	Construction
W5	**Waste disposal**	• All material proposed to be removed from the work site, for recycling or disposal or otherwise, must be waste classified using the Waste Classification Guidelines (NSW EPA, 2014) and segregated to ensure opportunities for reuse, recovery and recycling of wastes are optimised. Waste	During/ After construction

Reference	Impact	Safeguards and mitigation measures	Timing
		needs to be assessed for contamination due to the nature of the site.	
Climate and Air Quality			
CAQ1	**Air Quality**	• Works likely to generate dust will be avoided where possible during strong winds or weather conditions where high levels of dust is likely.	Construction
CAQ2	**Air Quality**	• Activities involving excavation or disturbance of soils or vegetation must implement controls to prevent and/or minimise the generation of dust as required (i.e water carts or apply soil binders for dust suppression as required).	Construction
CAQ3	**Air Quality**	• Minimise vehicle movement and speed on unsealed tracks and access paths.	Construction
CAQ4	**Air Quality**	• All plant and equipment must be serviced regularly to ensure exhaust emissions generated are within the specified plant and equipment standards.	Construction
CAQ5	**Air Quality**	• If dust is observed migrating offsite, additional dust controls such stopping dust generating works in high wind conditions or use of water carts, water sprays or application of dust suppression polymers.	Construction
CAQ6	**Air Quality**	• Machinery must not be left running idle when not in use.	Construction

9. SUMMARY OF LICENSES AND APPROVALS

ARTC currently holds EPL 3142 for the scheduled activity of railway systems activities. No changes to the EPL are proposed by this REF.

A crane permit is required for the operation of cranes within an area subject to Section 183 of the *Airports Act 1996* and regulation 7 of the *Airports (Protection of Airspace) Regulations 1996* where the crane infringes on the OLS.

The proposal site sits within this zone and a crane permit may be required. Notice to the pipeline operator for development adjacent to the high pressure pipelines within the rail corridor opposite Gaiarine Gardens may be required under Clause 66C of ISEPP should the pipeline have a license number as per clause 66C(3)a of ISEPP.

10. CONCLUSION

10.1. PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The *Protection of the Environment Administration Act 1991* defines the principles of ecologically sustainable development (ESD). These are presented below and discussed in relation to the proposal.

10.1.1. The Precautionary Principle

According to the precautionary principle, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be seen as a reason not to protect the environment. The use of the precautionary principle implies that proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

The precautionary principle has been applied in assessing conservation values and environmental threats and impacts associated with works proposed throughout this REF. The development of mitigation measures and safeguards to manage impacts aims to reduce the risk of serious and irreversible impacts on the environment.

Generally, throughout this assessment, there has been found to be a low level of uncertainty in regard to the factors assessed.

10.1.2. Inter-generational Equity

The principle of inter-generational equity requires the present generation to ensure that the health diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The impacts of the proposed works are likely to be localised and temporary and would not significantly diminish resources and nature conservation values available for the use by future generations.

10.1.3. Conservation of Biological Diversity and Ecological Integrity

Conservation of biological diversity and ecological integrity are a fundamental consideration of ESD.

An assessment of the existing local environment has been undertaken in order to identify and manage any potential impacts of the proposal on local biodiversity. The impacts of the proposal on local populations of threatened species, threatened communities and their habitats have been assessed in detail in Appendix A and Section 6.2. The proposal is not considered to have a significant impact on biological diversity and ecological integrity.

10.1.4. Appropriate Valuation of Environmental Factors

This principle requires that "*costs to the environment should be factored into the economics costs of a project*". This REF has examined the environmental consequences of the proposal and identified mitigation measures for factors which have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these mitigation measures would increase both the capital and operations costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

10.2. JUSTIFICATION OF THE PROPOSAL

This REF has assessed the potential construction and operational impacts of the proposed bi-directional signalling upgrades of the existing Botany rail line.

The REF has been prepared with due consideration given to the provisions of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000*. A Clause 228 checklist has been completed and is provided in Appendix D.

This assessment found that once operational, the proposal would benefit the community by providing more efficient and effective signalling and track infrastructure along the existing Botany rail line, enhancing freight transport and supporting the national freight network. The works were not found to result in any impacts to threatened species, populations or ecological communities listed on the NSW *Biodiversity Conservation Act 2016*, or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Having considered all the relevant factors documented in this document, it is concluded that the proposal would not have a significant impact on the environment, and would achieve the identified project objectives with the implementation of the mitigation measures identified within this REF.

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APPENDIX A BIODIVERSITY ASSESSMENT

4 November 2019

Jamie Fermio
Environment Advisor
Sydney Projects
Australian Rail Track Corporation
Level 13, 418a Elizabeth Street
Surry Hills NSW 2010

Jfermio2@artc.com.au

Dear Jamie,

Re: 19-505 Botany Yard REF Biodiversity Assessment

NGH Environmental has been engaged by ARTC to provide a Review of Environmental Factors (REF) to assess the environmental impacts of the proposed Botany Yard Bi-Directional Signalling project, which includes signal & track works within the ARTC rail corridor at Port Botany , NSW. This Biodiversity Assessment, which is appended to the REF and summarised within the main body of the report, includes the following:

1. Introduction and Project Description
2. Relevant Legislation
3. Methodology
4. Results
5. Impact Assessment
6. Recommended Mitigation Measures
7. Conclusion
8. Appendices

The purpose of this report is to assess the potential impacts of the proposed works on biodiversity and detail what mitigation measures may be required.

Should you have any further enquiries, please do not hesitate to contact me on my details provided below.

Yours sincerely,

Daniel Perkovic
Ecologist
0406 856 782
NGH

1 INTRODUCTION AND PROJECT DESCRIPTION

Australian Rail Track Corporation (ARTC) is seeking to undertake the reconfiguration of the Botany Yard signalling system. This includes enabling bi-directional signalling on the Arrival and Departure Tracks at Botany Yard (partial bi-directional signalling already exists). Additionally, track works to increase the Botany Yard operational performance are proposed including the removal of an existing siding, the motorising of points, installation of a new track crossover.

Botany Yard consist of approximately 4km of railway corridor from Banksia Street footbridge at the North to Penrhyn Road access gate in Banksmeadow in the South. Approximate chainages along the Port Botany rail line are from 10.000 km to 6.625km.

The estimated project scope may change with future design development. Proposed works include but are not restricted to:

Signal Works

- Removal of 4 existing Signal posts;
- Removal of 1 existing Signal Hut;
- Installation of 9 new Signal posts;
- Installation of 1 new Signal Hut;
- Provision of new cable routes to enable new Signal infrastructure above;
- Modification to 9 existing Signals (i.e. new aspex's).

Track and Civil Works

- Removal of an existing dis-used siding (Kelloggs Siding);
- Motorising of existing points (Gelco Sidings);
- Installation of a new track cross-over (between Banksia Street footbridge and 154 points).

All works will be wholly contained within the rail corridor.

1.1 PROPOSAL SITE, STUDY AREA AND LOCALITY

The site is located within the Bayside Council Local Government Area (Figure 1).

For the purposes of this report, the following definitions apply:

- *Subject site* means the area directly affected by the proposal. The subject site includes the footprint of the development and any ancillary works, facilities, accesses or hazard reduction zones that support the construction or operation of the development or activity.
- *Study area* means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account. For this proposal, the study area is the rail corridor which is the same as the subject site.
- *Locality* means the same meaning as ascribed to local population of a species or local occurrence of an ecological community (i.e. the area within a 10 km radius of the proposed work area).

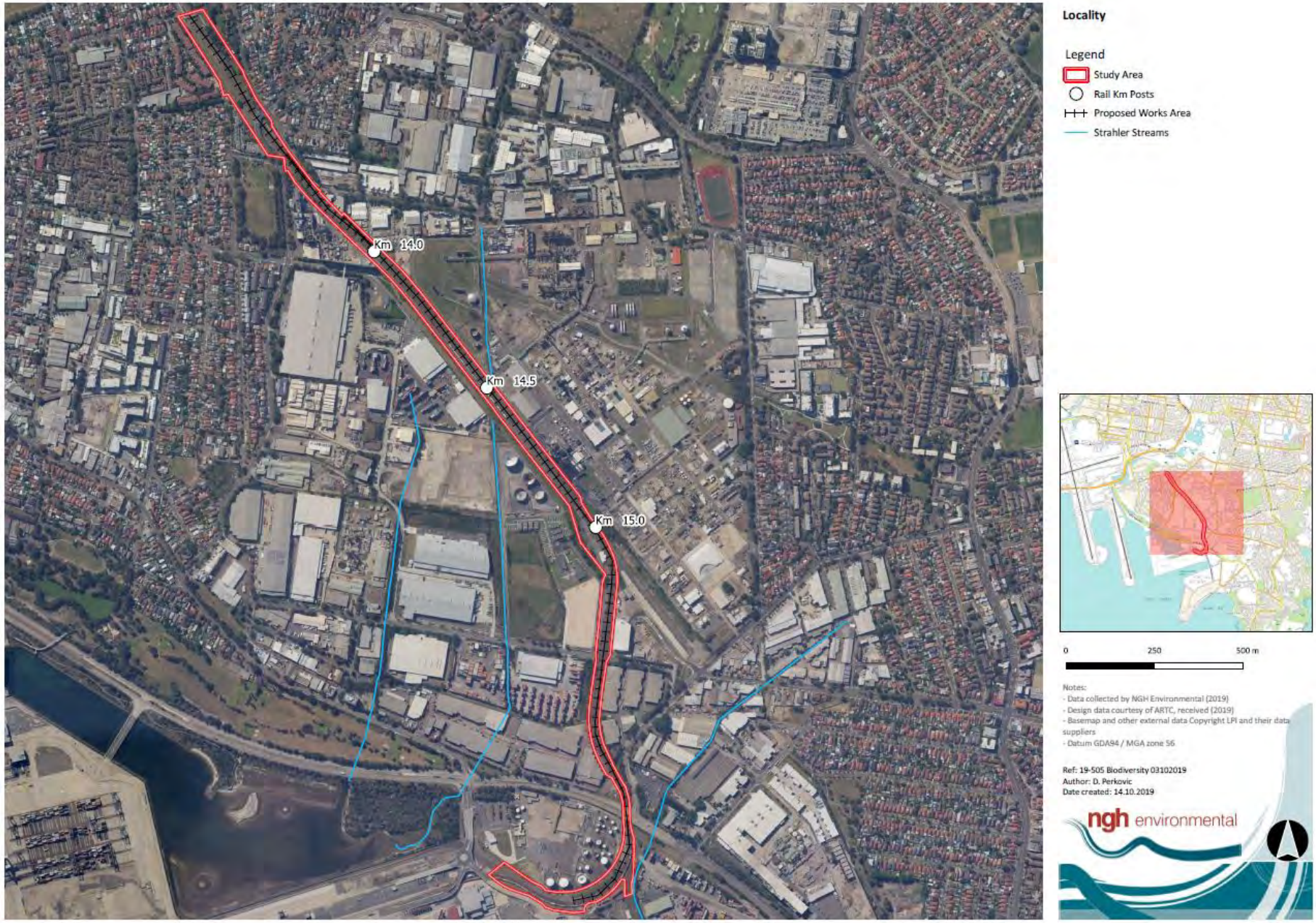


Figure 1-1 Location of the study area

2 RELEVANT LEGISLATION

2.1 NSW ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979 (NSW)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the framework for the assessment of development in NSW, and includes provisions to ensure that the potential environmental impacts of a development are considered in the decision making process prior to works proceeding.

The proposed works are classified as 'rail infrastructure facilities' under *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), and therefore are permissible without consent in accordance with clause 79 of the ISEPP. ARTC is a public authority for the purposes of clause 79 of the ISEPP, and as such, is the determining authority for the purposes of section 5.6 of the EP&A Act. Accordingly, ARTC is the proponent and determining authority for the project.

Under section 5.5 of the EP&A Act, ARTC has an obligation to consider and evaluate the potential environmental impacts of the project. The *ARTC Code of Practice for Environmental Impact Assessment of Development Proposals in NSW* (the Code) provides a framework for determining the appropriate environmental assessment pathway for ARTC activities. The project has been classed as a 'Class 4' proposal under the Code. Accordingly, an environmental impact assessment (known as a Review of Environmental Factors (REF)) has been prepared for the project. This assessment has been prepared to inform the REF.

2.2 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (CTH)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance. Under the EPBC Act a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land.

ARTC must consider potential impacts on nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the Matters of National Environmental Significance (MNES): Significant Impact Guidelines 1.1 (DoE 2013).

2.3 BIODIVERSITY CONSERVATION ACT 2016 (NSW)

The *Biodiversity Conservation Act 2016* (BC Act) outlines the framework for addressing impacts on biodiversity from development and clearing. Together with the *Biodiversity Conservation Regulation 2017*, it establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme (BOS). The BOS details biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity.

If works are likely to impact on a listed threatened species or ecological community, s 7.3 of the BC Act contains five factors that can be used to determine whether the impact on the entity will be significant or not.

Where a significant impact is likely to occur, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) must be prepared for projects assessed under Part 5 of the EP&A Act.

2.4 BIOSECURITY ACT 2015 (NSW)

The *Biosecurity Act 2015* has repealed and replaced the *Noxious Weeds Act 1993*. Its objective is to manage biodiversity risks from animal and plant pests and diseases, weeds and contaminants. Priority weeds identified within the study area are assessed in Section 4 of this report including related biosecurity duties.

2.5 FISHERIES MANAGEMENT ACT 1994 (NSW)

The *Fisheries Management Act 1994* (FM Act) sets out a framework for assessing impacts to threatened species, populations and ecological communities of aquatic species and marine vegetation. A permit under the FM Act is required for development other than State Significant Development (SSD) if significant impacts to listed species or communities are considered likely. No aquatic habitat or species occurs within the study area and therefore the FM Act is not considered further in this report.

2.6 STATE ENVIRONMENTAL PLANNING POLICY (COASTAL MANAGEMENT 2018 (CM SEPP)

The aim of the *State Environmental Planning Policy (Coastal Management) 2018* (CMSEPP) is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the *Coastal Management Act 2016,* including the management objectives for each coastal management area, by:

- Managing development in the coastal zone and protecting the environmental assets of the coast, and
- Establishing a framework for land use planning to guide decision-making in the coastal zone, and
- Mapping the four coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

The CMSEPP defines the following coastal areas, each with specific management requirements:

- Coastal wetlands and littoral rainforest area
- Coastal vulnerability area
- Coastal environment area
- Coastal use area

No coastal areas or proximity areas are mapped within the study area, refer to Appendix A (Fisheries NSW Spatial Data Portal 2019).

2.7 STATE ENVIRONMENTAL PLANNING POLICY NO 44 - KOALA HABITAT PROTECTION (SEPP 44)

"Core koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females and recent sightings, and historical records of a population. Bayside Council LGA is not listed under Schedule 1 of SEPP 44 and there are no records of Koalas in the locality. During the site inspection no feed tree species were recorded. The study area does not comprise “potential koala habitat” and has not been assessed further.

3 METHODOLOGY

3.1 BACKGROUND SEARCHES

Background searches undertaken for the purposes of this assessment included Commonwealth and State databases to determine whether any threatened flora and fauna species, populations, ecological communities, migratory species and Areas of Outstanding Biodiversity Value (AOBVs) as detailed in State and Commonwealth legislation occur or are likely to occur within the study area. In addition to this, searches of the groundwater dependent ecosystems database and priority weeds database were also undertaken (Table 3-1).

Appendix A provides a list of threatened species that have been recorded from database searches. These species were evaluated for their potential to occur in the study area based on habitat assessments undertaken in the field. This approach assumes that if suitable habitat is present within the study area, and local records occur, the study area has potential to harbour those species. The habitat evaluation approach increases the integrity of the survey to determine presence or absence of threatened species, and reduces limitations relating to survey timing or cryptic species that are difficult to detect in surveys.

Table 3-1 Database searches for threatened species and communities, groundwater dependent ecosystems and priority weeds

Resource	Target	Search date	Search area
OEH BioNet Atlas	Threatened flora and fauna species, populations and ecological communities listed under the BC Act.	10/10/2019	10 km radius of the study area
EPBC Act Protected Matters Search	Threatened flora and fauna, endangered populations and ecological communities and migratory species.	10/10/2019	10 km radius of the study area
DPI Weed Wise	Priority weeds declared in the Hunter Region which encompasses Blacktown LGA.	10/10/2019	Greater Sydney
Bureau of Meteorology National Atlas of Groundwater Dependant Ecosystems	Vegetation communities that are likely to rely on groundwater.	10/10/2019	Locality
OEH vegetation information system (VIS) database and Vegetation Types Database	Plant Community Type (PCT) identification.	10/10/2019	Study area
DPI Fisheries NSW Spatial Data Portal	Threatened fish and freshwater fish community status.	10/10/2019	Locality

3.2 FIELD SURVEY

3.2.1 Field survey

A diurnal site assessment of the study area was undertaken on the 11th of October 2019 by one Ecologist and one Environmental Consultant. A random meander search (Cropper 1993) was used to allow inspection of all available habitat types within the study area.

Criteria recorded during the site inspection included:

- Native flora species and vegetation communities present;
- Potential for threatened species presence identified during background searches with targeted transect surveys undertaken where suitable habitat is present;
- Opportunistic fauna sightings; and
- Weed species present and their abundance.

3.2.2 Weather conditions

Weather conditions during the field surveys are summarised in Table 3-2. Data is taken from the Sydney Airport AMO (station 066037) (BOM 2019).

Table 3-2 Weather condition at the time of surveys

Date	Temperature Min (°C)	Temperature Max (°C)	Rain (mm)	Survey type
11/10/2019	12.4	19.0	0	Diurnal

3.2.3 Flora

The objectives of the flora survey were to:

- Identify whether threatened species are present, or have the potential to occur, within the study area;
- Determine vegetation communities present within the study area, their condition and extent;
- Identify potential Threatened Ecological Communities (TECs) and determine their extent and condition, and;
- Assess the distribution and abundance of priority weeds at the study area.

An assessment and description of the vegetation communities present within the study area was undertaken with reference to existing vegetation mapping (OEH 2016). Plant Community Types (PCTs) were identified via analysis of floristic data collected using the PCT Identification Tool (OEH 2019).

Within areas of suitable habitat, targeted searches for those threatened flora species, populations or ecological communities of state or national significance were undertaken. Targeted searches were undertaken for the species shown in Appendix A.

3.2.4 Fauna

Habitat Assessment

The objectives of the fauna survey were to assess the habitat present (particularly for threatened species) within the study area in relation to the presence or absence of the following attributes:

- Habitat value (leaf litter, fallen timber, ground cover extent and type)
- Condition of vegetation
- Floristic diversity of vegetation
- Presence of hollow-bearing trees
- Presence of species-specific foraging or breeding habitat.

Targeted searches were undertaken in areas of suitable habitat for those threatened fauna species where background research suggested there is potential for occurrence of the species within the subject site. These searches were incorporated into the random meander as applicable. Opportunistic sightings of fauna and their traces (e.g. scats, tracks, scratches) when observed were also recorded. Targeted searches were undertaken for the species shown in Appendix A.

3.3 LIMITATIONS

A thorough search of areas to be affected by the proposal was undertaken. As the flora field surveys were undertaken in early October, the flora species lists reflect plant species usually detectable during Spring. There is the potential for some flora species that were not in flower at the time of the survey to have gone undetected. However, the lists are considered sufficient to identify vegetation communities present within the study area and therefore to evaluate the probability of threatened flora species to occur.

Detailed habitat assessments were made within the study area so local occurrence of fauna could be predicted. A precautionary approach has been taken as to the likelihood of the presence of threatened species so fauna species unlikely to be detected during the time of the survey are assessed.

4 RESULTS

4.1 EXISTING ENVIRONMENT

The study area is located within the Sydney Basin IBRA bioregion and the Pittwater IBRA subregion. It is located within the Sydney – Newcastle Barriers and Beaches Mitchell Landscape, situated on quaternary coastal sediments on long recurved quartz sand beaches between rocky headlands.

The study area occurs within a highly modified urban/industrial landscape and is confined to the rail corridor. Vegetation is only present at the sides of the rail corridor and consists largely of exotic species due to previous landscaping and disturbance, edge effects, weed invasion from surrounding properties, and altered hydrology.

Figure 4-1 Typical vegetation within the study area

4.2 FLORA

4.2.1 Plant Community Types and flora species

A total of 58 flora species were recorded within the study area, including 48 exotic species (83%). No threatened flora species were identified. All species recorded are included in Appendix B.

A review of existing vegetation mapping (OEH 2016) was ground-truthed using floristic data gathered within the study area. No native Plant Community Types (PCTs) are considered to occur within the study area due to the highly modified structure and composition of the vegetation present. Approximately 1.40 ha of Urban/Exotic Vegetation occurs within the study area including environmental weeds and sparse regrowth of native coloniser species.

A description of the vegetation type mapped within the study area is included in the table below. Ground-truthed vegetation mapping is presented in Figure 4-2 and Figure 4-3 below.

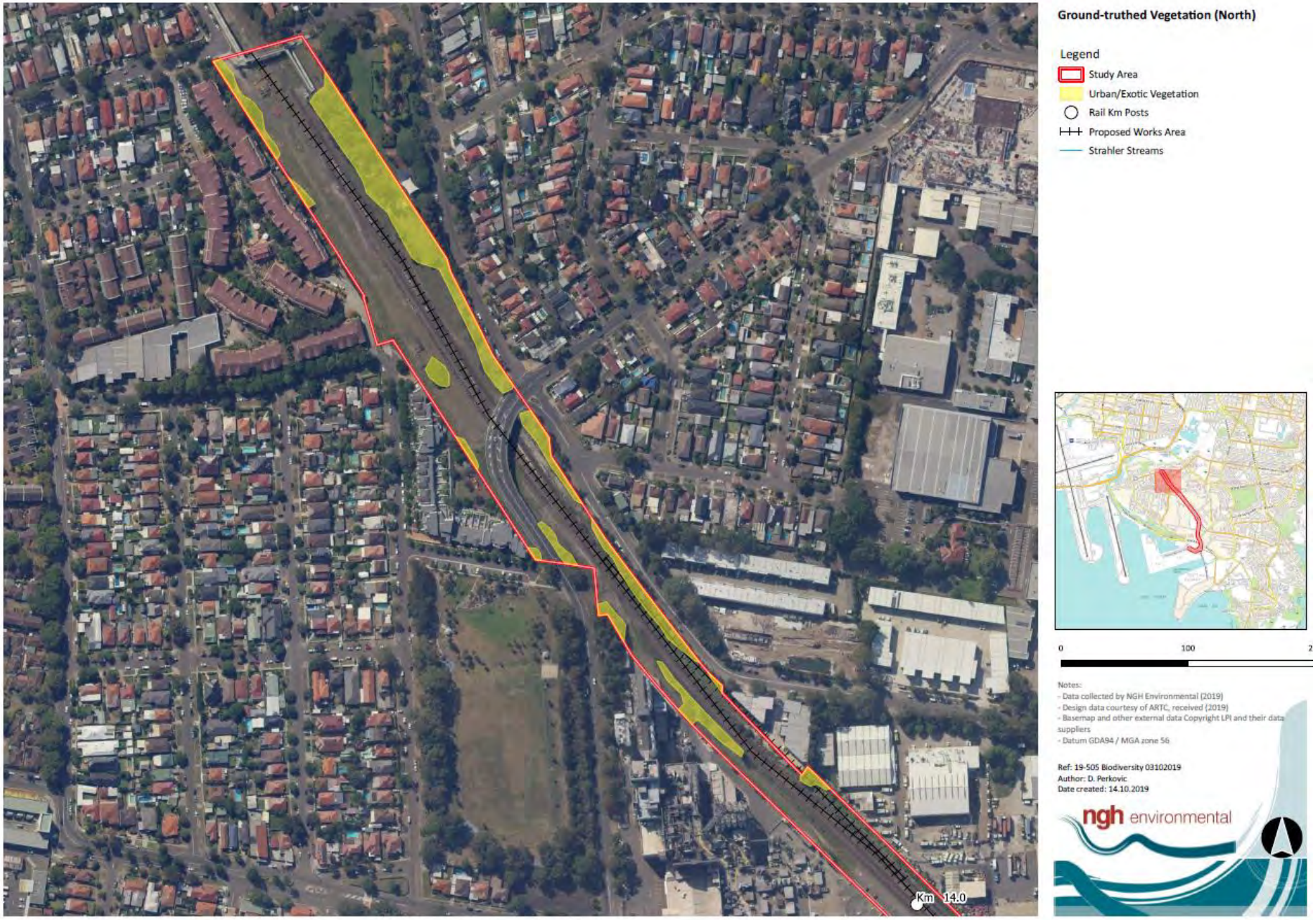


Figure 4-2 Ground-truthed Vegetation Map (North)

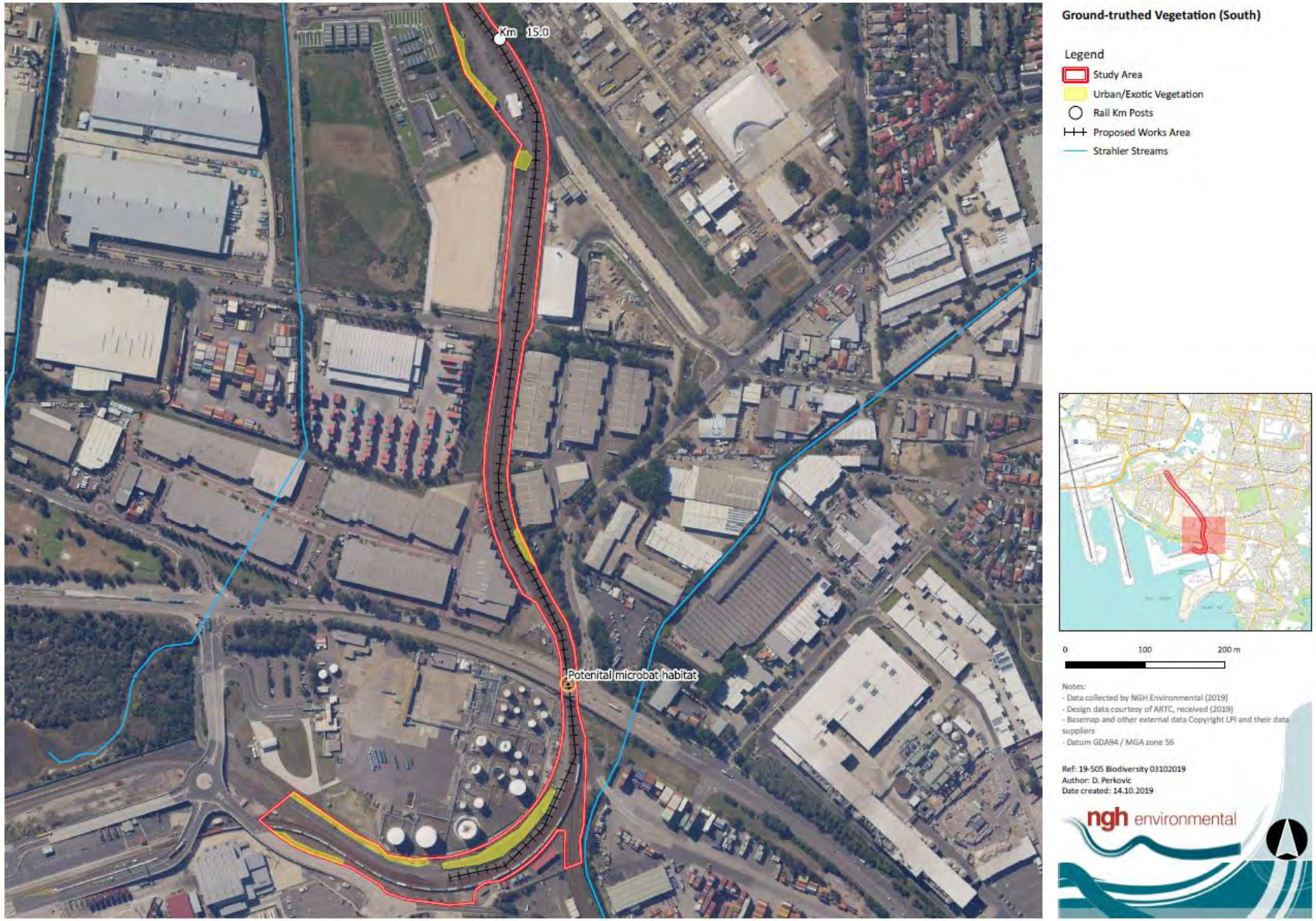


Figure 4-3 Ground-truthed Vegetation Map (South)

Urban/Exotic Vegetation

Vegetation formation: -

Vegetation class: -

PCT: -

Conservation status: -

Estimate of percent cleared: -

Extent in the study area: Approximately 1.40 ha

Structure	Average height (m)	Average cover	Typical species
Trees	8m	<1%	Swamp Oak *Casuarina glauca* Coral Tree *Erythrina x sykesii**
Small trees	5m	<5%	Golden Wreath Wattle *Acacia saligna** Port Jackson Fig *Ficus rubiginosa*
Shrubs	0.5-3	5%	Bitou Bush *Chrysanthemoides monilifera subsp. rotundata** Cotoneaster *Cotoneaster glaucophyllus** Green Cestrum *Cestrum parqui**
Ground covers	< 0.5	60%	African Lovegrass *Eragrostis curvula** Common Couch *Cynodon dactylon* Fireweed *Senecio madagascariensis** Kikuyu Grass *Pennisetum clandestinum** Perennial Ryegrass *Lolium perenne**
Vines & climbers	2	5%	Lantana *Lantana camara**

Description:

This community describes areas of vegetation dominated by exotic weed species. It has been identified throughout the majority of the study area with exotic grasses and shrubs dominating. Heavy infestations of Bitou Bush *Chrysanthemoides monilifera subsp. rotundata* and Lantana *Lantana camara* are present immediately adjacent to the rail corridor for the entirely of the study area. This community was found not to conform to any Threatened Ecological Communities listed under the BC or EPBC Acts.

4.2.2 Threatened Ecological Communities (TECs)

A search of the NSW BioNet database on October 10 2019 identified 26 TECs with potential to occur within the locality (Appendix A). Due to the lack of native PCTs within the study area, no TECs are considered present.

4.2.3 Threatened Flora

A search of the NSW BioNet database identified 8 threatened flora species with potential to occur within the locality (Appendix A). The closest threatened flora recorded in the locality is Coast Groundsel *Senecio spathulatus* which has been recorded within 5 km from the southern end of the study area.

No threatened flora species were recorded in the study area during the site survey nor are any considered to have a moderate to high likelihood of occurring (see Appendix D for habitat assessments).

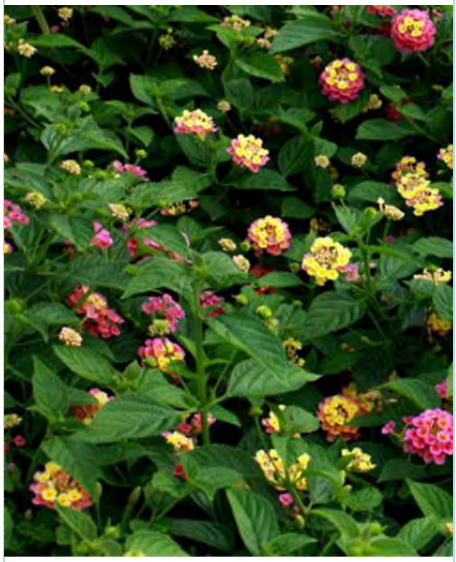
4.2.4 Priority Weeds

A total of 58 flora species were recorded within the study area, including 48 exotic species (83%) commonly found in disturbed areas. Five (5) priority weed listed under the Greater Sydney Strategic Weed Management Plan were recorded in the study area and are listed in Table 4-1 below.

The Biosecurity Act dictates that all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any land managers or authorities who deal with any plant has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Table 4-1 Priority weeds recorded within the study area

Common Name	Scientific Name	Duty	Photo
Bitou Bush	*Chrysanthemoides monilifera subsp. rotundata*	**Prohibition on dealings** Must not be imported into the State or sold **Biosecurity Zone** The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south. *Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be notified of any new infestations of this weed within the Biosecurity Zone*	
Green Cestrum	*Cestrum parqui*	**Regional Recommended Measure** Land managers should mitigate the risk of new weeds being introduced to land used for grazing livestock. Land managers should mitigate spread from their land. Plant should not be bought, sold, grown, carried or released into the environment.	

Common Name	Scientific Name	Duty	Photo
Fireweed	*Senecio madegascariensis*	**Mandatory Measure** Must not be imported into the State or sold	
Lantana	*Lantana camara*	**Prohibition on dealings** *Must not be imported into the State or sold*	
Pampas Grass	*Cortaderia* species	**Regional Recommended Measure** *Land managers mitigate the risk of the plant being introduced to their land. Land managers prevent spread from their land where feasible. Land managers reduce the impact on priority assets. The plant should not be bought, sold, grown, carried or released into the environment.*	

4.2.5 Groundwater Dependent Ecosystems and aquatic ecosystems

A search of the Bureau of Meteorology's National Atlas of Groundwater Dependent Ecosystems (GDEs) on October 10 2019 found that vegetation within the locality has no potential for groundwater dependent interaction. This reflects the highly modified urban/industrial landscape of the locality.

A search of DPI Fisheries NSW Spatial Data Portal on October 10 2019found that no freshwater fish habitat or threatened freshwater fish species are located in the study area or locality. Estuarine macrophytes including mangroves, saltmarsh and *Zostera* are mapped approximately 1 km west of the southern end of the study area. The proposed works will not have any direct or indirect impacts on these.

4.3 FAUNA

4.3.1 Terrestrial fauna habitat

The study area contains minimal fauna habitat due to the highly modified nature of the site and lack of native vegetation. The only fauna observed were common, highly-mobile birds including Superb Fairy-wren *Malurus cyaneus* and House Sparrow *Passer domesticus** which were utilising Lantana thickets adjacent to the rail corridor. No hollow bearing trees, stags, or other habitat features are present within the study area. Potential habitat for microchiropteran bats (microbats) is present within the scuppers of the bridge towards the southern end of the study area (Botany Road Bridge) (see Figure 4-3 above). It is noted that no works would occur to the Botany Road Bridge. The study area is located in a highly modified urban landscape and there is poor connectivity to vegetation outside of the rail corridor.

4.3.2 Threatened fauna

A NSW BioNet database search on 10/10/2019 identified 48 threatened fauna species with potential to occur within the study area (Appendix A). The closest threatened fauna recorded in the locality are migratory shorebirds including Curlew Sandpiper *Calidris ferruginea* and Red Knot *Calidris canutus* which have been recorded within 100m of the southern end of the study area.

No threatened fauna species were recorded during the site survey. Mobile threatened species including microbats and migratory shorebirds may occasionally visit the study area to investigate potential foraging opportunities. Threatened species evaluations have been undertaken in Appendix D.

4.4 EPBC MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

No threatened species listed under the EPBC Act are considered to be potentially impacted by the proposal. Some threatened and/or migratory species may utilise habitat within the study area on occasion, however, abundant and similar habitat occurs within the locality that is likely to be utilised preferentially.

5 ASSESSMENT OF IMPACTS

5.1 FLORA IMPACTS

5.1.1 Loss of Vegetation

The proposal does not require the removal of any mature trees. Minor grubbing work may be required at previously maintained or disturbed areas. These impacts are considered negligible as only groundcover vegetation, most of which is exotic, is likely to be temporarily disturbed.

Measures to mitigate impacts to vegetation are detailed in Section 6.

5.1.2 Threatened Ecological Communities

No TECs are present within the study area or would be impacted by the proposed works.

5.1.3 Threatened Flora

No threatened flora species were detected during the site survey and as discussed in Section 4.2.3, none are considered likely to occur or be impacted. Given this, no Tests or Assessments of Significance under the BC Act and/or EPBC Act have been prepared for threatened flora species.

5.2 FAUNA IMPACTS

5.2.1 Habitat Loss

As the proposed works will not require the removal of any significant vegetation or habitat features, habitat loss is considered negligible. The potential microbat habitat under the bridge towards the southern end of the study area will not be affected by the proposed works.

5.2.2 Threatened Fauna Species

Fauna habitats to be temporarily affected during construction generally comprise common foraging resources which occur widely within the surrounding landscape and are not unique to the proposal site. Given this, no Tests or Assessments of Significance under the BC Act and/or EPBC Act have been prepared for threatened flora species.

5.2.3 Injury and mortality

Wildlife injury or death could occur during the construction phase of the proposed works. Grubbing works may result in injury or death to resident fauna. Species at risk include ground dwelling snakes, lizards, and small mammals. There is also the risk of displaced fauna succumbing to predation or stress induced by competing with existing resident populations for resources including shelter habitat.

In summary, injury and mortality of fauna could occur during construction activities, including:

- During construction, during grubbing and maintenance works
- Operation of machinery and plant
- Construction-related traffic movements.

See Table 6-1 for mitigation measures to prevent and minimise impacts to fauna.

5.2.4 *Wildlife Connectivity and Habitat Fragmentation*

The existing rail corridor may provide a corridor for mobile fauna which utilise weed infestations on either side. The proposed works will not increase the distance between vegetation either side of the rail corridor. No further fragmentation is anticipated as a result of the proposed works.

5.3 IMPACTS ON RELEVANT KEY THREATENING PROCESSES

Table 5-1 Key Threatening Processes

Key Threatening Processes		
BC Act	**EPBC Act**	**Relevance**
Invasion of native plant communities by exotic perennial grasses	N/A	Exotic perennial grasses such as African Lovegrass *Eragrostis curvula* were recorded within the study area. Weed management at the site would help prevent these species from spreading within or outside the site.
Invasion, establishment and spread of Lantana (*Lantana camara* L. *sens. lat*)	N/A	Lantana was recorded within the study area. Weed management at the site would help prevent these species from spreading within or outside the site.

6 MITIGATION MEASURES

6.1 AVOID AND MINIMISE

The proposed works have been designed to minimise vegetation clearing, where possible, and minimise potential impacts to specific threatened species that may be present at the impact area.

6.2 SAFEGUARDS AND MITIGATION MEASURES

The proposed works would use these environmental safeguards (Table 6-1) to assist with minimising the impacts on biodiversity during construction and maintenance works.

Table 6-1 Safeguards and management measures to minimise environmental damage during the proposed works.

Impact	Environmental safeguards	Responsibility	Timing
Clearing and prevention of over-clearing	• Use areas already impacted by previous clearing or disturbance for access purposes, stockpiles or the establishment of compound sites. • If clearing of vegetation is required outside the subject site these areas will need to be assessed by an ecologist for potential impacts to TECs, threatened species and their habitats. • Trees to be retained, including trees adjacent but outside of the subject site, require an adequate tree protection zone (TPZ) for the duration of works. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. • If the TPZ cannot be avoided during works, the Structural Root Zones (SRZ) of trees to will be retained. Details for calculating the SRZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*.	ARTC	Project start up and ongoing
Direct impact to fauna including threatened fauna	• If fauna is detected within the proposal site during construction and is at risk of being injured, works in the location of the find will stop immediately, and the Environment Officer notified. Contact WIRES for fauna relocation or injured fauna pick up. • Information on the threatened species within the locality are to be included in the induction process for applicable personnel. • If unexpected threatened fauna species are discovered, works in the location of the find will stop immediately, and the Environment Officer notified. An ecologist would then be engaged to determine management actions to avoid or mitigate any potential impact.	ARTC	Project start up and ongoing
Direct impact to TEC and to threatened flora	• Vegetation removal will be restricted to the minimum extent necessary. • Through the course of the project, if it is revealed that clearing of vegetation is required outside the subject site, said areas will need to be assessed by an ecologist for potential impacts to TECs, threatened flora and their habitats. • Where unexpected threatened flora species are found within the worksite the following actions would take place:	ARTC	Project start up and ongoing

Impact	Environmental safeguards	Responsibility	Timing
	• All work within the vicinity would stop and the ARTC Environmental Officer contacted. • The area containing the threatened species would be surveyed by an ecologist who would determine appropriate actions to protect any individuals if required (e.g. translocation).		
Introduction and spread of noxious weeds and pathogens	• Priority weeds identified in Table 4-1 (Bitou Bush, Green Cestrum, Fireweed, Lantana, Pampas Grass) will be eliminated and prevented from spreading from the subject site so far as is reasonably practicable. All priority weed waste will need to be disposed of at a registered waste management facility. • All machinery (e.g. bulldozers, excavators, trucks, loaders etc.) will be cleaned using a high-pressure washer (or other suitable device) prior to entering and exiting work sites. All plant material containing seed heads, weeds that have allelopathic properties, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, will be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth. • Herbicides will be used in accordance with the requirements on the label. Any person undertaking herbicide application will be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	ARTC	Project start up and ongoing
Disturbance to woody debris and litter and bush rock	• Any fallen timber and dead wood encountered on site will be left in situ wherever possible or relocated to a suitable place nearby. Rock will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	ARTC	Project start up and ongoing

7 CONCLUSION

The proposed signalling and track upgrades at Botany Yard will not result in the clearing of any vegetation or removal of any habitat features. Minor grubbing work may be required at previously maintained areas. These impacts are considered negligible as only groundcover vegetation, most of which is exotic, is likely to be temporarily disturbed.

No threatened flora, fauna, or Threatened Ecological Communities are present within the study area or are considered likely to occur.

Safeguards and mitigation measures have been recommended in order to minimise disturbance and subsequent potential impacts to flora and fauna species. These include habitat retention and the prevention of priority weed spread where possible. With the effective implementation of the measures identified in this Biodiversity Assessment, impacts to biodiversity as a result of the proposal are considered negligible.

8 REFERENCES

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Office of Environment and Heritage (2019) *Atlas of NSW Wildlife*, available online at: https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx.

APPENDIX A DATABASE SEARCHES

A.1 NSW BIONET SEARCH

Data from the BioNet BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Entities in selected area [North: -33.90 West: 151.17 East: 151.27 South: -34.00] returned a total of 2,963 records of 56 species.
Report generated on 9/10/2019 3:33 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3137	*Crinia tinnula*		Wallum Froglet	V,P		1	
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	20	
Animalia	Reptilia	Cheloniidae	2007	*Chelonia mydas*		Green Turtle	V,P	V	1	
Animalia	Aves	Anatidae	0214	*Stictonetta naevosa*		Freckled Duck	V,P		1	
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		3	
Animalia	Aves	Diomedeidae	0086	*Diomedea exulans*		Wandering Albatross	E1,P	E,J	1406	
Animalia	Aves	Diomedeidae	0847	*Diomedea gibsoni*		Gibson's Albatross	V,P	V	1	
Animalia	Aves	Diomedeidae	0091	*Thalassarche cauta*		Shy Albatross	V,P	V	1	
Animalia	Aves	Diomedeidae	0088	*Thalassarche melanophris*		Black-browed Albatross	V,P	V	3	
Animalia	Aves	Procellariidae	0072	*Ardenna carneipes*		Flesh-footed Shearwater	V,P	J,K	2	
Animalia	Aves	Procellariidae	0929	*Macronectes giganteus*		Southern Giant Petrel	E1,P	E	116	
Animalia	Aves	Procellariidae	0937	*Macronectes halli*		Northern Giant-Petrel	V,P	V	5	
Animalia	Aves	Accipitridae	0226	*Haliaeetus leucogaster*		White-bellied Sea-Eagle	V,P	C	8	
Animalia	Aves	Accipitridae	8739	*Pandion cristatus*		Eastern Osprey	V,P,3		1	
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*		Sooty Oystercatcher	V,P		5	
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*		Pied Oystercatcher	E1,P		20	
Animalia	Aves	Charadriidae	0141	*Charadrius leschenaultii*		Greater Sand-plover	V,P	V,C,J,K	1	
Animalia	Aves	Charadriidae	0139	*Charadrius mongolus*		Lesser Sand-plover	V,P	E,C,J,K	10	
Animalia	Aves	Scolopacidae	0166	*Calidris alba*		Sanderling	V,P	C,J,K	5	
Animalia	Aves	Scolopacidae	0164	*Calidris canutus*		Red Knot	P	E,C,J,K	39	
Animalia	Aves	Scolopacidae	0161	*Calidris ferruginea*		Curlew Sandpiper	E1,P	CE,C,J,K	185	
Animalia	Aves	Scolopacidae	0165	*Calidris tenuirostris*		Great Knot	V,P	CE,C,J,K	16	

Animalia	Aves	Scolopacidae	0167	*Limicola falcinellus*	Broad-billed Sandpiper	V,P	C,J,K	4
Animalia	Aves	Scolopacidae	0152	*Limosa limosa*	Black-tailed Godwit	V,P	C,J,K	8
Animalia	Aves	Scolopacidae	0149	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	11
Animalia	Aves	Scolopacidae	0160	*Xenus cinereus*	Terek Sandpiper	V,P	C,J,K	9
Animalia	Aves	Laridae	0117	*Sternula albifrons*	Little Tern	E1,P	C,J,K	335
Animalia	Aves	Cacatuidae	0265	*^^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		3
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*	Little Lorikeet	V,P		2
Animalia	Aves	Psittacidae	0309	*Lathamus discolor*	Swift Parrot	E1,P,3	CE	1
Animalia	Aves	Psittacidae	0305	*Neophema chrysogaster*	Orange-bellied Parrot	E4A,P,3	CE	1
Animalia	Aves	Psittacidae	8913	*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V,P,3		2
Animalia	Aves	Strigidae	0248	*Ninox strenua*	Powerful Owl	V,P,3		11
Animalia	Aves	Dasyornithidae	0519	*^^Dasyornis brachypterus*	Eastern Bristlebird	E1,P,2	E	1
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat	V,P		35
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V,P		35
Animalia	Aves	Artamidae	8519	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		1
Animalia	Aves	Estrildidae	0663	*Neochmia ruficauda*	Star Finch	E4,P	E	1
Animalia	Aves	Estrildidae	0652	*Stagonopleura guttata*	Diamond Firetail	V,P		2
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	535
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		1
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		1
Animalia	Mammalia	Dugongidae	1558	*Dugong dugon*	Dugong	E1,P		5
Animalia	Mammalia	Otariidae	1543	*Arctocephalus forsteri*	New Zealand Fur-seal	V,P		2
Animalia	Mammalia	Otariidae	1882	*Arctocephalus pusillus doriferus*	Australian Fur-seal	V,P		3
Animalia	Mammalia	Balaenidae	1561	*Eubalaena australis*	Southern Right Whale	E1,P	E	4
Animalia	Mammalia	Balaenopteridae	1575	*Megaptera novaeangliae*	Humpback Whale	V,P	V	4

Plantae	Flora	Asteraceae	9458	*Senecio spathulatus*	Coast Groundsel	E1		2	
Plantae	Flora	Fabaceae (Mimosoideae)	9672	*Acacia terminalis subsp. terminalis*	Sunshine Wattle	E1	E	59	
Plantae	Flora	Myrtaceae	4007	*Callistemon linearifolius*	Netted Bottle Brush	V,3		3	
Plantae	Flora	Myrtaceae	4134	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	2	
Plantae	Flora	Myrtaceae	8907	*Eucalyptus scoparia*	Wallangarra White Gum	E1	V	3	
Plantae	Flora	Myrtaceae	4293	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	V	3	
Plantae	Flora	Orchidaceae	4464	*^^Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2	E	1	
Plantae	Flora	Proteaceae	5458	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	1	
Animalia	Mammalia	Miniopteridae	3330	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V		22	

Data from the BioNet BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Communities in selected area [North: -33.90 West: 151.17 East: 151.27 South: -34.00] returned 0 records for 26 entities.
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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Community				*Agnes Banks Woodland in the Sydney Basin Bioregion*		Agnes Banks Woodland in the Sydney Basin Bioregion	E4B	E	K	
Community				*Blue Gum High Forest in the Sydney Basin Bioregion*		Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE	K	
Community				*Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion*		Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E3	CE	K	
Community				*Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion*		Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V2	E	K	
Community				*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	K	
Community				*Coastal Upland Swamp in the Sydney Basin Bioregion*		Coastal Upland Swamp in the Sydney Basin Bioregion	E3	E	K	
Community				*Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion*		Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E3	CE	K	
Community				*Cumberland Plain Woodland in the Sydney Basin Bioregion*		Cumberland Plain Woodland in the Sydney Basin Bioregion	E4B	CE	K	
Community				*Duffys Forest Ecological Community in the Sydney Basin Bioregion*		Duffys Forest Ecological Community in the Sydney Basin Bioregion	E3		K	

Community	*Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion*	Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	E4B	E	K	
Community	*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Kurnell Dune Forest in the Sutherland Shire and City of Rockdale*	Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	E3		K	
Community	*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	K	
Community	*Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE	K	
Community	*Moist Shale Woodland in the Sydney Basin Bioregion*	Moist Shale Woodland in the Sydney Basin Bioregion	E3	CE	K	
Community	*Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion*	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	E3		K	
Community	*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Shale Gravel Transition Forest in the Sydney Basin Bioregion*	Shale Gravel Transition Forest in the Sydney Basin Bioregion	E3	CE	K	
Community	*Shale Sandstone Transition Forest in the Sydney Basin Bioregion*	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	E4B	CE	K	

Community	*Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3		K	
Community	*Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	E	K	
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Sydney Freshwater Wetlands in the Sydney Basin Bioregion*	Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3		K	
Community	*Sydney Turpentine-Ironbark Forest*	Sydney Turpentine-Ironbark Forest	E4B	CE	K	
Community	*Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Western Sydney Dry Rainforest in the Sydney Basin Bioregion*	Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE	K	

A.2 EPBC ACT PROTECTED MATTERS SEARCH TOOL

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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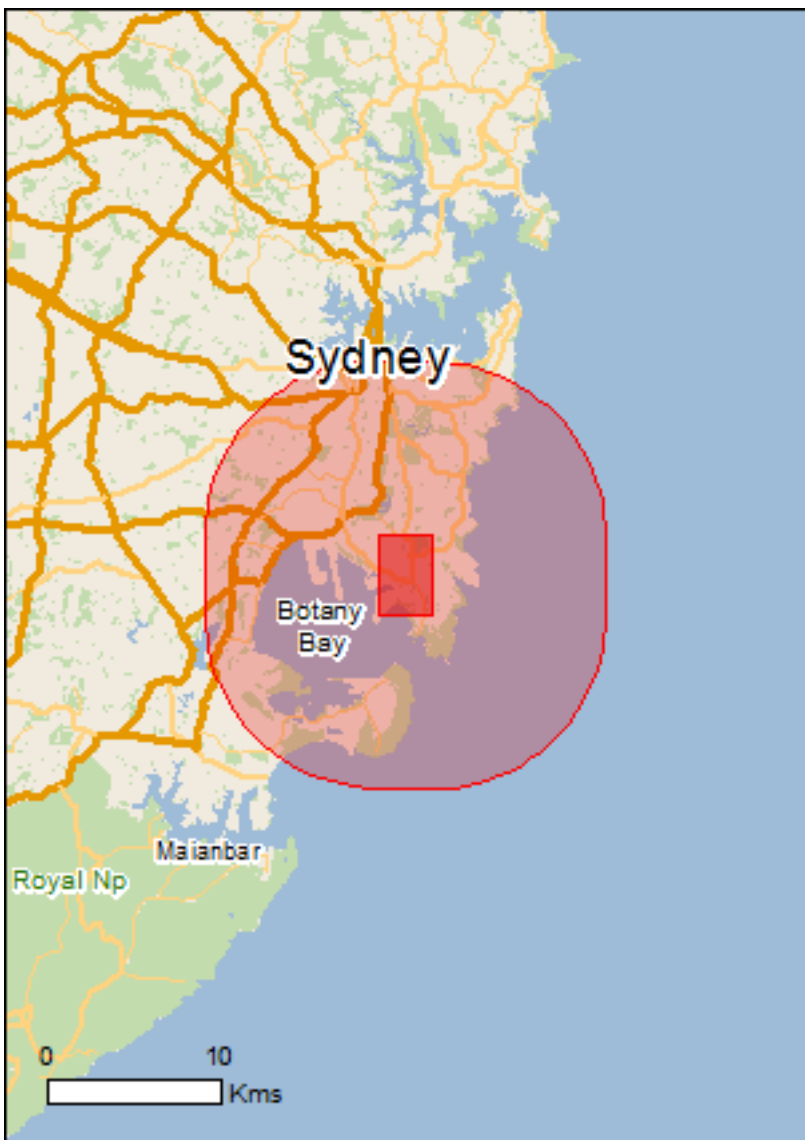
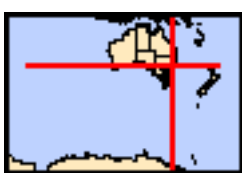


Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	4
National Heritage Places:	10
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	11
Listed Threatened Species:	86
Listed Migratory Species:	82

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	45
Commonwealth Heritage Places:	33
Listed Marine Species:	106
Whales and Other Cetaceans:	16
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	49
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Australian Convict Sites (Hyde Park Barracks Buffer Zone)	NSW	Buffer zone
Sydney Opera House - Buffer Zone	NSW	Buffer zone
Australian Convict Sites (Hyde Park Barracks)	NSW	Declared property
Sydney Opera House	NSW	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Indigenous		
Cyprus Hellene Club - Australian Hall	NSW	Listed place
Historic		
Bondi Beach	NSW	Listed place
Centennial Park	NSW	Listed place
First Government House Site	NSW	Listed place
Hyde Park Barracks	NSW	Listed place
Kamay Botany Bay: botanical collection sites	NSW	Listed place
Kurnell Peninsula Headland	NSW	Listed place
Sydney Harbour Bridge	NSW	Listed place
Sydney Opera House	NSW	Listed place
Bondi Surf Pavilion	NSW	Within listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Towra point nature reserve	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Eastern Suburbs Banksia Scrub of the Sydney Region	Endangered	Community known to occur within area
Littoral Rainforest and Coastal Vine Thickets of	Critically Endangered	Community likely to

Name	Status	Type of Presence
Eastern Australia		occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Insects		
Synemon plana		
Golden Sun Moth [25234]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Acacia terminalis subsp. terminalis MS Sunshine Wattle (Sydney region) [88882]	Endangered	Species or species habitat known to occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat may occur within area
Allocasuarina portuensis Nielsen Park She-oak [21937]	Endangered	Species or species habitat known to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat likely to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat may occur within area
Prostanthera densa Villous Mintbush [12233]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat likely to occur within area
Pterostylis sp. Botany Bay (A.Bishop J221/1-13) Botany Bay Bearded Greenhood, Botany Bay Bearded Orchid [64965]	Endangered	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis		
Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata		
Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon		
Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area

Name	Threatened	Type of Presence
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Airservices Australia
Commonwealth Land - Australian & Overseas Telecommunications Corporation
Commonwealth Land - Australian Broadcasting Corporation
Commonwealth Land - Australian National University
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Defence Service Homes Corporation & Alice Isabel Patterson
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Reserve Bank of Australia
Commonwealth Land - Telstra Corporation Limited
Defence - BANKSMEADOW DEPOT (Sydney Workshop Company)
Defence - DEFENCE PLAZA SYDNEY
Defence - DEGAUSSING RANGE
Defence - DSTO PYRMONT - (SEE SITE 1177)
Defence - ENDEAVOUR HOUSE - COOGEE
Defence - FLEET BASE WHARVES
Defence - FOREST LODGE (SYDNEY) TRG DEP
Defence - GARDEN ISLAND
Defence - HMAS KUTTABUL (AC 30/5 Lot4 DP218946)
Defence - JENNER BUILDING
Defence - KENSINGTON DEPOT
Defence - KISMET/HMAS KUTTABUL-POTTS PT
Defence - LADY GOWRIE HOUSE
Defence - MARITIME COMD CTRE-POTTS POINT ; BOMERAH/TARANA
Defence - MARITIME HEADQUARTERS
Defence - MATERIAL RESEARCH LAB
Defence - MILLER'S POINT TRAINING DEPOT

Name
Defence - OXFORD ST SYDNEY
Defence - PARKVIEW BUILDING - SYDNEY
Defence - RANDWICK (CARRINGTON RD)
Defence - RANDWICK BARRACKS
Defence - RANDWICK FRENCHMANS TRG
Defence - ROCKDALE TRAINING DEPOT
Defence - SYDNEY UNIVERSITY REGIMENT - DARLINGTON
Defence - TRESCO
Defence - VICTORIA BARRACKS - PADDINGTON
Defence - WOOLLOOMOOLOO CARPARK
Defence - ZETLAND NAVY SUPPLY CENTRE

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Natural		
Malabar Headland	NSW	Listed place
Historic		
Bondi Beach Post Office	NSW	Listed place
Botany Post Office	NSW	Listed place
Building VB1 and Parade Ground	NSW	Listed place
Building VB2 Guard House	NSW	Listed place
Buildings 31 and 32	NSW	Listed place
Buildings MQVB16 and VB56	NSW	Listed place
Buildings VB13, 15, 16 & 17	NSW	Listed place
Buildings VB41, 45 & 53	NSW	Listed place
Buildings VB60 and VB62	NSW	Listed place
Buildings VB69, 75 & 76 including Garden	NSW	Listed place
Buildings VB83, 84, 85, 87 & 89	NSW	Listed place
Buildings VB90, 91, 91A & 92	NSW	Listed place
Cape Baily Lighthouse	NSW	Listed place
Chain and Anchor Store (former)	NSW	Listed place
Factory	NSW	Listed place
Garden Island Precinct	NSW	Listed place
Gazebo	NSW	Listed place
General Post Office	NSW	Listed place
Marrickville Post Office	NSW	Listed place
Naval Store	NSW	Listed place
Office Building	NSW	Listed place
Paddington Post Office	NSW	Listed place
Pyrmont Post Office	NSW	Listed place
Reserve Bank	NSW	Listed place
Residences Group	NSW	Listed place
Rigging Shed and Chapel	NSW	Listed place
School of Musketry and Officers Mess, Randwick Army Barracks	NSW	Listed place
Sydney Airport Air Traffic Control Tower	NSW	Listed place
Sydney Customs House (former)	NSW	Listed place
Victoria Barracks Perimeter Wall and Gates	NSW	Listed place
Victoria Barracks Precinct	NSW	Listed place
Victoria Barracks Squash Courts	NSW	Listed place

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat known to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Kamay Botany Bay	NSW
Malabar Headland	NSW
Sydney Harbour	NSW
Towra Point	NSW
Wolli Creek	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Botany Wetlands	NSW
Eve St. Marsh, Arncliffe	NSW
Towra Point Estuarine Wetlands	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.945364 151.21276,-33.945791 151.240569,-33.980673 151.240741,-33.979962 151.21276,-33.945364 151.21276

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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A.3 COASTAL MANAGEMENT SEPP

Coastal SEPP

Legend

- Coastal Wetland Proximity
- Coastal Wetland
- Study Area

Ref: 19-505 Coastal SEPP
Author: Zeina Jokadar
Date created: 30.10.2019
Datum: GDA94 / MGA zone 56

0 250 500 750 1000 km

NGH

APPENDIX B FLORA AND FAUNA SITE LISTS

B.1 FLORA SPECIES

Entire Site

R = Rare, U = Uncommon, C = Common, VC = Very Common

Family	Exotic	Scientific Name	Common Name	BC Status	EPBC Status	Abundance
Fabaceae (Mimosoideae)		*Acacia longifolia subsp. sophorae*	Coastal Wattle			UC
Fabaceae (Mimosoideae)	*	*Acacia saligna*				C
Fabaceae (Mimosoideae)		*Acacia suaveolens*	Sweet Wattle			R
Polygonaceae	*	*Acetosa sagittata*	Rambling Dock			R
Asteraceae	*	*Ageratina adenophora*	Crofton Weed			UC
Amaranthaceae	*	*Amaranthus spp.*	Amaranth			R
Apocynaceae	*	*Araujia sericifera*	Moth Vine			UC
Asteraceae	*	*Arctotheca calendula*	Capeweed			R
Poaceae	*	*Avena fatua*	Wild Oats			C
Asteraceae	*	*Bidens pilosa*	Cobbler's Pegs			C
Brassicaceae	*	*Brassica oleracea*	Collards			C
Poaceae	*	*Briza maxima*	Quaking Grass			UC
Poaceae	*	*Bromus catharticus*	Praire Grass			R
Casuarinaceae		*Casuarina glauca*	Swamp Oak			R
Ulmaceae	*	*Celtis sinensis*	Japanese Hackberry			R
Poaceae	*	*Cenchrus echinatus*	Mossman River Grass			UC
Solanaceae	*	*Cestrum parqui*	Green Cestrum			UC
Asteraceae	*	*Chrysanthemoides monilifera subsp. rotundata*	Bitou Bush			C
Asteraceae	*	*Conyza spp.*	A Fleabane			C
Poaceae	*	*Cortaderia selloana*	Pampas Grass			C
Rosaceae	*	*Cotoneaster glaucophyllus*				R
Poaceae		*Cynodon dactylon*	Common Couch			VC
Phormiaceae		*Dianella caerulea*	Blue Flax-lily			R
Fabaceae (Faboideae)	*	*Dipogon lignosus*	Dolichos Pea			R
Poaceae	*	*Eragrostis curvula*	African Lovegrass			VC
Fabaceae (Faboideae)	*	*Erythrina x sykesii*	Coral tree			R
Moraceae		*Ficus rubiginosa*	Port Jackson Fig			R
Apiaceae	*	*Foeniculum vulgare*	Fennel			UC
Fumariaceae	*	*Fumaria officinalis*				UC

Family	Exotic	Scientific Name	Common Name	BC Status	EPBC Status	Abundance
Rubiaceae	*	*Galium aparine*	Goosegrass			UC
Asteraceae	*	*Gamochaeta spp.*				C
Apocynaceae	*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush			R
Asteraceae	*	*Hypochaeris radicata*	Catsear			C
Poaceae		*Lachnagrostis filiformis*				R
Asteraceae	*	*Lactuca serriola*	Prickly Lettuce			C
Verbenaceae	*	*Lantana camara*	Lantana			C
Poaceae	*	*Lolium perenne*	Perennial Ryegrass			VC
Fabaceae (Faboideae)	*	*Medicago spp.*	A Medic			VC
Poaceae	*	*Melinis repens*	Red Natal Grass			VC
Onagraceae	*	*Oenothera spp.*				R
Oleaceae	*	*Olea europaea subsp. cuspidata*	African Olive			R
Poaceae	*	*Pennisetum clandestinum*	Kikuyu Grass			VC
Poaceae		*Phragmites australis*	Common Reed			R
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues			C
Polygalaceae	*	*Polygala spp.*				C
Euphorbiaceae	*	*Ricinus communis*	Castor Oil Plant			UC
Asteraceae	*	*Senecio madagascariensis*	Fireweed			C
Poaceae	*	*Setaria parviflora*				C
Malvaceae	*	*Sida rhombifolia*	Paddy's Lucerne			UC
Solanaceae	*	*Solanum nigrum*	Black-berry Nightshade			R
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle			UC
Asteraceae	*	*Taraxacum officinale*	Dandelion			UC
Typhaceae		*Typha orientalis*	Broad-leaved Cumbungi			R
Scrophulariaceae	*	*Verbascum spp.*				R
Verbenaceae	*	*Verbena bonariensis*	Purpletop			R
Fabaceae (Faboideae)	*	*Vicia sativa*	Common vetch			R
Campanulaceae		*Wahlenbergia gracilenta*	Annual Bluebell			R
Agavaceae	*	*Yucca spp.*				R

B.2 FAUNA SPECIES

Class	Scientific name	Common name
Aves		
	*Acridotheres tristis**	Common myna
	*Columba livia**	Rock Dove
	Cracticus tibicen	Australian Magpie
	*Hirundo neoxena**	Welcome Swallow
	Malurus cyaneus	Superb Fairy-wren
	Manorina melanocephala	Noisy Miner
	*Passer domesticus**	House Sparrow
	*Spilopelia chinensis**	Spotted Dove
	Threskiornis moluccus	Australian white ibis

APPENDIX C THREATENED SPECIES EVALUATIONS

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed for the locality in the *NSW BioNet Database*[1] and those identified as potentially occurring in the area according to the Commonwealth EPBC *Protected Matters Search Tool*[2].

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat:

Present: Potential or known habitat is present within the study area.

Marginal: Habitat present that could be used by the species on occasion but not preferred.

Absent: No potential or known habitat is present within the study area.

Likelihood of occurrence

Recorded: The species was observed in the study area during the current survey

High: It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.

Moderate: Potential habitat is present in the study area. Species known to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is known to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.

Low: It is known that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

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[1] *BioNet* is administered by the NSW Office of Environment& Heritage (OEH) and is an online database of fauna and flora records that contains over four million recorded sightings.

[2] This online tool is designed for the public to search for matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is managed by the Commonwealth Department of the Environment and Energy.

Potential to be impacted

Low: The proposal would not impact this species or its habitats. No Test of Significance (ToS) is necessary for this species.

Moderate: The proposal could impact this species or its habitats however the impacts are considered manageable such that no direct or indirect impacts are likely. No Test of Significance (ToS) is necessary for this species.

High: The proposal is likely to impact this species or its habitats. A ToS has been applied to these entities.

C.1 EVALUATION OF THE LIKELIHOOD AND EXTENT OF IMPACT ON THREATENED FLORA AND TECS

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
Trees					
Eucalyptus nicholii **Narrow-leaved Black Peppermint** **BC-V, EPBC-V**	A medium-sized tree 10-20 m tall with rough, thick, grey-brown bark which extends to the larger branches. Adult leaves are slightly broader than the juvenile leaves, and are a dull grey-green, 6-12 cm long and 5-10 mm wide and have a strong peppermint smell when crushed. The gumnuts are hemispherical or cone shaped, 2-5 mm long and 3-4 mm wide, and grow in groups of seven. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	2	Absent	Low	Low
Eucalyptus scoparia **Wallangarra White Gum** **BC-E, EPBC-V**	A small tree to 15 m tall with smooth, powdery white to pale grey bark. The adult leaves are shiny green, 10 - 15 cm long and 6 - 10 mm wide. The flower buds are oval-shaped with a conical cap, and the small gumnuts are oval-shaped, 4-5 mm long and wide. Ths canopy is often open and pendulous. In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites on the Stanthorp Plateau including one population in Girrawween National Park. Only one Queensland population has more than a dozen trees.	3	Absent	Low	Low
Shrubs					
Acacia terminalis **subsp. *Terminalis*** **Sunshine Wattle** **BC-E, EPBC-E**	An erect or spreading shrub, 1-5 metres tall, with pale yellow flowers and seed pods 3-11 cm long. The small branches (branchlets) are angled and have longitudinal ridges. The leaves including stalks (petioles) are 0.5-2.1 cm long, and contain between 2 and 5 pairs of pinnae (=leaflets). Differs from more widespread subspecies by being hairier, possessing thicker flower stalk and wider seed pods. Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney.	59	Absent	Low	Low

[1] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

OEH threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	Recent collections have mainly been made from the Quarantine Station, Clifton Gardens, Dover Heights, Parsely Bay, Nielson Park, Cooper Park, Chifley and Watsons Bays.				
Callistemon linearifolius **Netted Bottle Brush** **BC-V**	A shrub up to 3-4m tall. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coal Cliffs in the Southern Rivers CMA. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Was more widespread across its distribution in the past. There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past. Three of these are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring to summer.	3	Absent	Low	Low
Persoonia hirsuta **Hairy Geebung** **BC-E, EPBC-E**	Has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. *Persoonia hirsuta* has a large area of occurrence, but occurs in small populations, increasing the species fragmentation in the landscape. The Hairy Geebung has been recorded in the Sydney coastal area (subsp. *hirsuta* - Gosford to Berowra to Manly to Royal National Park), the Blue Mountains area (subsp. *evoluta* - Springwood, Lithgow, Putty) and the Southern Highlands (subsp. *evoluta* - Balmoral, Buxton, Yanderra and Hill Top areas). The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone from near sea level to 600m altitude. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed. Flowering is generally in summer.	1	Absent	Low	Low
Syzygium paniculatum **Magenta Lilly Pilly** **BC-E, EPBC-V**	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. Has been recorded in widely scattered small populations along the NSW coast from Booti (near Forster) in the north to Conjola State Forest (near Jervis Bay) in the south. Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest. Associated species include *Alphitonia obliqu*, *Acmena smithii*, *Cryptocarya glaucescens*, *Toona 31blique*, *Eucalyptus saligna*, *Ficus fraseri*, *Syzygium oleosum*, *Acmena smithii*, *Cassine oblique*, *F. oblique*, *Glochidion ferdinandi*, *Endiandra sieberi*, *Synoum glandulosum*, *Podocarpus elatus*, *Notelaea longifolia*, *Guioa semiglauca* and *Pittosporum undulatum.* Is thought to tolerate wet and dry conditions on sands. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and	3	Absent	Low	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	remnant littoral rainforest communities. Flowers December to March, with fruit ripe from March to May, occasionally to September.				
Herbs & Forbs					
Senecio spathulatus **Coast Groundsel** **BC-E**	A low-growing smooth-stemmed daisy, often forming hummocks to 30 cm tall. It has short (1 to 5cm long) fleshy, entire or sometimes divided leaves with toothed margins and large fleshy yellow flowerheads. The yellow flowers consist of 8 to 16 ray florets (with petals) to 13 mm long and up to 70 disc florets (in the central section of the flower). Further identification relies on microscopic features. Coast Groundsel occurs in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah). In Victoria there are scattered populations from Wilsons Promontory to the NSW border.	2	Absent	Low	Low
Orchids					
Genoplesium baueri **Bauer's Midge Orchid** **BC-E, EPBC-E**	The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. The species typically grows in dry sclerophyll forest and moss gardens over sandstone sand flowers February to March.	1	Absent	Low	Low
TECs					
Agnes Banks Woodland in the Sydney Basin Bioregion **BC-CEEC, EPBC-EEC**	A low woodland community with Scribbly Gum *Eucalyptus sclerophylla*, Narrow-leaved Apple *Angophora bakeri* and Old Man Banksia *serrata* as the dominant canopy trees. Diverse understorey shrubs include Wallum Banksia *Banksia aemula*, *Banksia oblongifolia*, Coneseed *Cononspermum taxifolium*, Wedding Bush *Ricinocarpus pinifolius*, Showy Parrot Pea *Dillwynia sericea* and Nodding Geebung *Persoonia nutans*. Contains many more species and other references should be consulted to identify these. Occurs in western Sydney and originally extended over about 615 hectares, but now has only 98 hectares remaining intact, mostly near Agnes Banks on the east bank of the Hawkesbury River, in the Penrith local government area. A good example can be seen at the Agnes Banks Nature Reserve, near Richmond. The community occurs on areas of wind-blown sand which overlay Tertiary Alluvium deposits from ancient river systems. Depending on drainage conditions, there is great	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	variation within the community, from low woodland on higher ridges to sedge-type vegetation in low lying depressions.				
Blue Gum High Forest in the Sydney Basin Bioregion **BC-CEEC, EPBC-CEEC**	A moist, tall open forest community, with dominant canopy trees of Sydney Blue Gum *Eucalyptus saligna* and Blackbutt *E. pilularis*. Forest Oak *Allocasuarina torulosa* and Sydney Red Gum *Angophora costata* also occur. Species adapted to moist habitat such as Lillypilly *Acmena smithii*, Sandpaper Fig *Ficus coronata*, Soft Bracken *Calochlaena dubia* and Maiden Hair *Adiantum aethiopicum* may also occur. Contains many more species and other references should be consulted to identify these. Originally restricted to the ridgelines in Sydney's north from Crows Nest to Hornsby, and extending west along the ridges between Castle Hill and Eastwood. In 2000 there was less than 200 ha remaining (about 4.5% of its original extent). It only occurs in small remnants of which the largest is less than 20 ha. The remnants mainly occur in the Lane Cove, Willoughby, Ku-ring-gai, Hornsby, Baulkham Hills, Ryde and Parramatta local government areas. An example of Blue Gum High Forest can be seen at the Dalrymple-Hay Nature Reserve, St Ives. The community also occurs on soils associated with localised volcanic intrusions, 'diatremes'. Occurs only in areas where rainfall is high (above 1100 millimetres per year) and the soils are relatively fertile and derived from Wianamatta shale. In lower rainfall areas, it grades into Sydney Turpentine-Ironbark Forest. The rainforest understorey species rely on birds and mammals to disperse their seeds and are vulnerable to fire Along the drier ridgelines, fire would have been more frequent and an important factor in maintaining understorey diversity.	N/A	Absent	None	Low
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion **BC-EEC, EPBC-CEEC**	Characteristic tree species of this ecological community are *Eucalyptus deanei* (Deane's Gum), *E. cypellocarpa* (Monkey Gum) and *Syncarpia glomulifera* (Turpentine). Other tree species include *Angophora costata*, *A. floribunda*, *E. notabilis*, *E. piperita* and *E. punctata*. Tree species composition varies between sites depending on geographical location and local conditions (e.g. topography, rainfall exposure). Known from the local government areas of Blue Mountains and Hawkesbury, both within the Sydney Basin Bioregion. Blue Mountains Shale Cap Forest is found on deep fertile soils formed on Wianamatta Shale, on moist sheltered sites at lower to middle altitudes of the Blue Mountains and Wollemi areas. Extensive occurrences of shale are at Springwood, Berambing to Kurrajong Heights, Mountain Lagoon and Colo Heights. Blue Mountains Shale Cap Forest includes vegetation that is part of Map Unit 9a Shale Cap Forest of the Royal Botanic Gardens' 1:100 000 vegetation maps and vegetation that is part of Smith and Smith's Eucalyptus deanei–Syncarpia glomulifera Tall Open Forest. Blue Mountains Shale Cap Forest is a rich habitat for fauna, supporting greater numbers and a greater diversity of mammals and birds than the typical lower, drier eucalypt forests and woodlands of the Blue Mountains. The *Eucalyptus deanei* trees	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	are a major provider of nest hollows for owls, parrots, gliders and other hollow dependent fauna including the threatened species Powerful Owl and Glossy Black-Cockatoo. Blue Mountains Shale Cap Forest has been extensively cleared for agricultural and urban development and is poorly represented in Blue Mountains and Wollemi national parks. The structure of the community was originally tall open forest to open forest, depending on site conditions and history, but as a result of partial clearance may now exist as woodland or as groups of remnant trees.				
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion **BC-VEC, EPBC-EEC**	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion is dominated by *Eucalyptus parramattensis* subsp. *parramattensis*, *Angophora bakeri* and *E. sclerophylla*. A small tree stratum of *Melaleuca decora* is sometimes present, generally in areas with poorer drainage. It has a well-developed shrub stratum consisting of sclerophyllous species such as *Banksia spinulosa* var. *spinulosa*, *Melaleuca nodosa*, *Hakea sericea* and *H. dactyloides* (multi-stemmed form). The ground stratum consists of a diverse range of forbs including *Themeda australis*, *Entolasia stricta*, *Cyathochaeta diandra*, *Dianella revoluta* subsp. *revoluta*, *Stylidium graminifolium*, *Platysace ericoides*, *Laxmannia gracilis* and *Aristida warburgii* (Tozer 2003). Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium (Tozer 2003). It is most often found on sandy soils and tends to occur on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest in the Sydney Basin Bioregion (Tozer 2003). The boundary between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest or Shale Gravel Transition Forest in the Sydney Basin Bioregion appears to be a function of the interaction of localised drainage conditions and the thickness of the Tertiary alluvium mantle (Tozer 2003). Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion is to occur within the local government areas of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith (James 1997), but may occur elsewhere within the Sydney Basin Bioregion. The main occurrence of Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion is in the Castlereagh area of the Cumberland Plain, with small patches occurring at Kemps Creek and Longneck Lagoon. It is also present around Holsworthy, however the floristic composition in this area shows stronger similarities to Castlereagh Ironbark Forest than at other localities (Tozer 2003). Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion corresponds to the community of the same name described by Benson (1992) (Map Unit 14a), NSW NPWS (1997, 2002) and Tozer (2003) (Map Unit 6). It is similar to the Scribbly Gum woodlands found on perched sands in the Mellong Swamp area in Yengo and Wollemi National Parks, however there are distinct geological and floristic differences (James 1997). Occurs almost	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium. Often adjacent to and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest in the Sydney Basin Bioregion. The boundary with these units appears to be a function of the localised drainage conditions and the thickness of the tertiary alluvium mantle. The shrub understorey includes a number of listed threatened species including *Acacia bynoeana*, *Allocasuarina glareicola*, *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, *Micromyrtus minutiflora*, *Persoonia nutans* and *Pultenaea parviflora*, and may also possibly contain *Grevillea parviflora* subsp. *parviflora*. There are periodic fires in Castlereagh Scribbly Gum Woodland and most species are able to regenerate from lignotubers and buds beneath the bark, as well as seed stored in the soil.				
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC, EPBC-VEC**	Coastal Saltmarsh occurs in the intertidal zone along the NSW coast on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea*, *Juncus krausii*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Triglochin striata*, *Isolepis nodosa*, *Samolus repens*, *Selliera radicans*, *Suaeda australis* and *Zoysia macrantha*. Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pan. Species composition varies with elevation and latitude, with Saltmarsh in southern NSW being generally more species-rich than further north. The sediment surface may support a diversity of seaweed species. Species restricted to coastal saltmarshes include *Distichlis distichophylla* (endangered), *Halosarcia pergranulata subsp. pergranulata*, *Wilsonia backhousei* (vulnerable) and *Wilsonia rotundifolia* (endangered). Coastal Saltmarsh occurs in a number of conservation reserves including the Ramsar listed sites at Towra Point and Kooragang Island Nature Reserves, and at Sydney Olympic Park.	N/A	Absent	None	Low
Coastal Upland Swamp in the Sydney Basin Bioregion **BC-EEC, EPBC-EEC**	The Coastal Upland Swamp in the Sydney Basin Bioregion includes open graminiod heath, sedgeland and tall scrub associated with periodically waterlogged soils on the Hawkesbury sandstone plateaux. The Coastal Upland Swamp is generally associated with soils that are acidic and vary from yellow or grey mineral sandy loams with a shallow organic horizon to highly organic spongy black peat soils with pallid subsoils. The vegetation of the Coastal Upland Swamp may include tall open scrubs, tall closed scrubs, closed heaths, open graminoid heaths, sedgelands and fernlands. Larger examples may include a complex of these structural forms. The flora comprising the upland swamp is diverse there are 73 plant species listed as characterising the ecological community. The total species list is much greater and is likely to exceed 200 species of vascular plants. The Coastal Upland Swamp is endemic to NSW and confined to the Sydney Basin Bioregion. It occurs in the eastern Sydney Basin from	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	the Somersby district in the north to the Robertson district in the south. In the north it occurs on the Somersby-Hornsby plateaux, in the south it occurs on the Woronora plateau. It occurs in elevations from 20 metres to over 600 metres above sea level, with the majority of swamps occurring within 200 and 450 metres elevation. Coastal Upland Swamps occur primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture. The Coastal Upland Swamp is generally associated with soils that are acidic and vary from yellow to grey mineral sandy loams with a shallow organic horizon to highly organic spongy black peats with pallid subsoils.				
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion **BC-EEC, EPBC-CEEC**	Ranges from open forest to low woodland, with a canopy dominated by Broad-leaved Ironbark *Eucalyptus fibrosa* and Paperbark *Melaleuca decora*. The canopy may also include other eucalypts such as Woolybutt *E. longifolia*. The dense shrubby understorey consists of *Melaleuca nodosa* and Peach Heath *Lissanthe strigosa*, with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, *Pultenaea villosa* and *Daviesia ulicifolia* (can be locally abundant). The sparse ground layer contains a range of grasses and herbs. Contains many more species and other references should be consulted to identify these. Occurs in western Sydney, and the extent of intact remnants is now reduced to 1011 ha, with the most extensive stands occurring in the Castlereagh and Holsworthy areas. Smaller remnants occur in the Kemps Creek area and in the eastern section of the Cumberland Plain. Good examples can be seen at the Castlereagh and Windsor Downs Nature Reserves, and Cox Creek Nature Reserve. Has a very restricted natural distribution and mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales. Can intergrade into Shale-Gravel Transition Forest (where the alluvium is shallow), Castlereagh Swamp Woodland (in moist depressions) and Castlereagh Scribbly Gum Woodland (on sandier soils).	N/A	Absent	None	Low
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest **EPBC-CEEC, BC-CEEC**	The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest lies in a coastal valley rain shadow that occupies the driest part of the Cumberland Plain. It typically occurs on flat to undulating or hilly terrain, at elevations up to about 350 m above sea level, and on clay soils (derived from Wianamatta Group shales), with some occurrences on other soils. Annual rainfall in the region typically lies within the range of 700–900 mm. This ecological community has several vegetation layers in its natural state. The tree canopy is typically dominated by *Eucalyptus moluccana* (grey box), *E. tereticornis* (forest red gum), and/or *E. fibrosa* (red ironbark). Other canopy species may occur in association with the typical dominants and may be locally dominant at some sites, depending on local variation in the landscape. Smaller trees and shrubs grow underneath the tree canopy. The vegetation on the ground is a mix of grasses	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	and herbs. It was formerly extensive across the Cumberland Plain, but now occurs as mostly small patches. The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is endemic to New South Wales, specifically the area in and around western Sydney. It mostly occurs within the Cumberland subregion of the Sydney Basin bioregion (as defined by the Interim Biogeographic Regionalisation for Australia—IBRA v6.1), with some occurrences extending into neighbouring subregions.				
Duffys Forest Ecological Community in the Sydney Basin Bioregion **BC-EEC**	Open-forest or woodland community dominated by Red Bloodwood *Corymbia gummifera*, Black Ash *Eucalyptus sieberi*, Smooth-barked Apple *Angophora costata*, and frequently a stringybark *E. capitellata* or *E. oblonga*. Other understorey species include Myrtle Wattle *Acacia myrtifolia*, Hairpin Banksia *Banksia spinulosa*, Rusty Velet-bush *Lasiopetalum ferrugineum*, Crinkle Bush *Lomatia silaifolia*, Broad-leaf Geebung *Persoonia levis*, Apple–berry *Billardiera scandens*, Wiry Panic *Entolasia stricta*, Twisted Mat-rush *Lomandra obliqua*, *Micrantheum ericoides* and *Xanthorrhoea media*. The endangered shrub *Grevillea caleyi* is largely restricted to Duffys Forest Ecological Community though it is not present at all locations of the community. Extensively fragmented distribution, occurring primarily within Warringah, and Ku-ring-gai Local Government Areas (LGA) with minor occurrences in the Pittwater (Ingleside and Bilgola Plateau), Manly (Seaforth Oval) and Hornsby (South Turramura and Epping North) LGAs. Estimated original extent was approximately 1450 ha, of which less than 16%, or approximately 240 ha, remains. Occurs in association with shale lenses and lateritic soils in Hawkesbury Sandstone. Rock outcrops are usually absent from this community, except on the fringes, where it adjoins typical sandstone vegetation, generally characterised by extensive sandstone outcrops. Situated on ridgetops, plateaus and upper slopes, but may also occur on mid-slopes or benches downslope of Sydney Sandstone Ridgetop Woodland. Occurs on Somersby, Blacktown, Lucas Heights and Lambert Soil Landscapes and, to a lesser extent, the Gymea and Hawkesbury Soil Landscapes.	N/A	Absent	None	Low
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion **BC-EEC, EPBC-EEC**	Predominantly a sclerophyllous heath or scrub community although, depending on site topography and hydrology, some remnants contain small patches of woodland, low forest or limited wetter areas. Common species include *Banksia aemula*, *B. ericifolia*, *B. serrata*, *Eriostemon australasius*, *Lepidosperma laterale*, *Leptospermum laevigatum*, *Monotoca elliptica* and *Xanthorrhoea resinifera*. Once occupied around 5,300 hectares of land between North Head and Botany Bay in Sydney's eastern suburbs. Surviving stands totalling approximately 146 hectares have been recorded from the local government areas of Botany, Randwick, Waverley, and Manly. All ESBS remnants are small (typically 0.06 to 1 ha), isolated and degraded to some extent. Occurs on disjunct patches of nutrient poor (windblown) dune sand. The community	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	possesses soil seed bank and has been observed to regenerate naturally on cleared sand where the soil profile remains intact. Field observations indicate that after a prolonged period (>15 years) without fire or similar disturbance, the floristic composition and vegetation structure becomes simplified with a few species dominating the standing vegetation.				
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC**	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime: Those that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Where they are subject to regular inundation and drying the vegetation may include large emergent sedges over 1 metre tall, such as *Baumea articulata*, *Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogsmouth), *Ludwigia peploides* subsp. *montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum* spp. (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant. These latter species include *Azolla filiculoides* var. *rubra*, *Ceratophyllum demersum* (hornwort), *Hydrilla verticillata* (water thyme), *Lemna* spp. (duckweeds), *Nymphaea gigantea* (giant waterlily), *Nymphoides indica* (water snowflake), *Ottelia ovalifolia* (swamp lily) and *Potamageton* spp. (pondweeds). The threatened aquatic plants, *Aldrovanda vesiculosa* and *Najas marina*, also occur within this community. Known from along the majority of the NSW coast. However, it is distinct from Sydney Freshwater Wetlands which are associated with sandplains in the Sydney Basin bioregion. Extensively cleared and modified. In the 1990s the extent remaining were: 3% in the NSW North Coast bioregion, 66% in the lower Hunter – Central coast region, 40% on the Cumberland Plain, 70% in the Sydney – South Coast region, and 30% in the Eden region. There is less than 150 ha remaining on the Tweed lowlands (estimate in 1985); about 10,600 ha on the lower Clarence floodplain (in 1982); about 11,200 ha on the lower Macleay floodplain (in 1983); about 3,500 ha in the lower Hunter – Central Hunter region (in 1990s); less than 2,700 ha on the NSW south coast from	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	Sydney to Moruya (in the mid 1990s), including about 660 ha on the Cumberland Plain (in 1998) and about 100 ha on the Illawarra Plain (in 2001); and less than 1000 ha in the Eden region (in 1990). Poorly reserved, known to occur in Ukerebagh, Tuckean, Tabbimoble Swamp, Hexham Swamp, Pambalong and Pitt Town Nature Reserves and Bungawalbin, Scheyville and Seven Mile Beach National Parks.				
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale **BC-EEC**	A low open sclerophyll forest community with a distinctive moist forest component in its flora. The community occupies coastal dune sand and is often found in association with areas of sclerophyll heath and scrub. Characteristic sclerophyll tree and shrub species include *Angophora costata*, *Banksia ericifolia*, *Banksia serrata*, *Eucalyptus botryoides*, *Eucalyptus robusta*, *Leptospermum laevigatum* and *Monotoca elliptica*. The moist component of the flora is characterised by species including *Breynia oblongifolia*, *Cissus antarctica*, *Cissus hypoglauca*, *Clerodendrum tomentosum*, *Cupaniopsis anacardioides*, *Elaeocarpus reticulatus*, *Endiandra sieberi*, *Glochidion ferdinandi*, *Maclura cochinchinensis*, *Notelaea longifolia*, *Rapanea variabilis* and *Stephania japonica* var. *discolor*. Occurs within the local government areas (LGAs) of Sutherland and Rockdale. Within Sutherland LGA, major occurrences of the community are found on the Kurnell Peninsula, with other stands near Bundeena. Within Rockdale LGA, the community is recorded from Leo Smith Reserve.	N/A	Absent	None	Low
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC, CEEC**	Generally a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis* occur in many stands. Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. Littoral Rainforest is very rare and occurs in many small stands. In total, it comprises less than one percent of the total area of rainforest in NSW. The largest known stand occurs in Iluka Nature Reserve, which is about 136 hectares in size. Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their windward sides. Most stands occur within two kilometres of the sea, though are occasionally found further inland within reach of the maritime influence. A number of species characteristic of Littoral Rainforest in NSW reach their southern limits at various places along the coast; a number of temperate species are restricted to the south coast; the total Littoral Rainforest flora declines	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	from north to south. The species composition (flora and fauna) of a site will be influenced by its geographic location, the size of the site, its degree of exposure and rainfall, its disturbance history (including fire) and, if previously disturbed, the stage of regeneration.				
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions **BC-EEC, EPBC-CEEC**	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions is an ecological community of subtropical rainforest and some related, structurally complex forms of dry rainforest. Lowland Rainforest, in a relatively undisturbed state, has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a wide variety of shapes and sizes. Typically, the trees form three major strata: emergents, canopy and sub-canopy which, combined with variations in crown shapes and sizes results in an irregular canopy appearance. The trees are taxonomically diverse at the genus and family levels, and some may have buttressed roots. A range of plant growth forms are present in Lowland Rainforest, including palms, vines and vascular epiphytes. In disturbed stands of this community the canopy cover may be broken, or the canopy may be smothered by exotic vines. The Hawkesbury River notionally marks the southern limit of Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions. South of the Sydney metropolitan area, Lowland Rainforest is replaced by Illawarra Subtropical Rainforest of the Sydney Basin Bioregion, which is listed as an endangered ecological community. Milton Ulladulla Subtropical Rainforest is also a related rainforest endangered ecological community that occurs still further south in the South East Corner Bioregion.	N/A	Absent	None	Low
Moist Shale Woodland in the Sydney Basin Bioregion **BC-EEC, EPBC-CEEC**	Similar to Cumberland Plain Woodland. It differs in having a shrub understorey that contains plants from moist habitats. Dominant canopy trees include Forest Red Gum *Eucalyptus tereticornis*, Grey Box *E. moluccana*, Narrow-leaved Ironbark *E. crebra* and Spotted Gum *Corymbia maculata*. Small trees, such as Hickory Wattle *Acacia implexa* and Sydney Green Wattle *A. parramattensis* ssp *parramattensis* are also common. The shrub layer includes *Breynia oblongifolia*, Hairy Clerodendrum *Clerodendrum tomentosum* and Indian Weed *Siegesbeckia orientalis* ssp *orientalis*. Moist Shale Woodland usually occurs on soils derived from Wianamatta Shale on high country in the southern half of the Cumberland Plain, and occurs mainly in Wollondilly local government area. Also occurs in smaller amounts further north in the Camden, Campbelltown, Fairfield, Liverpool and Penrith local government areas. There are 604 ha remaining intact. A small remnant can be seen in Western Sydney Regional Park. Mainly occurs in the hilly country with higher elevations where there is increased rainfall. The shrubs and trees of Moist Shale Woodland provide excellent habitat for birds and insects, and provide ideal nesting hollows for mammals and birds. Occurs on clay soils derived from Wianamatta shale and is intermediate between Cumberland Plain Woodland on drier sites and Western Sydney Dry Rainforest on wetter sites.	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	Understorey shrubs in moist habitats are sensitive to fire and would be lost from the community with frequent fire.				
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion **BC-EEC**	General structural form is open-forest but may now exist as woodland or remnant trees. The tree canopy layer is characterised by Spotted Gum *Corymbia maculata* and Grey Ironbark *Eucalyptus paniculata* and is associated with Smooth-barked Apple *Angophora costata*, Red Bloodwood *Corymbia maculata*, Broad-leaved White Mahogany *E. umbra*, Grey Gum *E. punctata*, Turpentine *Syncarpia glomulifera*, Bangalay *E. botryoides*, and Rough-barked Apple *Angophora floribunda*. Occurs entirely within the Pittwater Local Government Area, on the Barrenjoey Peninsula and Western Pittwater Foreshores. Remnants are typically small and on private property, however there are a few remnants in Council reserves and one remnant within Ku-ring-gai Chase NP. Occurs in association with shale derived soils with high rainfall on lower hillslopes on the Narrabeen Group - Newport Formations on the Barrenjoey Peninsula and western Pittwater Foreshores. Assemblage diversity must take into account species likely to be present in the soil seedbank. Structural form is typically open-forest but may now exist as woodland or remnant trees. Floristic composition and structural diversity influenced by the remnant size, disturbance history and fire severity and frequency.	N/A	Absent	None	Low
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC**	This EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis (forest red gum)*, *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) south from Sydney. A layer of small trees may be present, including *Melaleuca decora, M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azaderach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa* , *Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii* .The groundcover is composed of abundant forbs, scramblers and grasses including *Microlaena stipoides, Dichondra repens, Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens, Entolasia marginata, Oxalis perennans* and *Veronica plebeia* . The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	elevation, but may occur on localised river flats up to 250 m above sea level. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically form mosaics with other floodplain forest communities and treeless wetlands, and often fringe treeless floodplain lagoons or wetlands with semi-permanent standing water. Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions.				
Shale Gravel Transition Forest in the Sydney Basin Bioregion **BC-EEC EPBC-CEEC**	Has an open forest structure with a canopy dominated by Broad-leaved Ironbark *Eucalyptus fibrosa*, with Grey Box *E. moluccana* and Forest Red Gum *E. tereticornis* occurring less frequently. Paperbark *Melaleuca decora* is common in the small tree layer. A sparse shrub layer is usually present which includes Blackthorn *Bursaria spinosa*, *Daviesia ulicifolia*, and Peach Heath *Lissanthe strigosa*. Mainly found in the northern section of the Cumberland Plain, western Sydney, in the Richmond, Marsden Park and Windsor districts. Also appears in the Liverpool/ Holsworthy area, and there are small occurrences at Bankstown, Yennora and Villawood and the Kemps Creek area. There are 1,721 ha remaining intact. Good examples can be seen at Windsor Downs Nature Reserve and Kemps Creek Nature Reserve. The shrub understorey includes a number of listed threatened species in the 'pea' flower group. The plants in this group rely on nitrogen fixing root nodules and soil/root fungi to extract nutrients form the poor soils. There are periodic fires in Shale-Gravel Transition Forest and most species are able to regenerate from lignotubers and buds beneath the bark, as well as seed stored in the soil. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. A transitional plant community which grades into Cumberland Plain Woodland where the influence of gravel soil declines, and grades into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick.	N/A	Absent	None	Low
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include Forest Red Gum Eucalyptus tereticornis,	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
BC-EEC EPBC-CEEC	Grey Gum *E. punctata*, stringybarks (*E. globoidea, E. eugenioides*) and ironbarks (*E. fibrosa and E. crebra*). Areas of low sandstone influence have an understorey that is closer to Cumberland Plain Woodland. Contains many more species and other references should be consulted to identify these. Before European settlement, was extensive around the edges of the Cumberland Plain, western Sydney, particularly the southern half. Today, only 9,950 ha remains intact (22.6% of its original extent) and the bulk of this occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas. It occurs in an area bounded by Sackville (north), Mulgoa (west), Wilton (south) and Revesby (east). Good examples can be seen at Gulguer Nature Reserve. High sandstone influence sites have poor rocky soils, some of the shrubs of which rely on nitrogen-fixing root nodules and soil/root fungi to obtain nutrients.				
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion **BC-EEC**	An open forest dominated by eucalypts with scattered subcanopy trees, a diverse shrub layer and a well-developed groundcover of ferns, forbs, grasses and graminoids. The dominant trees include *Angophora costata*, *Eucalyptus piperita* and occasionally *Eucalyptus pilularis*, particularly around Helensburgh. Associated with occurrences of *Eucalyptus pilularis*, *Acacia binervata*, *Elaeocarpus reticulatus*, *Pittosporum undulatum* and a relatively dense groundcover of ferns, grasses, rushes, lilies and forbs. The community typically has an open forest structure, although disturbance may result in local manifestations as woodland or scrub. Found within an estimated total extent of less than 45 000 ha, bounded approximately by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai. Within this range, the community is currently estimated to occupy an area of approximately 400 - 4 000 ha. The community has been recorded from the local government areas of Campbelltown, Hurstville, Kogarah, Sutherland, Wollondilly and Wollongong within the Sydney Basin Bioregion and may occur elsewhere in the Bioregion. In Hurstville, Kogarah and Sutherland, the community persists as small fragments surrounded by urban development. The community is also present in the upper Hacking River catchment around Helensburgh and in Royal National Park. The terrain is primarily gentle, with slopes not often exceeding 10°, and where sandstone outcrops occur infrequently. The community is typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates.	N/A	Absent	None	Low
Swamp Oak Floodplain Forest of the New South Wales North	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (Swamp Oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (Lilly Pilly), *Glochidion* spp. (Cheese Trees) and *Melaleuca* spp. (Paperbarks) may be present as subordinate	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
Coast, Sydney Basin and South East Corner Bioregions **BC-EEC**	species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui. Known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers. Small areas of Swamp Oak Floodplain Forest are contained within existing conservation reserves, including Stotts Island, Ukerebagh, Tuckean, Pambalong, Wamberal, Towra Point and Cullendulla Creek Nature Reserves and Bongil Bongil, Myall Lakes and Conjola National Parks. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Often fringes treeless floodplain lagoons or wetlands with semi-permanent standing water.				
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC**	Usually an open to closed forest with a shrubby or reedy/ferny understorey. Has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Paperbark) and, south from Sydney, *Eucalyptus botryoides* (Bangalay) and *Eucalyptus longifolia* (Woollybut). This community is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions.	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	The exact amount of its original extent is unknown but it is much less than 30%. There are less than 350 ha of native vegetation attributable to this community on the Tweed lowlands, less than 2,500 ha on the Clarence floodplain, less than 700 ha on the Macleay floodplain, up to 7,000 ha in the lower Hunter – central coast district, and less than 1,000 ha in the Sydney – South Coast region. Small areas of Swamp Sclerophyll Forest on Coastal Floodplains are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The understorey may have a substantial component of exotic grasses, vines and forbs. Often fringes treeless floodplain lagoons or wetlands with semi-permanent standing water.				
Sydney Freshwater Wetlands in the Sydney Basin Bioregion **BC-EEC**	A complex of vegetation types largely restricted to freshwater swamps in coastal areas. These also vary considerably due to fluctuating water levels and seasonal conditions. Characteristic species include sedges and aquatic plants such as *Baumea* species, *Eleocharis sphacelata*, *Gahnia* species, *Ludwigia peploides* ssp. *montevidensis* and *Persicaria* species. Areas of open water may occur where drainage conditions have been altered and there may also be patches of emergent trees and shrubs. Occurs on sand dunes and low-nutrient sandplains along coastal areas in the Sydney Basin bioregion. Typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. It is known from the Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Woollahra, Waverley, Botany, Rockdale, Randwick, Sutherland and Wollongong local government areas, but is likely to occur elsewhere within the bioregion. Small areas of Sydney Freshwater Wetlands have been reported to occur in Wyrrabalong, Royal and Botany Bay National Parks. Has been extensively cleared and filled and remnants are often small and disturbed. Largely restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplains such as those of the Warriewood and Tuggerah soil landscapes. Swampy areas on alluvium with a saline influence do not fall within this community.	N/A	Absent	None	Low
Sydney Turpentine-Ironbark Forest	Open forest, with dominant canopy trees including Turpentine *Syncarpia glomulifera*, Grey Gum *Eucalyptus punctata*, Grey Ironbark *Eucalyptus paniculata* and Thin-leaved Stringybark *E. eugenoides*. In areas of high rainfall (over 1050 mm per annum) Sydney Blue Gum *E. saligna* is more dominant. The shrub stratum is usually sparse and may	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
BC-EEC, EPBC-CEEC	contain mesic species such as Sweet Pittosporum *Pittosporum undulatum* and Elderberry Panax *Polyscias sambucifolia*. Occurs in Sydney and is heavily fragmented, with only 0.5 percent its original extent remaining intact. Remnants mostly occur in the Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly local government areas. Good examples can be seen in small reserves such as Wallumatta Nature Reserve and Newington Nature Reserve. Occurs close to the shale/sandstone boundary on the more fertile shale influenced soils, in higher rainfall areas on the higher altitude margins of the Cumberland Plain, and on the shale ridge caps of sandstone plateaus. A transitional community, between Cumberland Plain Woodland in drier areas and Blue Gum High Forest on adjacent higher rainfall ridges. Is reported to be a rich habitat for mammals and birds, providing nest hollows for species such as hollow-dependent fauna including the Powerful Owl and Glossy Black-Cockatoo.				
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions **BC-EEC**	The structure of the community is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs. *Themeda australis* is the dominant species in this ecological community. *Themeda australis* is an extremely widespread species, but in this community it may have a distinctive appearance, being prostrate and having glaucous leaves. These features are retained in cultivation and the form is believed to be genetically distinct. Scattered shrubs occur in many stands, most frequently *Pimelea linifolia, Banksia integrifolia* and *Westringia aculata*. These and other woody species often have dwarf growth forms. A number of threatened species occur in some stands of the community, including *Diuris* sp. aff. *Chrysantha, Pultenaea maritima, Rutidosus heterogama, Thesium aculat* and *Zieria prostrata*. Themeda Grassland on seacliffs and coastal headlands is found on a range of substrates in the NSW North Coast, Sydney Basin and South East Corner bioregions. Stands on sandstone are infrequent and small. Larger stands are found on old sand dunes above cliffs, as for example at Cape Banks and Henry Head in Botany Bay National Park, and on basalt headlands, as for example at Damerals Head in Moonee Beach National Park. Individual stands of the community are often very small, a few square metres, but at some sites larger stands of up to several hectares or tens of hectares occur. Overall, the community has a highly restricted geographic distribution comprising small, but widely scattered patches.	N/A	Absent	None	Low
Western Sydney Dry Rainforest and Moist Woodland on Shale **BC-EEC, EPBC-CEEC**	The Western Sydney Dry Rainforest and Moist Woodland on Shale ecological community covers two vegetation units, Western Sydney Dry Rainforest and Moist Shale Woodland, described by Tozer (2003) and Tozer et al. (2010) and listed as endangered under the New South Wales *Threatened Species Conservation Act 1995* (NSW Scientific Committee, 2000a; 2000b). The	N/A	Absent	None	Low

Species	Description of habitat[1]	BioNet Records	Presence of habitat	Likelihood of occurrence	Possible impact?
	ecological community varies from a low closed rainforest, typically in lower slopes and gullies, to a more open moist woodland form on upper slopes and disturbed sites. Emergent trees can be up to around 25 m high and a lower tree layer is often present. Dominant species of the canopy and the sub-canopy vary across the latitudinal range of the ecological community, and also according to the available moisture and shelter. Each dry rainforest stand is unique in its assemblage of species, although there are a group of common species throughout with local floristics depending on local conditions. In sheltered gullies and on lower slopes the canopy layer of the ecological community is typically dominated by *Melaleuca styphelioides* (prickly-leaved paperbark). Other diagnostic tree species include *Acacia implexa* (hickory wattle), *Alectryon subcinereus* (native quince), *Brachychiton populneus* (kurrajong), *Corymbia maculata* (spotted gum), *Melicope micrococca* (white euodia) and *Streblus brunonianus* (whalebone tree). *Eucalyptus* spp. occur as emergents in the rainforest form, and grade into a canopy in moist woodlands, the dominant species generally being *E. tereticornis* (forest red gum), *E. moluccana* (coastal grey box) and/or *E. crebra* (narrow-leaved ironbark).				

E BC = listed as Endangered under Schedule 1 of the NSW *Biodiversity Conservation Act 2016*

E EPBC = listed as Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

V BC = listed as Vulnerable under Schedule 2 of the NSW *Biodiversity Conservation Act 2016*

V EPBC = listed as Vulnerable under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

EEC BC = Endangered Ecological Community listed under Schedule 1 of the NSW *Biodiversity Conservation Act 2016*

CE EPBC = listed as Critically Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

C.2 EVALUATION OF THE LIKELIHOOD AND EXTENT OF IMPACT ON THREATENED FAUNA

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
Aves					
Ardenna carneipes **Flesh-footed Shearwater** **BC-V, EPBC-M**	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia. Nest on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach.	2	Absent	Low	Low
Artamus cyanopterus cyanopterus **Dusky Woodswallow** **BC-V**	Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. Primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. Also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Also occasionally take nectar, fruit and seed. Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding. Migrants generally depart between March and May, heading south to breed again in spring. There is some evidence of site fidelity for breeding. Although dusky woodswallows generally breed as solitary pairs or occasionally in small flocks, large flocks may form around abundant food sources in winter. Large flocks may also form before migration, which is often undertaken with other species. Nest is an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and	1	Absent	Low	Low

[2] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's *Species Profiles and Threats* database (SPRAT) unless otherwise stated.

OEH threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	may be lined with grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Nest sites may be exposed or well concealed by foliage.				
Calidris alba **Sanderling** **BC-V, EPBC-M**	An active, pale wader reaching 20 cm long. The non-breeding adult is pale grey above and white below, with a black patch at the angle of the wing. It has a short, straight, broad-based black bill, blackish-brown wings with broad, white wing-stripes, and short, black legs. In flight, it shows the widest white wing-bar of any sandpiper, on a very dark wing. The forehead and eyebrows are white; the rump and tail have a brown centre and white sides. Elements of the rufous breeding plumage may be visible in some birds just after their spring arrival or before their autumn departure, and in some overwintering birds. A regular summer migrant from Siberia and other Arctic breeding grounds to most of the Australian coastline. It is uncommon to locally common, arriving from September and leaving by May (some may overwinter in Australia). Sanderlings occur along the NSW coast, with occasional inland sightings.	5	Absent	Low	Low
Calidris canutus **Red Knot** **EPBC-E**	Breeding in the Arctic Circle between August and April, it visits Australian shores in large numbers and frequents coastal sand flats and the margins of estuaries and rivers. It feeds in close-packed flocks that move in unison.	39	Absent	Low	Low
Calidris ferruginea **Curlew Sandpiper** **BC-E, EPBC-CE**	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	185	Absent	Low	Low
Calidris tenuirostris ***Great Knot*** **BC-V, EPBC-CE**	A medium-sized bulky wader with a straight, dark-brown bill and yellowish-brown legs. It has a striped crown with an indistinct white eyebrow. Its upperparts are grey, with dark feather tips; its underparts are white. The rump is pure white, the tail is tipped with grey. Breeding plumage consists of darker upperparts with black and chestnut markings. In NSW, the species has been recorded at scattered sites along the coast	16	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms.				
Calyptorhynchus lathami **Glossy Black-cockatoo** **BC-V**	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. In the Riverina area, inhabits open woodlands dominated by Belah (*Casuarina cristata*). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.	3	Absent	Low	Low
Charadrius leschenaultii **Greater Sand-plover** **BC-V, EPBC-V**	The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	1	Absent	Low	Low
Charadrius mongolus ***Lesser Sand Plover*** **BC-V, EPBC-E**	In non-breeding grounds in Australia, this species usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves. The species also inhabits saltworks and near-coastal saltpans, brackish swamps and sandy or silt islands in river beds. The species feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks. They roost near foraging areas, on beaches, banks, spits and banks of sand or shells, and occasionally on rocky spits, islets or reefs. They rarely roost in mangroves. The species does not breed in Australia.		Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
Dasyornis brachypterus **Eastern Bristlebird** **BC-E, EPBC-E**	There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species. The Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, habitat in northern NSW requires frequent fires to maintain habitat condition and suitability. The northern fire regimes is between 3-6 years and of variable intensity depending on the habitat condition.	1	Absent	Low	Low
Diomedea exulans **Wandering Albatross** **BC-E, EPBC-E**	The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and September. It has been recorded along the length of the NSW coast. At other times birds roam the southern oceans and commonly follow fishing vessels for several days. Wandering albatross spend the majority of their time in flight, soaring over the southern oceans. Breeding takes place on exposed ridges and hillocks, amongst open and patchy vegetation. They feed in pelagic, offshore and inshore waters, often at night, taking fish and cephalopods such as squid, crustaceans and carrion, and will often follow ships feeding on the refuse they trail.	1406	Absent	Low	Low
Diomedea gibsoni **Gibson's Albatross** **BC-V, EPBC-V**	Essentially endemic to the Auckland Islands of New Zealand. The non-breeding range is poorly known however the species probably disperses across the southern Pacific. The species is regularly encountered on trans-Tasman shipping routes and at seas off Sydney, and regularly occurs off the NSW coast usually between Green Cape and Newcastle. This species regularly occurs off the NSW coast from Green Cape to Newcastle. Although representing a small proportion on its total foraging area, potential forage in NSW waters during the winter is nonetheless considered significant for the species.	1	Absent	Low	Low
Epthianura albifrons **White-fronted Chat** **BC-V**	In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-	35	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	populations are separated from each other by 25 km of urbanised land, across which the Chats are unlikely to fly. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. White-fronted Chats were previously recorded at Penrith Lakes (2001), Hawkesbury Swamps (2002), Tuggerah Lake (1997) and Lake Macquarie (1998). Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals. The Newington and Towra Point populations are thought to be disjunct from each other (and from the nearest populations outside Sydney Metropolitan CMA). Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground). Two to three eggs are laid in each clutch, and the complete nesting cycle from nest-building to independent young is approximately 50 days. Birds can breed at one year of age and are estimated to live for five years.				
Epthianura albifrons **White-fronted Chat population in the Sydney Metropolitan Catchment Management Area** **BC-E**	The White-fronted Chat is an endemic Australian passerine bird, 12 cm in length and weighing approximately 13 g. It has a short slender bill, long spindly legs, a short square-tipped tail and rounded wings. Classified as a honeyeater it is most similar in form to its close relatives, the Orange Chat, Yellow Chat and Crimson Chat from which it is easily distinguished by its black and white colouration. The male's plumage is more striking than the females; juvenile plumage is most similar to the female. A distinctive 'tang, tang' is used as a contact call. The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-	35	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	populations are separated from each other by 25 km of urbanised land, across which the Chats are unlikely to fly. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. White-fronted Chats were previously recorded at Penrith Lakes (2001), Hawkesbury Swamps (2002), Tuggerah Lake (1997) and Lake Macquarie (1998).				
Glossopsitta pusilla **Little Lorikeet** **BC-V**	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September.	2	Absent	Low	Low
Haematopus fuliginosus **Sooty Oystercatcher** **BC-V**	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.	5	Absent	Low	Low
Haematopus longirostris **Pied Oystercatcher** **BC-E**	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. 'Pied' Oystercatchers are occasionally recorded on Lord Howe island but it is uncertain which species is involved. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or	20	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.				
Haliaetus leucogaster **White-bellied Sea Eagle** **BC-V, EPBC-M**	White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Birds form permanent pairs that inhabit territories throughout the year. Their loud "goose-like" honking call is a familiar sound, particularly during the breeding season. Birds are normally seen, perched high in a tree, or soaring over waterways and adjacent land. In addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. The White-bellied Sea-Eagle feeds mainly off aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. It is a skilled hunter and will attack prey up to the size of a swan. Sea-Eagles also feed on carrion (dead prey) such as sheep and fish along the waterline. They harass smaller birds, forcing them to drop any food that they are carrying. Sea-Eagles feed alone, in pairs or in family groups. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground but may be also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season (May to October), the nest is lined with fresh green leaves and twigs. The female carries out most of the incubation of the two white eggs, but the male performs this duty from time to time.	8	Absent	Low	Low
Lathamus discolor **Swift Parrot** **BC-E, EPBC-CE**	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana*, Blackbutt *E. pilularis*, and Yellow Box *E. melliodora*. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *Eucalyptus globulus*.	1	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
Limicola falcinellus **Broad-billed Sandpiper** **BC-V, EPBC-M**	The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	4	Absent	Low	Low
Limosa limosa **Black-tailed Godwit** **BC-V, EPBC-M**	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps. Individuals have been recorded in wet fields and sewerage treatment works. Forages for insects, crustaceans, molluscs, worms, larvae, spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water. Roosts and loafs on low banks of mud, sand and shell bars. Frequently recorded in mixed flocks with Bar-tailed Godwits.	8	Absent	Low	Low
Macronectes giganteus **Southern Giant Petrel** **BC-E, EPBC-E**	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	116	Absent	Low	Low
Macronectes halli **Northern Giant Petrel** **BC-V, EPBC-V**	The Northern Giant-petrel has a circumpolar pelagic distribution, predominantly in sub-Antarctic to Antarctic waters north of the Antarctic convergence, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. The provenance of Northern Giant-petrels occurring in NSW waters is restricted to Macquarie Island. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Northern Giant-petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population do not nest.	5	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
Neochmia ruficauda ***Star Finch*** **BC-CE, EPBC-E**	The Star Finch is a 11.5 cm small, compact Finch with rounded head, slender bill, and moderately long tail with rounded tip. The Star Finch is a plain olive-brown with a pale belly. It has a red face and bill and is spotted white on the face, breast and flanks. The tail is reddish brown dotted white on the uppertail coverts. Juveniles are mostly plain brown with a rusty tail and dark bill. *Neochmia ruficauda* is endemic to Australia, and is listed in Commonwealth records as 'endangered'. The species is currently only found in central Queensland. The distribution of the Star Finch formerly extended from Bowen in central Queensland, south to the Namoi River in northern New South Wales, and west to the Blackall Range. Recent records have been obtained only from scattered sites in central Queensland and, consequently, the Star Finch now appears to be extinct in both south-eastern Queensland and northern New South Wales. The Star Finch is held in more than 20 zoos and institutions worldwide. In Australia, populations are maintained in Currumbin Wildlife Sanctuary in Queensland, Melbourne Zoo in Victoria, Adelaide Zoo in South Australia and Territory Wildlife Park in the Northern Territory.	1	Absent	Low	Low
Neophema chrysogaster **Orange-bellied Parrot** **BC-CE, EPBC-CE**	The Orange-bellied Parrot is a small, stocky, ground-dwelling parrot, primarily a deep, grassy green. It is noticeably smaller than the superficially similar and much more familiar Red-rumped Parrot *Psephotus haematonotus*. It has a blue forehead-band (that does not extend behind the eye), a green (not yellow) face, and blue wing-edges. The orange patch on the yellow belly is not a very reliable field mark. It sometimes feeds with the very similar Blue-winged Parrot *Neophema chrysotoma*. Its buzzy alarm call is also unique. The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be being more frequently utilised than observations suggest. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. The species can be found foraging in weedy areas associated with these coastal habitats or even in totally modified landscapes such as pastures, seed crops and golf courses.	1	Absent	Low	Low
Ninox strenua **Powerful Owl** **BC-V**	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub-canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and	11	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	abundant hollows supporting high densities of arboreal marsupials. Roosts in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Species commonly used for roosting include the She-oaks *Allocasuarina* spp., rainforest species such as Coachwood *Ceratopetalum apetalum*, Lilly Pilly *Acmena smithii* and Sassafras *Doryphora sassafras*, Black Wattle *Acacia melanoxylon*, Turpentine *Syncarpia glomulifera* and eucalypts. Roosting sites are commonly among small groves of up to 2 ha of similar-sized trees with dense foliage in the height range 3-15 m. Nests in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines, with hollows greater than 45 cm diameter and greater than 100 cm deep; surrounded by canopy trees and subcanopy or understorey trees or tall shrubs. Hollow entrances are greater than 6 m above ground, commonly more than 20 m where the forest permits, in trees of at least 80 cm diameter at breast height. During the breeding season, the male Powerful Owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). The Powerful Owl is highly sensitive to nest disturbance during the egg and chick stages and will readily abandon the nest if disturbed. Home range has been estimated as 300-1500 ha according to habitat productivity. Moist forest in unlogged corridors in gully systems is used for nesting and roosting, and also preferentially for foraging although much foraging is also conducted in dry and regrowth forest. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider.				
Numenius madagascariensis **Eastern Curlew** **BC-CE, EPBC-CE**	In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	11	Absent	Low	Low
Pandion cristatus **Eastern Osprey** **BC-V**	The breeding range of the Eastern Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW. In NSW, the breeding population occurs from the Queensland border (contiguous with the Queensland population) south to Gosford and recently (2005-2007) to Sydney, with a more recent (2008) breeding attempt recorded further south at Ulladulla, where a bird has been observed nest-building (Clancy 2008, 2009). Vagrants occur south to and beyond the Victorian border. Forages over clear estuarine and inshore marine waters and coastal rivers, and nests in tall (usually dead	1	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	or dead-topped) trees in coastal habitats from open woodland to open forest, within 1-2 km of water. Build a large stick bowl usually in the top of a dead or partly dead tree, from isolated trees in open country to open forest, with prominent emergent perches nearby (*e.g.* dead trees). The species is increasingly seen making use of artificial structures for nest sites and lookout perches (*e.g.* power pylons, towers, bridges) and purpose-built nest platforms on poles. A clutch of usually three eggs is laid in winter, with a single attempt per season. The incubation period is about 38 days, the nestling period 9-11 weeks, and the post-fledging dependence period lasts two to three months. Breeding productivity is 0.9-1.1 young per pair per year in NSW. Feed mostly on surface-swimming, schooling fish caught by diving into water. Highly mobile and dispersive.				
Pezoporus wallicus wallicus **Eastern Ground Parrot** **BC-V**	The Ground Parrot is a stunningly beautiful bird. It is a distinctive, bright grass-green, long-tailed, ground-dwelling parrot of the coastal and sub-coastal heaths, reaching 30 cm long. The green upperparts are heavily mottled with yellow and black, and the greenish-yellow underparts are barred brown. Sexes are alike. The forehead of individuals older than three or four months is orange-red. This species has a distinctive call, given at dawn and dusk, that consists of a series of piercing, resonating whistles, rising in steps, with each note flowing on almost unbroken, but abruptly higher than the preceding note. The species is rarely seen unless flushed, although birds can be seen fluttering low over heath at dusk. There are three recognised subspecies of the Ground Parrot in Australia, though the subspecies in Tasmania (*leachii*) is not always recognised. Recently, the possibility that the western subspecies (*flaviventris*) may be a separate species has been raised. The eastern subspecies (*wallicus*) inhabits south-eastern Australia from southern Queensland through NSW to western Victoria. It formerly occurred in South Australia, but was last recorded in 1945. In NSW populations have declined and contracted to islands of coastal or subcoastal heathland and sedgeland habitats. The species is found in relatively large numbers on the north coast (Broadwater, Bundjalung, Yuraygir and Limeburners Creek NPs) and in smaller numbers at Myall Lakes on the central coast. There are also large populations on the NSW south coast, particularly Barren Grounds NR, Budderoo NP, the Jervis Bay area and Nadgee NR. Small numbers are recorded at Morton and Ben Boyd NP and other areas on the south coast. Estimated population size is about 2000 birds.	2	Absent	Low	Low
Ptilinopus superbus **Superb Fruit-dove** **BC-V**	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in	3	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	autumn. Breeding takes place from September to January. The nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species. The male incubates the single egg by day, the female incubates at night.				
Stagonopleura guttata **Diamond Firetail** **BC-V**	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Cental and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between 5 to 40 birds, occasionally more. Groups separate into small colonies to breed, between August and January.	2	Absent	Low	Low
Sternula albifrons **Little Tern** **BC-E, EPBC-M**	In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	335	Absent	Low	Low
Stictonetta naevosa **Freckled Duck** **BC-V**	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the	1	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
	day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. Nests are usually located in dense vegetation at or near water level.				
Thalassarche cauta **Shy Albatross** **BC-V, EPBC-V**	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. while at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks.	1	Absent	Low	Low
Thalassarche melanophris **Black-browed Albatross** **BC-V, EPBC-V**	Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Spends most of its time at sea, breeding on small isolated islands. When at sea, individuals soar on strong winds and rest on the ocean, when calm, often in groups. Individuals seize prey from the surface while swimming or landing, sometimes submerging their head and body to capture prey underwater, and they scavenge in large flocks behind fishing vessels. This species nests annually on a mound of soil and vegetation, on the cliffs or steep slopes of vegetated Antarctic and subantarctic islands. Colonies of up to 100,000 nests are formed, occasionally containing other species such as the Grey-headed Albatross, during which time the birds are territorial while nesting.	3	Absent	Low	Low
Xenus cinereus **Terek Sandpiper** **BC-V, EPBC-M**	In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools. Generally roosts communally amongst mangroves or dead trees, often with related wader species. Breaks up into smaller flocks or even solitary birds when feeding in open intertidal mudflats.	9	Absent	Low	Low
Mammals					
Miniopterus orianae oceanensis **Large Bent-winged Bat**	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a	22	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
BC-V	maternity cave that is used annually in spring and summer for the birth and rearing of young.				
Myotis macropus **Southern Myotis** **BC-V**	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	1	Absent	Low	Low
Pteropus poliocephalus **Grey-headed Flying-fox** **BC-V, EPBC-V**	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.	535	Absent	Low	Low
Saccolaimus flaviventris **Yellow-bellied Sheathtail-bat** **BC-V**	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	1	Absent	Low	Low
Amphibians					
Crinia tinnula **Wallum Froglet**	Wallum Froglets are small (to about 20mm) and extremely variable in colour and pattern. They range from light grey or brown to dark grey above and usually white or light brown below (sparsely flecked or heavily mottled with darker patches). They have	1	Absent	Low	Low

Species and Status	Description of habitat[2]	BioNet Records	Presence of habitat	Likelihood of occurrence	Potential for impact?
BC-V	a relatively pointed snout that projects beyond the lower jaw. A fine median line of white dots often occurs on the underside on the throat that may continue across the belly. They have no webbing on their feet and toe pads are absent. Pupils are horizontal. The call is a distinctive short high-pitched ringing 'tching..tching..', heard throughout the year, particularly following rain. Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney.				
Litoria aurea **Green and Golden Bell Frog** **BC-E, EPBC-V**	Its former distribution was predominantly coastal but extended inland to the central and southern tablelands, including Bathurst in the west. It was known from the northern coastal part of NSW from around Brunswick Heads south along the entire NSW coast extending into the north-eastern portion of Victoria. There are presently 43 identified remaining key populations, most of which have a small fragmented distribution of mainly near coastal locations. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes.	20	Absent	Low	Low
Reptiles					
Chelonia mydas **Green Turtle** **BC-V, EPBC-V**	Widely distributed in tropical and sub-tropical seas. Usually found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast.	21	Absent	Low	Low

E BC = listed as Endangered under Schedule 1 of the NSW *Biodiversity Conservation Act 2016.*

E EPBC = listed as Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

V BC = listed as Vulnerable under Schedule 2 of the NSW *Biodiversity Conservation Act 2016.*

V EPBC = listed as Vulnerable under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

M EPBC = listed as Migratory under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

CE EPBC = listed as Critically Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

CAMBA = Chinese-Australia Migratory Bird Agreement

JAMBA = Japan-Australia Migratory Bird Agreement

APPENDIX B NOISE ASSESSMENT

BOTANY YARD BI-DIRECTIONAL SIGNALLING WORKS

Noise and Vibration Assessment
Review of Environmental Factors

Prepared for:

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Unit 2, 54 Hudson St
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SLR Ref: 610.30002-R01
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with NGH Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
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APPENDICES

1 Introduction

1.1 Overview

Australian Rail Track Corporation (ARTC) proposes to construct and operate the Botany Yard Bi-Directional Signalling project (the proposal). The location of the proposal is shown in **Figure 1**.

This Noise and Vibration Technical Report has been prepared to accompany the Review of Environmental Factors (REF) for of the proposal.

1.2 Overview of Works

Botany Yard consists of approximately 4 km of railway corridor from Banksia Street footbridge at the north to Penrhyn Road access gate in Banksmeadow in the south, with approximate chainage along the Botany Rail Line from 10.000 km to 6.625 km.

An operational requirement specification (ORS) has been approved for the Botany Rail Line and preliminary signal scheme produced by SMEC 2017 with an outline for the design. The estimated project scope may change with future design development. Proposed works include but are not restricted to:

Signal Works

- Removal of 4 existing Signal posts
- Removal of 1 existing Signal Hut
- Installation of 10 new Signal posts
- Installation of 1 new Signal Hut
- Provision of new cable routes to enable new Signal infrastructure above
- Modification to 14 existing Signals (ie new indications).

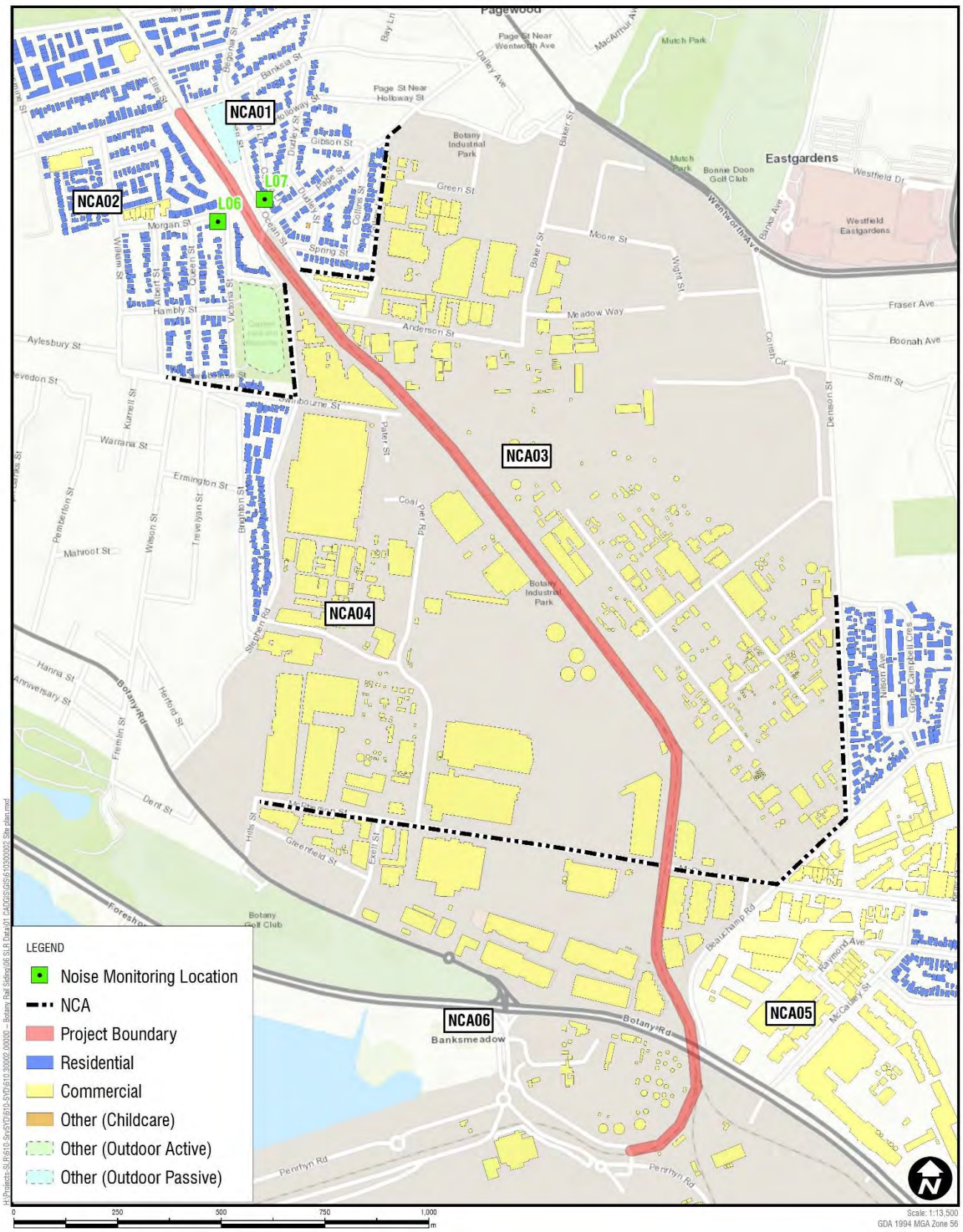
Track and Civil Works

- Finalise the removal of a track connection (and associated equipment) to the existing dis-used siding (Kelloggs Siding)

All works will be wholly contained within the Botany Rail Line rail corridor.

As per Section 8 of the Environmental Protection License (EPL) 3142, these activities are defined as construction activities (erection or installation of new track and ancillary works). In conjunction with these works, there will be some railway maintenance activities.

Figure 1 Site Location, Receivers and Monitoring Locations



1.3 Purpose and Scope of this Report

The purpose of this report is to assess the potential noise and vibration impacts from the construction and operation of the proposal.

The report:

- Describes the existing environment
- Assesses the impacts of constructing and operating the proposal on the nearby communities and receivers
- Evaluates the potential cumulative impact of the proposal with other major infrastructure projects
- Recommends measures to mitigate the predicted impacts.

1.4 Terminology

The assessment has used specific acoustic terminology and an explanation of common terms is included in **Appendix A**.

This assessment largely uses the same methodology that was used in the *Botany Rail Duplication Technical Report 2 – Noise and Vibration Technical Report Construction and Operation* (SLR, 2019) and corresponding *Submissions Report*.

2 Existing Environment

2.1 Study Area

The Botany Rail Line is located near to the suburbs of Botany, Pagewood, Banksmeadow, Hillsdale and Matraville, and is close to a number of major existing transportation corridors, including Sydney Kingsford Smith Airport which is located to the north-west of the proposal.

Botany Yard consists of approximately 4 km of railway corridor from Banksia Street footbridge at the north to Penrhyn Road access gate in Banksmeadow in the south, with approximate chainage along the Botany Rail Line from 10.000 km to 6.625 km.

Major roads include Southern Cross Drive to the north-west, Foreshore Road to the south-west and Bunnerong Road to the east. The Botany Rail Line is a freight line which connects Port Botany to the Metropolitan Freight Network.

Existing noise levels in the study area are generally dominated by transportation noise, with road, rail and aircraft noise affecting most locations during the daytime. During the evening and night-time ambient noise levels typically decrease due to a reduction in road traffic volumes on the surrounding road network. There is also a curfew on flights at Sydney Airport from 11 pm to 6 am.

The suburbs of Botany and Pagewood have areas of residential receivers which adjoin Botany Yard. Residential receivers in other areas are typically distant from the proposal, with the southern section of the study area being mostly commercial and industrial areas associated with Port Botany.

The assessment has been summarised using six Noise Catchment Areas (NCAs) that reflect the land uses in the study area. These are shown in **Figure 1** and described in **Table 1**.

Table 1 Noise Catchment Areas and Surrounding Land Uses

NCA	Description
NCA01	Located to the east of the rail corridor in Pagewood. This catchment is generally residential with the nearest receivers being adjacent the proposal on Myrtle Street, Banksia Street and Ocean Street.
NCA02	Located to the west of the rail corridor in Botany. This catchment is mainly residential with the nearest receivers being adjacent the proposal on Ellis Street, Morgan Street and Victoria Street.
NCA03	Located to the east of the proposal in Banksmeadow. This catchment is entirely commercial or industrial.
NCA04	Located to the west of the proposal in Banksmeadow. This catchment is entirely commercial or industrial.
NCA05	Located to the south of the proposal in Hillsdale, Matraville and Banksmeadow. This catchment is mostly commercial or industrial, with distant residential receivers in Hillsdale and Matraville.
NCA06	Located to the south-west of the proposal in Banksmeadow. Receivers within 900 m of the rail corridor in this catchment are commercial or industrial uses associated with Port Botany. Some distant residential receivers are located around 950 m west of the proposal near Botany Road.

2.2 Noise and Vibration Sensitive Receivers

Receivers potentially sensitive to noise and vibration have been categorised on the basis of their use, which includes residential dwellings, commercial/industrial buildings, and 'other sensitive' land uses such as childcare centres and outdoor recreation areas. Receiver types are shown in **Figure 1**.

The 'other sensitive' non-residential receivers identified in the study area are detailed in **Table 2**.

Table 2 'Other Sensitive' Receivers (Non-Residential)

NCA	Description	Address	Type
NCA01	Kiddie Cloud Early Learning Centre	1A Dudley Street, Pagewood	Child care
	Gaiarine Gardens	Ocean Street, Pagewood	Outdoor passive
NCA02	Garnet Jackson Reserve	Victoria Street, Botany	Outdoor active

2.3 Existing Noise Surveys and Monitoring Locations

Unattended noise monitoring was completed in the study area in June 2018 as part of the adjoining Botany Rail Duplication project. The measured noise levels have been used to determine the existing noise environment and to set criteria to assess the potential impacts from the proposal.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time periods for the survey period. All equipment carried current National Association of Testing Authorities (NATA) calibration certificates and the calibration was checked before and after each measurement.

The results of the noise monitoring have been processed with reference to the NSW EPA *Noise Policy for Industry* (EPA, 20117) (NPfI) to exclude noise from extraneous events and/or data affected by adverse weather conditions, such as strong wind or rain (measured at Sydney Airport), to establish representative existing noise levels for each NCA.

The noise monitoring locations are shown in **Figure 1** and the results are summarised in **Table 3**. Details of each monitoring location together with graphs of the measured daily noise levels are in **Appendix B**.

Table 3 Summary of Unattended Noise Logging Results

ID	Address	Measured Noise Level (dBA)[1]					
		Background Noise (RBL)			Average Noise Level (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L06	13 Morgan Street, Botany	39	39 (41 actual)[2]	37	56	53	51
L07	38 Ocean Street, Pagewood	46	46	43	58	54	54

Note 1: Daytime is 7.00 am to 6.00 pm, evening is 6.00 pm to 10.00 pm and night-time is 10.00 pm to 7.00 am.

Note 2: The monitored evening level was found to be higher than the daytime, therefore the NPfI requires that the evening level be reduced to match the daytime level.

2.4 Attended Noise Measurements

Short-term attended noise monitoring was completed at each monitoring location. The attended measurements allow the contributions of the various noise sources at each location to be determined. Detailed observations from the attended measurements are provided in **Appendix B**.

The attended measurements were generally found to be consistent with the results of the unattended noise monitoring and show that existing noise levels are typically dominated by transportation sources including road, rail and air noise, depending on location and time of day.

3 Policy Context

This section summarises the guidelines and/or policies referred to in the assessment.

3.1 Relevant Policies and Guidelines

3.1.1 Construction Noise and Vibration Guidelines

The guidelines used to assess construction impacts from the proposal are listed in **Table 4**. The guidelines aim to protect the community and environment from excessive adverse noise and vibration impacts as projects are constructed.

Table 4 Construction Noise and Vibration Guidelines

Guideline/Policy Name	Where Guideline Used
Interim Construction Noise Guideline (DECC, 2009) (ICNG)	Assessment of airborne noise and ground-borne noise impacts on sensitive receivers
Assessing Vibration: a technical guideline (DEC, 2006)	Assessment of vibration impacts on sensitive receivers
Road Noise Policy (DECCW, 2011) (RNP)	Assessment of construction traffic impacts
BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2, BSI, 1993	Assessment of vibration impacts (structural damage) to non-heritage sensitive structures
DIN 4150:Part 3-2016 Structural vibration – Effects of vibration on structures, Deutsches Institute fur Normung, 1999	Screening assessment of vibration impacts (structural damage) to heritage sensitive structures, where the structure is found to be unsound

3.1.1.1 Interim Construction Noise Guideline

The NSW *Interim Construction Noise Guideline* (DECC, 2009) (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

Table 5 ICNG NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises 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 (HNA) 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 restructuring 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 for works near schools 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 Standard Construction Hours	RBL + 5 dB	• 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. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

Works are recommended to be completed during Standard Construction Hours where possible. More stringent requirements are placed on works that are required to be completed outside of Standard Construction Hours (ie during the evening or night-time) which reflects the greater sensitivity of communities to noise impacts during these periods.

Sleep Disturbance

Infrastructure projects in urban areas often require certain works to be completed during the night-time due to a range of constraints. Where night works are located close to residential receivers there is potential for sleep disturbance.

The ICNG lists five categories of works that might be undertaken outside of Standard Construction Hours:

- The **delivery of oversized equipment or structures** that require special arrangements to transport on public roads
- **Emergency work** to avoid the loss of life or damage to property, or to prevent environmental harm

- **Maintenance and repair of public infrastructure** where disruption to essential services or considerations of worker safety do not allow work within standard hours
- **Public infrastructure works** that shorten the length of the project and are supported by the affected community
- Works where a proponent demonstrates and justifies **a need to operate outside the recommended standard hours**.

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed.

A method for assessing sleep disturbance is contained in the NPfI. Although the NPfI sleep disturbance criteria relates to industrial noise, they are considered relevant for reviewing potential impacts from construction noise. The NPfI defines external sleep disturbance criteria as being:

- 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is the greater.

For this assessment, the existing background level plus 15 dB approach has been used. As per the NPfI, the assessment should consider several factors contributing to sleep disturbance including the number of times the criterion is exceeded, the distribution of high noise events across the night-time period and early-morning shoulder periods.

Summary of Residential NMLs

The residential NMLs for the proposal are determined using the results from the unattended ambient noise monitoring (see **Section 2.3**) and are shown in **Table 6**.

Table 6 Residential Receiver Construction Noise Management Levels

NCA	Representative Background Monitoring Location	NML ($L_{Aeq(15minute)}$ – dBA)				Sleep Disturbance Screening Criteria (RBL +15 dB)
		Standard Construction (RBL +10 dB)	Out of Hours (RBL +5 dB)			
		Daytime	Daytime[1]	Evening	Night-time	
NCA01	L07	56	51	51	48	58
NCA02	L06	49	44	44	42	52
NCA03[2]	-	-	-	-	-	-
NCA04	L06	49	44	44	42	52
NCA05	L06	49	44	44	42	52
NCA06[2]	-	-	-	-	-	-

Note 1: Daytime out of hours is 7am to 8am and 1pm to 6pm on Saturday, and 8am to 6pm on Sunday and public holidays.

Note 2: NCA has no residential receivers within 600 m of the proposal.

Other Sensitive Land Uses and Commercial Receivers

A number of non-residential land uses have been identified in the study area and some of these 'other sensitive' uses are considered sensitive to potential noise impacts. The ICNG NMLs for 'other sensitive' receivers are shown in **Table 7**.

Table 7 ICNG NMLs for Other Sensitive Receivers

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (Applied when the property is in use)
Classrooms at schools and other education institutions	Internal noise level 45 dBA[1]
Hospital wards and operating theatres	Internal noise level 45 dBA[1]
Places of Worship	Internal noise level 45 dBA[1]
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion)	External noise level 60 dBA
Community centres	Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses
Commercial	External noise level 70 dBA

Note 1: The criteria is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation. Hospital wards are assumed to have fixed windows with 20 dB higher external levels.

3.1.1.2 Construction Ground-borne Noise Guidelines

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. Vibration can be transmitted through the ground and into the structure of nearby buildings, which can then create audible noise impacts inside the building. The ICNG provides evening and night-time ground-borne noise NMLs for residences to protect the amenity and sleep of residents. The internal ground-borne noise NMLs are:

- Evening $L_{Aeq(15minute)}$ 40 dBA
- Night-time $L_{Aeq(15minute)}$ 35 dBA

The NMLs only apply where internal ground-borne noise levels are higher than noise transmitted through the air. This situation can occur where buildings near to construction works have high performing facades which attenuate the airborne component, or where sensitive internal areas do not have facades which face the construction works.

For this project, the majority of receivers are likely to be sufficiently distant from the works for ground-borne noise impacts to be minimal.

3.1.1.3 Construction Vibration Guidelines

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

The criteria for these categories are taken from a number of guidelines and are discussed in the following sections. It is noted that several assessment parameters are used to assess the various vibration impacts.

Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (EPA, 2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort impacts are shown in **Table 8**.

Table 8 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, is located in buildings near to construction works. Criteria for vibration sensitive equipment are discussed in **Section 3.1.1.4**.

Structural and Cosmetic Damage Vibration

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings. The levels of vibration required to cause cosmetic damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. Structural damage vibration limits are contained in British Standard BS 7385 and German Standard DIN 4150.

BS 7385

British Standard BS 7385 recommends vibration limits for transient vibration which are judged to give a minimal risk of vibration induced damage to effected buildings. The limits for residential and industrial buildings are shown in **Table 9**.

Table 9 BS 7385 Transient Vibration Values for Minimal Risk of Damage

Group	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	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

Note 1: Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%.

For heritage buildings, the standard states that *"a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive"*. Assessment of potential impacts to heritage buildings from construction vibration is further discussed below.

DIN 4150

German Standard DIN 4150 also provides guideline vibration limits for different buildings. Damage is not expected to occur where the values are complied with and the values are generally recognised to be conservative. The DIN 4150 values for buildings and structures are shown in **Table 10**.

Table 10 DIN 4150 Guideline Values for Short-term[1] Vibration on Structures

Group	Type of Structure	Guideline Values Vibration Velocity (mm/s)				
		Foundation, All Directions at a Frequency of			Topmost Floor, Horizontal	Floor Slabs, Vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 **and** are of great intrinsic value (eg heritage listed buildings)	3	3 to 8	8 to 10	8	20[2]

Note 1: Short-term is defined in DIN 4150 as vibration that does not occur often enough to cause material fatigue and whose development over time and duration is not suitable for producing a significant increase in vibration due to resonance in the particular structure.

Note 2: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

Heritage Items

Heritage buildings and structures should be considered on a case-by-case basis but as noted in BS 7385 should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive following investigation by a structural engineer, the more stringent DIN 4150 Group 3 guideline values in **Table 10** can be applied.

3.1.1.4 Sensitive Scientific and Medical Equipment

Some scientific equipment, such as electron microscopes and microelectronics manufacturing equipment, can require stringent vibration goals (as set by the manufacturer). Other equipment used for various business requirements as well as medical equipment may also have specific vibration goals. Vibration sensitive equipment is however often housed in rooms specifically designed and constructed for such items.

No receivers likely to have scientific or medical equipment requiring stringent vibration goals have been identified in the study area.

3.1.1.5 Minimum Working Distances for Vibration Intensive Works

Construction vibration has the potential to result in cosmetic damage and human comfort impacts when works are completed near to receivers. Minimum working distances for typical vibration intensive construction equipment are provided **Table 11**.

The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from the NSW *Assessing Vibration: a technical guideline* (DEC, 2006)) and are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 11 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Distance		
		Cosmetic Damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1-2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2-4 tonne)	6 m	13 m	20 m
	<200 kN (4-6 tonne)	12 m	15 m	40 m
	<300 kN (7-13 tonne)	15 m	31 m	100 m
	>300 kN (13-18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	15 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	44 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	5 m	n/a
Jackhammer	Hand held	1 m (nominal)	3 m	Avoid contact with structure

Note: The minimum working distances have been referenced from the Transport for NSW *Construction Noise and Vibration Strategy* (CNVS).

Where works are within the minimum working distances and considered likely to exceed the cosmetic damage objectives, construction works should not proceed unless:

- A different construction method with lower source vibration levels is used, where feasible
- Attended vibration measurements are undertaken at the start of the works to determine the risk of exceeding of the vibration objectives.

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions.

3.1.2 Operational Rail Noise and Vibration Guidelines

The guidelines used for assessing the potential operational rail impacts from the proposal are listed in **Table 12**. The guidelines aim to protect the community and environment from excessive noise and vibration impacts from the long-term operation of the proposal.

Table 12 Operational Rail Noise and Vibration Guidelines

Guideline/Policy Name	When Guideline is Used
Rail Infrastructure Noise Guideline (EPA, 2013) (RING)	Assessment of operational airborne and ground-borne noise impacts on sensitive receivers.
Noise Prediction and Mitigation Guideline (ARTC, 2018)	Provides guidance on the assessment and design of mitigation for ARTC rail projects. This is an ARTC internal document that forms part of the ARTC Environmental Management System.
Assessing Vibration: a technical guideline (DEC, 2006)	Assessment of vibration impacts on sensitive receivers.
AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors	Provides recommended design sound levels for internal areas of occupied spaces.

3.1.2.1 Airborne Noise – Rail Infrastructure Noise Guideline

The NSW *Rail Infrastructure Noise Guideline* (EPA, 2013) (RING) is used to assess and manage potential airborne noise impact from new and redeveloped railway projects. The guideline provides non-mandatory 'trigger levels' for residential and other sensitive land uses.

Where a project results in rail noise levels which are predicted to be above the trigger levels, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

The RING uses the following scenarios to assess the impacts from rail projects:

- **'Without project'** – the scenario used to predict noise levels if the project were not to go ahead
- '**With project**' – the scenario used to predict noise levels with the project.

The difference between the 'Without project' and the 'With project' noise levels is used to determine the noise level increase from the project.

Residential Receivers

The proposal is a redevelopment of an existing rail line and the relevant airborne noise trigger levels for residential receivers are shown in **Table 13**.

Table 13 RING Airborne Rail Noise Trigger Levels for Residential Receivers

Sensitive Land Use	Noise Trigger Level (dBA)	
	Daytime	Night-time
Residential	Development increases existing $L_{Aeq(period)}$[1] rail noise levels by 2 dB or more, or existing L_{Amax} rail noise levels by 3 dB or more ***and*** predicted rail noise levels exceed:	
	65 $L_{Aeq(15hour)}$ or 85 L_{Amax}[2]	60 $L_{Aeq(9hour)}$ or 85 L_{Amax}[2]

Note 1: $L_{Aeq(period)}$ refers to average noise level in the period. $L_{Aeq(15hour)}$ is the daytime and $L_{Aeq(9hour)}$ is the night-time.

Note 2: L_{Amax} refers to the maximum noise level not exceeded for 95% of rail pass-by events.

The L_{Aeq} noise trigger levels are lower for the night-time due to the greater sensitivity of communities to noise impacts during this period.

The RING requires noise to be assessed at project opening and for a future design year which is representative of the design capacity for the project and is typically ten years after opening. For this proposal, the opening year is 2024 and the design year is 2034.

Other Sensitive Land Uses

A number of 'other sensitive' non-residential land uses have been identified in the study area. The noise trigger levels for these receivers are shown in **Table 14**. The RING does not consider commercial and industrial receivers as being sensitive to operational airborne rail noise impacts.

Table 14 RING Airborne Rail Noise Trigger Levels for Other Sensitive Receivers

Sensitive Land Use	Noise Trigger Level (dBA) (when in use)
Schools, educational institutions and child care centres	45 $L_{Aeq(1hour)}$ Internal[1]
Open space – passive use (eg parkland, bush reserves)	65 $L_{Aeq(15hour)}$
Open space – active use (eg sports field, golf course)	65 $L_{Aeq(15hour)}$

Note 1: The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

3.1.3 Operational Ground-borne Noise and Vibration Guidelines

3.1.3.1 Ground-borne Noise

Ground-borne vibration from passing trains can cause perceptible vibration impacts to occupants of nearby buildings. Ground-borne vibration can also result in audible impacts inside buildings in the form of a low frequency rumble if the vibration is sufficient to cause floors or walls of the structure to vibrate. The integrity of building structures is unlikely to be comprised by passing trains.

The RING provides operational ground-borne noise and vibration criteria for rail infrastructure projects which apply only where internal ground-borne noise levels are higher than noise transmitted through the air. The ground-borne noise trigger levels for residential and 'other sensitive' receivers are shown in **Table 15**.

Table 15 RING Ground-borne Noise Trigger Levels

Sensitive Land Use	Time of Day	Internal Noise Trigger Level (dBA)
		Development increases existing rail noise levels by 3 dBA or more ***and*** resulting rail noise levels exceed:
Residential	Day (7am to 10pm)	40 L_{ASmax}
	Night (10pm to 7am)	35 L_{ASmax}
Schools, educational institutions, places of worship	When in use	40 - 45 L_{ASmax}

3.1.3.2 Ground-borne Vibration

People can perceive floor vibration at levels well below those likely to cause damage to buildings or their contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

The RING refers to the EPA's *Assessing Vibration: a technical guideline* (EPA, 2006) for vibration criteria for rail projects, which are sources of intermittent vibration. The 'preferred' and 'maximum' VDVs for human comfort are shown in **Table 16**.

Table 16 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

The guideline states *"activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum range may be used if they can be justified"*.

4 Methodology

This section describes the methodology used to undertake the noise and vibration assessment for the proposal.

4.1 Construction Airborne Noise Assessment Methodology

A noise model of the study area has been used to predict noise levels from the proposed construction works to all surrounding receivers. The model uses ISO 9613 algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

4.1.1 Works Description

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the proposal. These scenarios are shown in **Table 17** together with a high-level description of each works activity. The locations of the various work scenarios are shown in **Figure 2**.

The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that is likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

Key scenarios have been categorised into 'Peak' and 'Typical' works. The 'Peak' works represent the noisiest stage of the works and can require noise intensive equipment, such as concrete saws. While 'Peak' works would be required at certain times, the highest noise impact works would only last for relatively short periods of the overall works duration. The 'Typical' works represent typical noise emissions from the proposal when noise intensive equipment is not in use.

The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

Construction works would not occur continuously at each site and it is expected that there would be relatively long periods where construction noise levels are much lower than the realistic worst-case levels presented in this assessment. There would also be times when works are not audible at receivers due to less noisy items of equipment being used or when works move along the rail corridor (ie towards the south which is further from residential receivers in NCA01 and NCA02).

Table 17 Construction Scenario Descriptions

ID	Scenario	Description
01	Site Establishment	Site establishment would be undertaken prior to construction, outside of weekend possessions, and would include the setup of the four compound areas (site office, toilet etc). Other activities would include establishing environmental controls including erosion and sediment controls, signage and fencing and stockpiling of rail infrastructure. These works generally have no requirement for noise intensive equipment, however, they are required to be completed relatively close to residential receivers, particularly at the Banksia Street Compound.

ID	Scenario	Description
02	Compound Operation	The four proposed compound sites are: - Banksia Street compound (also being utilised for Botany Rail Duplication) - McPherson Street compound - Swinbourne Street compound - Botany Road compound. Operation of the compounds would last throughout construction and would include deliveries, storage of equipment and materials, and typical worker activities. Compound operation generally has no requirement for noise intensive equipment.
03	Trackworks - Peak	Track works would include: - Removal of redundant ARTC rail infrastructure associated with the track connection to the Kelloggs siding (during and outside of possession) involving: - Cutting of existing dis-used track into smaller portions - Removal of dis-used track using lifting equipment - Removal of old sleepers. - Motorising of existing manual points at the Gelco siding involving; - Transportation of new motorised points prior to weekend possession and storage at an appropriate location (ancillary site) - Removal of existing points mechanism, turnout renewal, minor track work and lifting of new motorised points machine into position and commissioning. These works would require noise intensive equipment such as concrete/rail saws and a ballast tamper at certain stages of the works.
04	Trackworks - Typical	
05	Signal Works - Peak	Signal works would be undertaken outside of weekend possessions, including: - Removal and installation of signalling equipment: - Installation of Signalling Equipment Room foundations and Signal foundations outside the danger zone with excavator - Installation of prefabricated sandwich panel Signalling Equipment Rooms with crane. - Enabling/reconfiguration of equipment within Signalling Equipment Room (hand tools and light vehicles) - Cable installation in existing and new Combined Services Route - Signal equipment removal – decommissioning of signal equipment, physical removal of signal assets by use of an excavator, and concrete breaker for foundations. - Install pre-fabricated concrete signal bases and signals at designated locations. - New cable routes to be installed to enable new signal infrastructure: - Survey mark out of new Signal route to be installed - Excavation of trench (approx. 1 m deep) - Lay plastic PVC conduits in place (housing for new signal cables) - Install pre-fabricated concrete pits at designated locations, connecting the PVC conduits - Backfill the trenches with approved materials - Minor drainage works to accommodate signal infrastructure. These works are required across the full project area. They generally have no requirement for noise intensive equipment.
06	Signal Works - Typical	

ID	Scenario	Description
07	Site Rehabilitation/ De-commissioning	Decommission works are required after the main construction works are complete and could include: - Removal of fencing, waste and environmental controls - Site rehabilitation - Removal of site amenities.

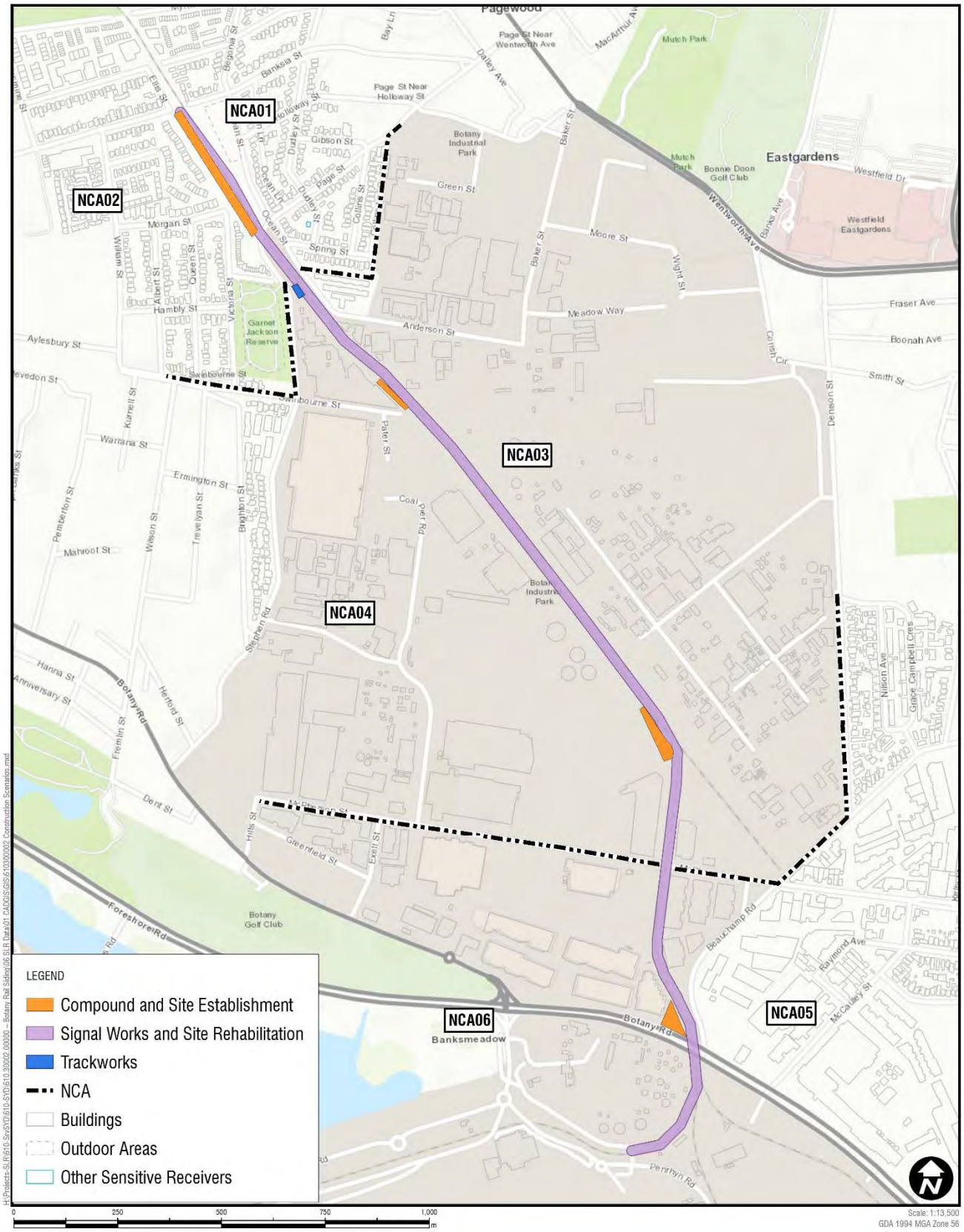
Note: Equipment lists for each scenario and sound power level data are provided in **Appendix C**.

The assessment in **Section 5** presents a summary of the predicted impacts from the above construction scenarios. To gain an understanding of the potential impacts from the proposal, detailed results are also provided for:

- The scenario with the predicted **worst-case impacts** (ie the highest noise levels, effecting many receivers)
- The scenario with the **longest duration**.

The assessment presents the impacts from the various construction scenarios assuming works are occurring at all locations at the same time. In reality, works would occur at discreet locations before moving on to the next area, which would limit the extent of impacts to nearby receivers.

Figure 2 Construction Works Locations



4.1.1.1 Working Hours

Construction of the proposal would be carried out during Standard Construction Hours where possible. Standard Construction Hours are defined in the ICNG and shown in **Table 18**.

Table 18 Standard Construction Hours

Hour commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday																								
Tuesday																								
Wednesday									Standard										OOH[3]					
Thursday	OOH								Construction Hours[2]										Period 1					
Friday	Period 2																		Evening					
Saturday																								
Sunday									OOH[3] Period 1										OOH[3]					
Public Holiday									Day										Period 2					

Note 1: Taken from the TfNSW *Construction Noise and Vibration Strategy*.

Note 2: Standard Construction Hours are Monday to Friday 7 am to 6 pm and Saturdays from 8 am to 1 pm, as defined in the ICNG.

Note 3: OOH = Out of Hours (ie not during Standard Construction Hours).

However, the proposal specific constraints mean evening and night-time work would be required at certain times to minimise impacts on road and rail traffic, and for safety reasons. Works outside of Standard Construction Hours would include:

- Delivery of materials and equipment required by authorities for safety reasons.
- Track and civil works, and civil signalling works (eg CSR installation) would need to be undertaken during periods when trains are not operating. These works are planned to be undertaken across six weekend possession periods across the construction period. Works may also be undertaken during controlled signal blocks (CSBs), which typically occur during low demand periods eg early mornings. These works must be undertaken when trains are not operating to protect workers and infrastructure.
- During Standard Construction Hours it is estimated that only one crew would be operating (5-10 workers), with minimal equipment. During occasional weekend possessions additional crews may be operating, with heavier machinery for track works.

The periods in which the construction works would be required are shown in **Table 19**. At this early stage in the proposal, Out of Hours Works (OOHWs) have been included in the assessment of most construction scenarios as they would likely require periods of works outside of Standard Construction Hours at some point during construction.

The anticipated duration of each activity is also provided in the table, noting that noisy activities would not occur at full capacity for the entire duration and would not be undertaken every day.

Table 19 Construction Scenarios – Working Hours and Indicative Durations

ID	Scenario	Duration	Hours of Works			
			Day	Day OOH[1]	Evening	Night-time
W01	Site Establishment	2 weeks	✓	-	-	-
W02	Compound Operation	36 months standard hours and 6 possessions	✓	✓	✓	✓
W03	Trackworks - Peak	6 possessions	✓	✓	✓	✓
W04	Trackworks - Typical		✓	✓	✓	✓
W05	Signal Works - Peak	6 possessions	✓	✓	✓	✓
W06	Signal Works - Typical		✓	✓	✓	✓
W07	Site Rehabilitation/Decommissioning	2 weeks	✓	-	-	-

Note 1: OOH = out of hours.

Possessions/Closedown Periods Required for Construction

The Botany Rail Line would remain operational during construction of the proposal. ARTC currently schedules routine maintenance possessions on four weekends each calendar year and the shutdowns start at around 2 am on Saturday and end at 2 am on Monday.

Subject to detailed construction planning, these scheduled maintenance possessions would be used to carry out construction works that cannot be done when the line is in operation. Work during possessions would be undertaken on a 24-hour basis continuously for the duration of each possession.

In addition to 48-hour possessions, it is anticipated that other types of worksite protection would be used where the operation of trains on the Botany Rail Line is controlled to allow construction works to progress.

4.1.2 Works Schedule

Subject to planning approval, construction associated with the proposal is expected to start in June 2023, with completion by 2025. The works would take around 36 months to complete.

The construction timeline overlaps with the timeline for the adjacent Botany Rail Duplication project and it is likely works would occur concurrently on both projects at times.

4.2 Construction Vibration Assessment

The works generally have minimal requirement for vibration intensive equipment. Jackhammers may be occasionally used and a ballast tamper would be required for trackworks to the south of Banksia Street.

Jackhammers only result in vibration impacts to localised works area and vibration from ballast tampers would be expected to be consistent with vibration levels from existing rail maintenance activities which are currently performed on the rail line.

As such, the potential vibration impacts from the works are considered low and have not been considered further in this assessment.

4.3 Construction Mitigation

The ICNG acknowledges that due to the nature of construction works it is inevitable that there will be impacts where construction is near to sensitive receivers. There are a number of approaches used on major infrastructure projects to minimise the potential noise and vibration impacts as far as practicable.

The results of the construction noise assessment have been used to determine project specific mitigation measures that should be applied where feasible and reasonable. These are summarised in **Section 8.1**.

4.4 Operational Noise Modelling Methodology

4.4.1 Noise Model

A noise model of the study area that was constructed as part of the Botany Rail Duplication Environmental Impact Statement (EIS) has been used to predict noise levels from the operation of the proposal to all surrounding receivers. The model uses the Nordic Rail Traffic Noise Prediction Method (Kilde 1984) algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the rail corridor and surrounding areas.

The '**Without project**' scenarios use the existing track alignment and existing operational features.

The '**With project**' scenarios use the proposed design of the project which includes all new works and proposed modifications.

Source Noise Levels

The source noise levels used in the modelling have been taken from the NSW rail noise database and are shown in **Table 20**.

Table 20 Source Noise Levels

Train Type	Reference Conditions	Source Noise Level (dBA)[1]	
		L_{AE}[2]	L_{Amax}[3]
Freight wagon rolling noise	1000 m of wagons	88	94
Freight locomotive rolling noise	1 locomotive, 20 m long	88	94
Freight locomotive engine and exhaust noise	1 locomotive, 20 m long	100	90
Freight locomotive idling noise	1 locomotive, 20 m long	70	70

Note 1: Referenced to a train speed of 80 km/h and where rail roughness is in accordance with ISO 3095. The reference measurement location is 15m from the track centre and at a height of 1.5 m above top of rail.

Note 2: Logarithmic average sound exposure level.

Note 3: Represents the maximum noise level not exceeded for 95% of trains.

The source noise levels assume track in good condition and the running surface of the rail head is free of defects. Wheel tread condition is also assumed to be in good to fair condition. The maximum source noise levels are representative of locomotives operating in high notch.

The source noise levels and modelling methodology have been validated against the measured rail noise levels in the study area as part of the Botany Rail Duplication project.

Track Feature Corrections

Impact noise from rail discontinuities such as turnouts, expansion joints or rail defects can increase noise levels from trains and are heard as impulsive noise as each train wheel passes over the discontinuity.

In areas where the track has curves, flanging noise and/or curve squeal is often heard and can increase noise levels at nearby receivers. The noise level corrections used in the modelling of track features are shown in **Table 21**.

Table 21 Track Feature Corrections

Feature	Noise Correction (dB)[1]	
	L_{Aeq}	L_{Amax}
Radius greater than 500m	+0	+0
Radius 400m to 500m	+8	+21
Radius 300m to 400m	+8	+21
Radius less than 300m	+9	+23
Turnouts	+6	+6
Level crossing	+3	+3

Note 1: Corrections taken from the NSW Rail Noise Database and the ARTC *Noise Modelling and Mitigation Guideline.*

The proposal would straight-rail turnouts at the disused Kellogg's Siding near Stephen Road in Botany, removing this impulsive noise generating track feature. The Botany Rail Duplication project is also proposing to remove an existing crossover near the Banksia Street footbridge.

Speed Profile

The existing and future train speeds for the Botany Rail Line were provided by the project team and are limited to 30 km/h in the study area.

Rail Traffic Data

The rail traffic data used in the noise modelling for the year of opening and the 10-year design year is shown in **Table 22**. The data assumes both Botany Yard Bi-Directional Signalling and Botany Rail Duplication occur.

Table 22 Rail Traffic Data

Year	Scenario	Train Movements			
		Daytime		Night-time	
		To Port Botany	From Port Botany	To Port Botany	From Port Botany
2024 At Opening	Without project	24	24	14	14
	With project	24	24	14	14
2034 Future Design	Without project	28	28	17	17
	With project	35	35	21	21

Freight Locomotive Idling

The Botany Yard Bi-Directional Signalling proposal would result in changes to freight locomotive idling in the study area and the assumptions used in the modelling are shown in **Table 23**. The worst-case anticipated train idling events have been used to conservatively predict the potential noise impacts assuming every arrival and departure train idles in Botany Yard.

Table 23 Train Idling Operations

Location	Without Project				Botany Yard Bi-Directional Signalling			
	Daytime		Night-time		Daytime		Night-time	
	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)
Gelco Siding	1	12	1	12	1	2	1	2
Botany Yard Departures	24	30	14	30	24	30	14	30
Botany Yard Arrivals	24	30	14	30	24	30	14	30

Note: Average idling duration specified per idling event.

The proposal is expected to reduce the duration trains are required to idle at the Gelco siding from 12-minutes to two minutes per event. The existing manual operation of Gelco siding requires the train driver to contact the Network Control Centre to allow the points to be manually operated. As a result, trains are currently required to idle in this location as they wait to access the siding. Motorising the points at the Gelco siding would remove this requirement. Arrivals and departures at the Botany Yard are not altered as part of the Botany Yard Bi-Directional Signalling Works proposal.

Freight Wagon Breaking / Bunching / Stretching

Based on the number of idling trains in **Table 23**, noise from braking and wagon bunching and/or stretching is not expected to change as a result of the proposal as the number of trains and corresponding speeds would remain unchanged.

4.4.2 Noise Model Validation

The noise model was validated as part of the Botany Rail Duplication EIS with details available in the *Botany Rail Duplication Technical Report 2 – Noise and Vibration Technical Report Construction and Operation* (SLR, 2019).

4.4.3 Noise Mitigation

The RING provides guidance in managing and controlling impacts from rail noise projects and describes the principles to be applied when reviewing noise mitigation.

Where a project is likely to result in impacts which exceed the identified trigger levels, then feasible and reasonable mitigation should be considered to reduce noise towards the relevant absolute trigger level. The guideline notes that it is not mandatory to achieve the trigger levels, but the assessment should provide justification where they cannot be met.

A noise mitigation measure is feasible if it can be engineered and is practical to build, given project constraints such as safety and maintenance requirements. Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measures.

The RING requires mitigation measures to be considered in the following order of preference:

- Source control – controlling noise and vibration at the point where the noise is generated
- Path control – controlling the transmission of noise and vibration from the source to noise sensitive receivers, such as through the use of noise barriers
- Receiver control – once source and transmission controls are exhausted, mitigation measures at the noise sensitive receivers are to be considered, such as at-property treatments.

4.5 Operational Vibration and Ground-borne Noise Modelling

The proposal does not include any features that are likely to increase rail related ground-borne noise or vibration, such as moving the rail tracks closer to receivers, and the potential impacts have not been considered further in this assessment.

5 Construction Impact Assessment

The potential noise and vibration impacts during construction have been predicted for all identified sensitive receivers in the study area and the impacts are discussed in the following sections. Additional information relating to the construction assessment is provided in **Appendix C**.

The methodology and various inputs to the construction assessment are outlined in **Section 4.1**.

5.1 Overview of Construction Impacts on Residential Receivers

The following summary is based on the predicted noise impacts on the most affected receivers in each NCA and is representative of the worst-case situation where construction equipment is at the closest point to each receiver.

For most works, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only apparent for a relatively short period when noisy equipment is in use nearby

The following assessment shows the predicted noise impacts based on the exceedance of the NML, as per the three categories in **Table 24**. The likely subjective response of people affected by the impacts is also shown in the table, noting that the subjective response would vary and depends on the period in which the impacts occur (ie people are generally less sensitive to impacts during the daytime and more sensitive in the evening and night-time).

Table 24 NML Exceedance Bands and Corresponding Qualitative Response to Impacts

Exceedance of NML	Symbol	Likely Subjective Response
Compliance	·	Barely noticeable
1 to 10 dB	●	Marginal to minor
11 dB to 20 dB	◆	Moderate
>20 dB	■	High

The predicted construction noise impacts are presented for the most affected receiver. Receivers which are further away from the works and/or shielded from view would have substantially lower noise impacts. The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

A summary of the predicted construction noise impacts in each NCA for residential receivers is shown in **Table 25**. Detailed noise level predictions and summaries of the number of receivers predicted to have 'minor', 'moderate' and 'high' impacts in each NCA are provided in **Appendix C**.

Where impacts are predicted, the methods for controlling the impacts through the use of mitigation measures and management techniques are discussed in more detail in **Section 8.1**.

Table 25 Predicted Construction Noise Exceedances – Residential Receivers

Period	ID	Scenario Activity	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06
Daytime	01	Site Establishment	●	■	·	·	·	·
	02	Compound Operation	·	◆	·	·	·	·
	03	Trackworks - Peak	◆	■	·	●	·	·
	04	Trackworks - Typical	·	●	·	·	·	·
	05	Signal Works - Peak	●	◆	·	·	·	·
	06	Signal Works - Typical	·	●	·	·	·	·
	07	Site Rehabilitation/Decommissioning	●	◆	·	·	·	·
Evening	01	Site Establishment	n/a	n/a	n/a	n/a	n/a	n/a
	02	Compound Operation	●	◆	·	·	·	·
	03	Trackworks - Peak	◆	■	·	◆	·	·
	04	Trackworks - Typical	·	●	·	·	·	·
	05	Signal Works - Peak	◆	■	·	●	·	·
	06	Signal Works - Typical	●	◆	·	·	·	·
	07	Site Rehabilitation/Decommissioning	n/a	n/a	n/a	n/a	n/a	n/a
Night-time	01	Site Establishment	n/a	n/a	n/a	n/a	n/a	n/a
	02	Compound Operation	●	■	·	·	·	·
	03	Trackworks - Peak	■	■	·	◆	·	·
	04	Trackworks - Typical	●	●	·	·	·	·
	05	Signal Works - Peak	◆	■	·	●	·	·
	06	Signal Works - Typical	●	◆	·	·	·	·
	07	Site Rehabilitation/Decommissioning	n/a	n/a	n/a	n/a	n/a	n/a
Key to Impacts			● Marginal to minor (1 to 10 dB)		◆ Moderate (11 dB to 20 dB)		■ High (>20 dB)	

Note: Cells with no coloured shape represent noise levels are either compliant or there are no residential receivers in the catchment.

The above assessment for residential receivers shows that:

- The impacts at residential receivers are generally limited to NCA01 and NCA02 due to residential receivers being directly adjacent to the rail corridor in these areas. NCA03, NCA05 and NCA06 either have no residential receivers or they are sufficiently distant for noise levels to be compliant with the criteria.
- Some of the highest noise levels are seen when noise intensive equipment is used, such as during *Trackworks – Peak*, which requires a ballast tamper and concrete saw. These noise intensive works would, however, only be required for relatively short periods and noise levels and impacts during *Trackworks – Typical* that do not require noise intensive equipment are significantly lower.

  It is also noted that *Trackworks* are only required in one location (to the south of Banksia Street Bridge at the Kelloggs siding) meaning the number of affected receivers is relatively small and limited to the receivers surrounding the works.

- During the daytime, 'high' impacts are seen during the noisiest scenarios, including *Site Establishment* and *Trackworks – Peak*, at the most affected receivers in NCA02. 'Moderate' worst-case daytime impacts are seen at the nearest receivers in NCA01, with 'minor' daytime impacts in NCA04 during one scenario.
- During the night-time, 'high' impacts are seen at the nearest receivers in NCA01 and NCA02 during noisy works, with 'moderate' or 'minor' impacts during less noisy works. 'Moderate' worst-case impacts are seen at the closest receivers in NCA04 with compliant noise levels predicted during less noisy works.

5.2 Detailed Construction Noise Impacts – All Receiver Types

The predicted construction noise impacts from each works scenario are provided in assessment tables in **Appendix C** for each NCA. The following sections provide a detailed discussion of the key construction impacts at all receivers which are associated with:

- *Trackworks*, which is the scenario with the predicted **worst-case noise levels** during the night-time
- *Signal Works*, which is the scenario with the **longest duration** and over the largest area.

5.2.1 Worst-case Scenarios

5.2.1.1 Trackworks – All Locations

The highest night-time construction noise levels are predicted during *Trackworks* when noise intensive equipment such as concrete saws or a ballast tamper are in use. The predicted night-time impacts during *Trackworks* are shown in:

- **Figure 3** – *Trackworks – Peak*, when noise intensive equipment is being used as part of these works
- **Figure 4** – *Trackworks – Typical*, when less noisy works are being completed.

Figure 3 Predicted Impacts *Trackworks – Peak* (Night-time)

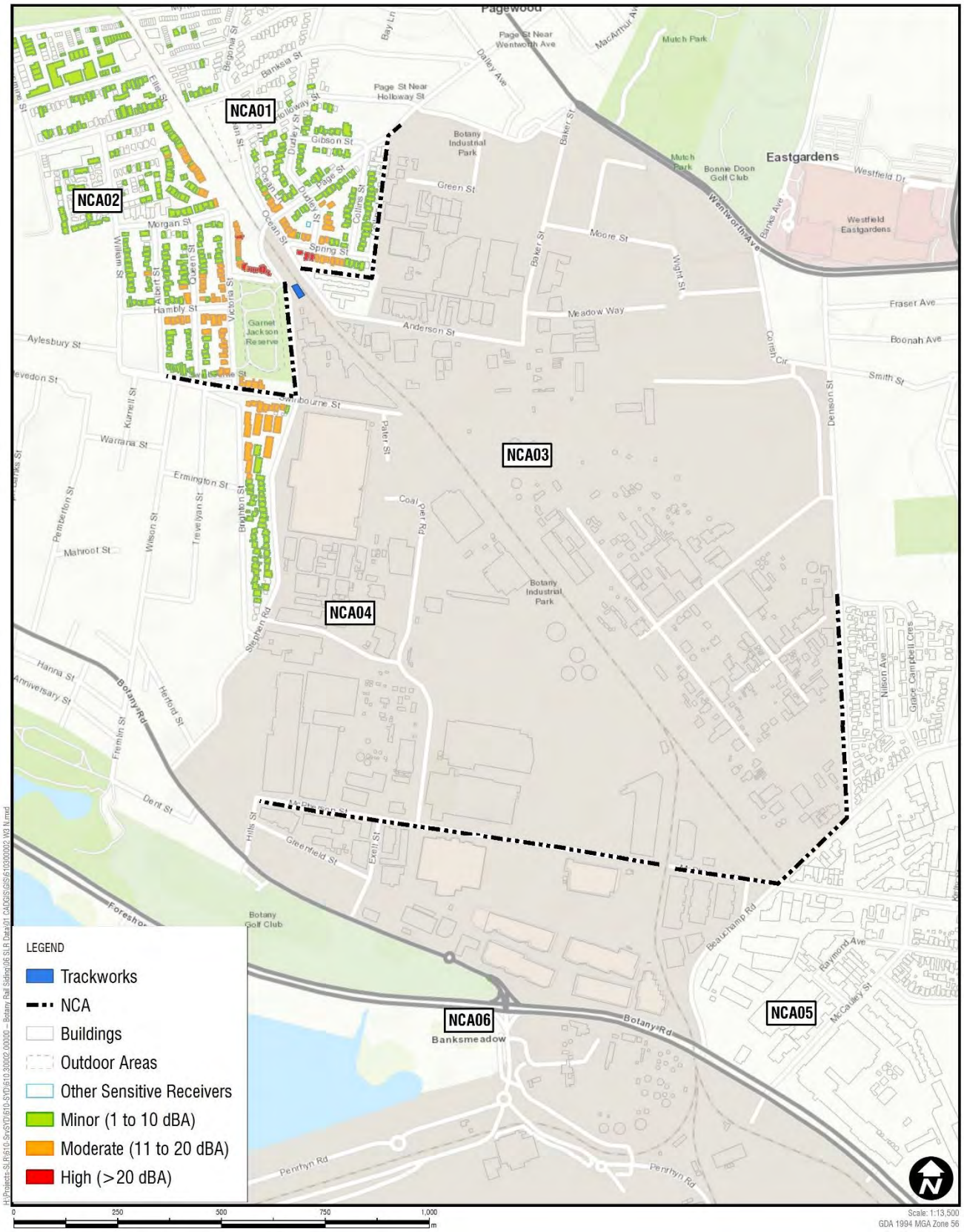
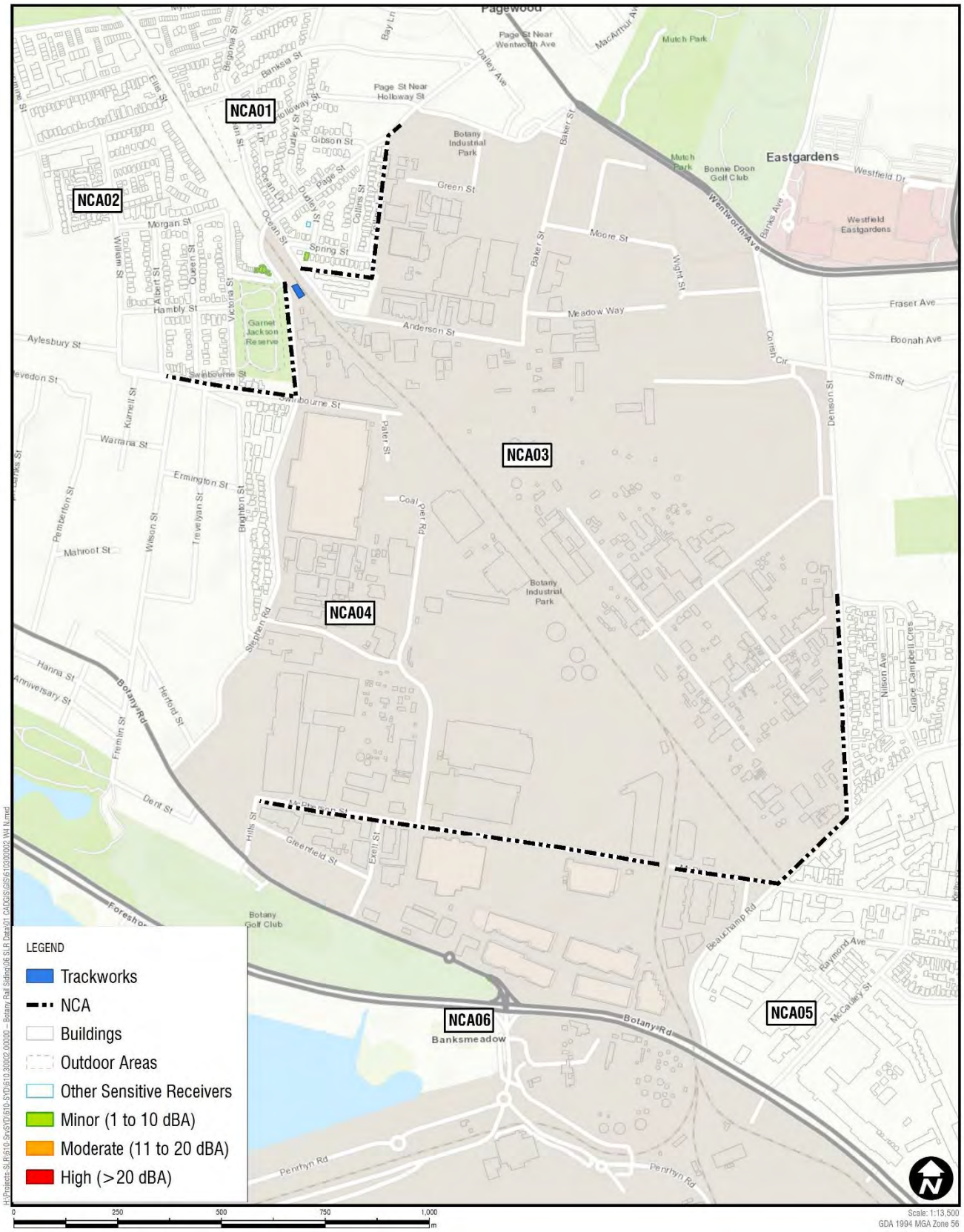


Figure 4 Predicted Impacts *Trackworks – Typical* (Night-time)



The above assessment shows that during the use of noise intensive equipment in *Trackworks – Peak* (see **Figure 3**), 'high' impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Moderate' or 'minor' impacts are predicted at receivers which are further away from the works. The worst-case impacts would, however, only occur when the noisiest equipment such as concrete saws or a ballast tamper are in use.

When noise intensive equipment is not being used during *Trackworks – Typical* (see **Figure 4**), the noise levels would be lower and the impacts are substantially reduced. 'Minor' impacts are seen at a small number of the nearest receivers, with receivers beyond predicted to be compliant with the NMLs.

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would frequently be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur.

5.2.2 Longest Duration Scenario

The longest duration works scenario is *Signal Works*. Noisy activities would be required during some stages of the works and could include the use of equipment such as cranes, super suckers or trucks.

The predicted **daytime** impacts during *Signal Works* are shown in:

- **Figure 5** – *Signal Works – Peak*, when noisy works are being completed
- **Figure 6** – *Signal Works – Typical*, when less noisy works are being completed.

The predicted **night-time** impacts during *Signal Works* are shown in:

- **Figure 7** – *Signal Works – Peak*, when noisy works are being completed
- **Figure 8** – *Signal Works – Typical*, when less noisy works are being completed.

Figure 5 Predicted Impacts *Signal Works – Peak* in All Locations (Daytime)

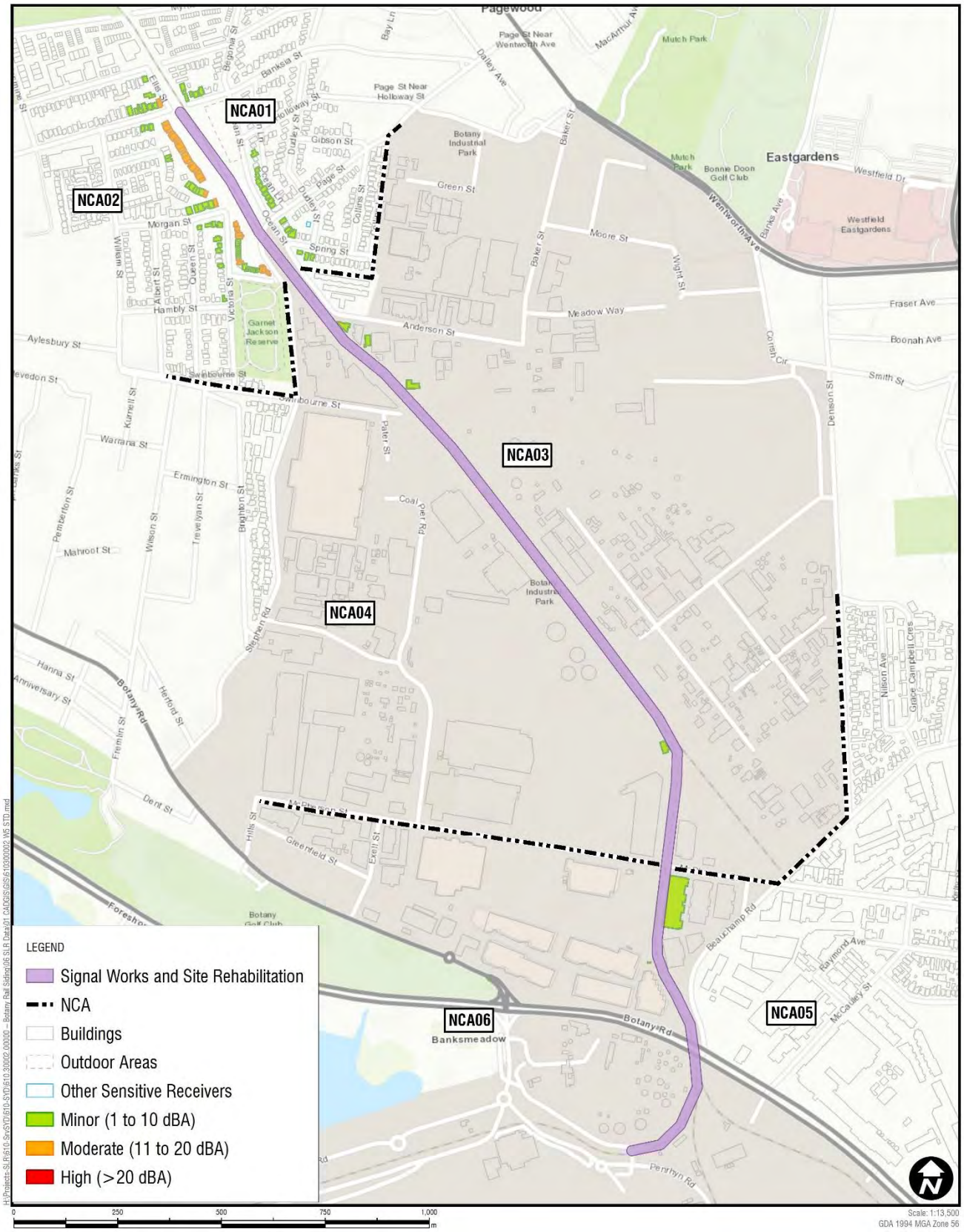


Figure 6 Predicted Impacts *Signal Works – Typical* in All Locations (Daytime)

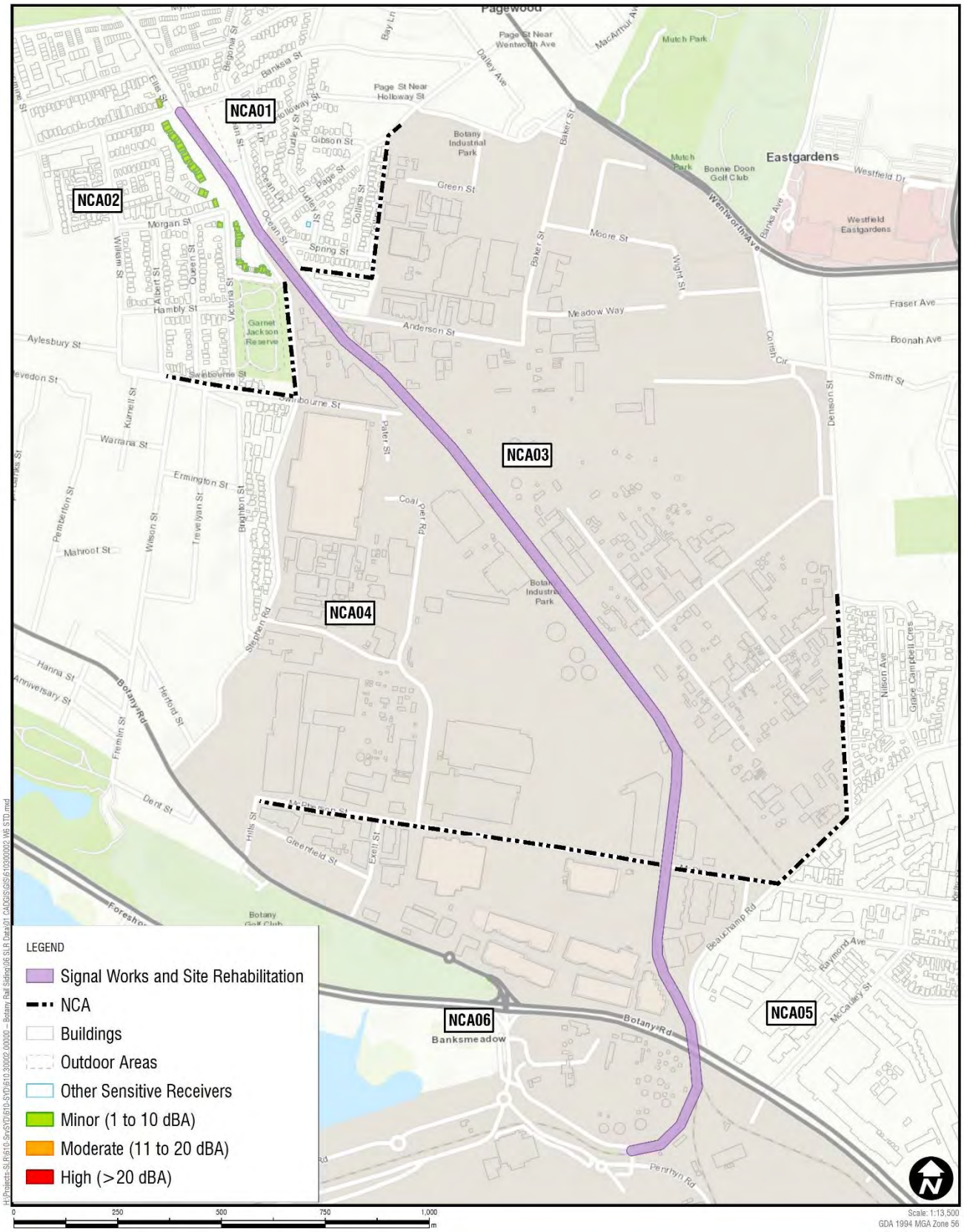


Figure 7 Predicted Impacts *Signal Works – Peak* in All Locations (Night-time)

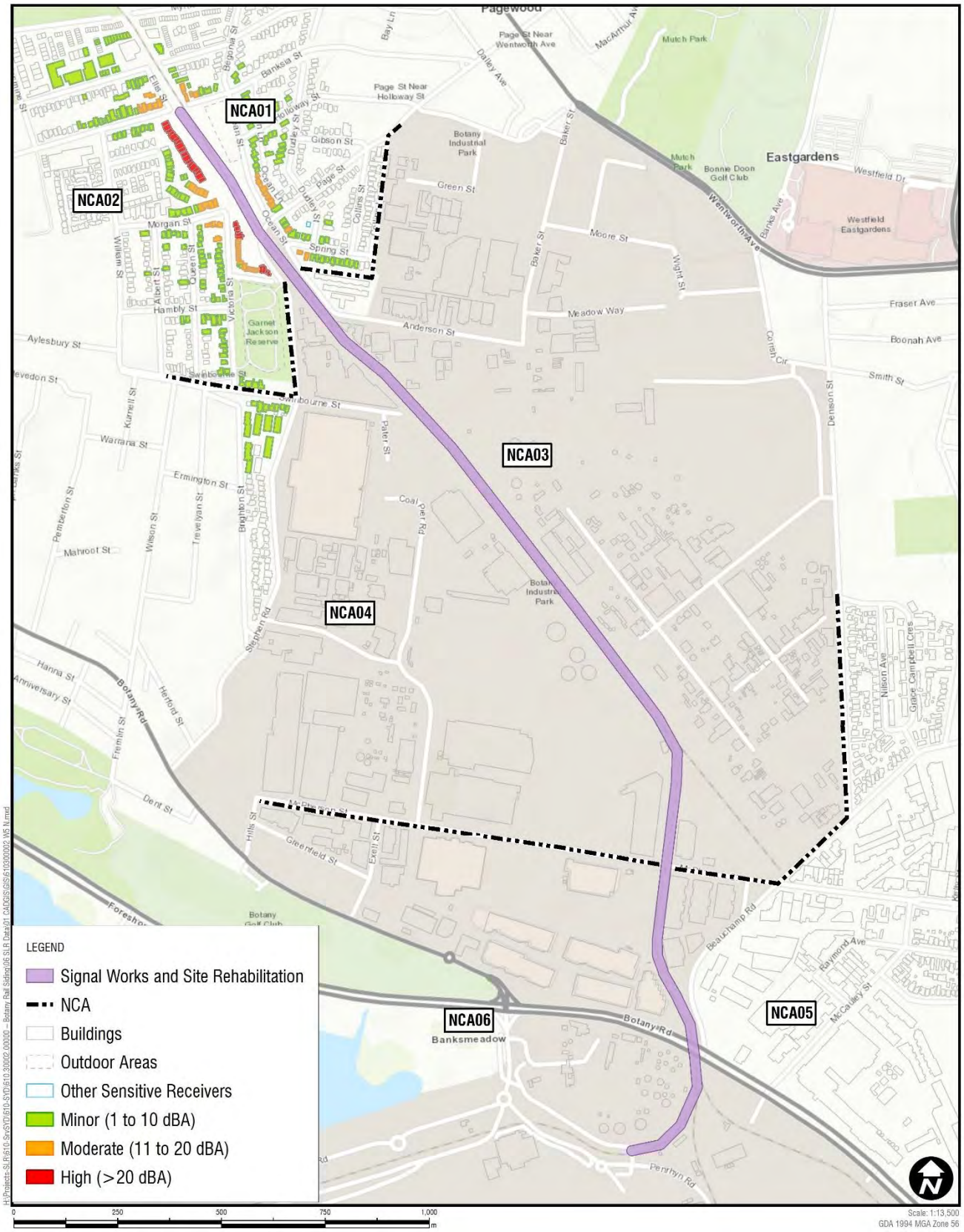
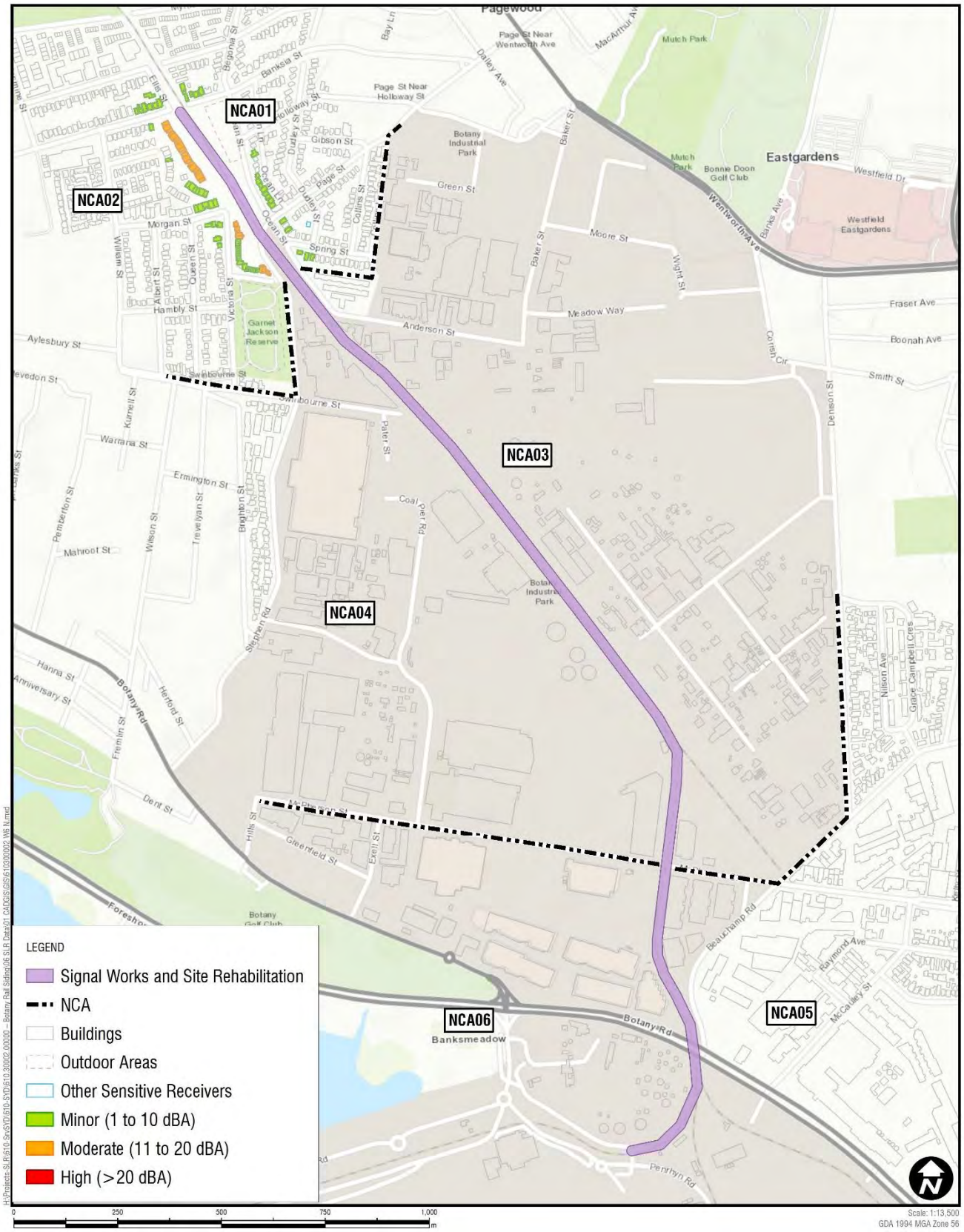


Figure 8 Predicted Impacts *Signal Works – Typical* in All Locations (Night-time)



Daytime

The above assessment shows that during *Signal Works – Peak* (see **Figure 5**), 'moderate' worst-case daytime impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Minor' impacts, or noise levels that are compliant with the NMLs, are predicted at receivers which are further away.

When less noisy equipment is being used during *Signal Works – Typical* (see **Figure 6**), the noise levels would be lower and the daytime impacts are substantially reduced. 'Minor' impacts are seen at receivers adjacent the works in NCA02.

A small number of commercial receivers which are adjacent to the rail corridor in the other NCAs are predicted to have 'minor' worst-case impacts during the daytime.

Night-time

The above assessment shows that during *Signal Works – Peak* (see **Figure 7**), 'high' worst-case night-time impacts are likely at the nearest receivers to the works in NCA01 and NCA02. 'Moderate' or 'minor' impacts are predicted at receivers which are further away.

When less noisy equipment is being used during *Signal Works – Typical* (see **Figure 8**), the noise levels would be lower and the night-time impacts are substantially reduced. 'Moderate' or 'minor' impacts are seen at the nearest receivers in NCA01 and NCA02, with receivers beyond those nearest predicted to be compliant with the NMLs.

Receivers in other parts of the study area are generally predicted to not be impacted by Signal Works, except for some isolated 'minor' impacts at commercial receivers close to the rail corridor.

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would frequently be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur. The impacts would also be lower than predicted when works are occurring in distant parts of the study area or where they are screened from view of the nearest receivers.

5.3 Highly Noise Affected Residential Receivers

Residential receivers that are subject to noise levels of 75 dBA or greater are considered Highly Noise Affected by the ICNG. Receivers can be Highly Noise Affected when noisy works are occurring close to residents.

No receivers are predicted to be Highly Noise Affected during the works in any period.

5.4 'Other Sensitive' and Commercial Receivers

The predicted NML exceedances for 'other sensitive' and commercial receivers are shown in **Figure 9** and in **Table 26**.

Figure 9 Predicted Worst-case Noise Impacts – 'Other Sensitive' and Commercial Receivers

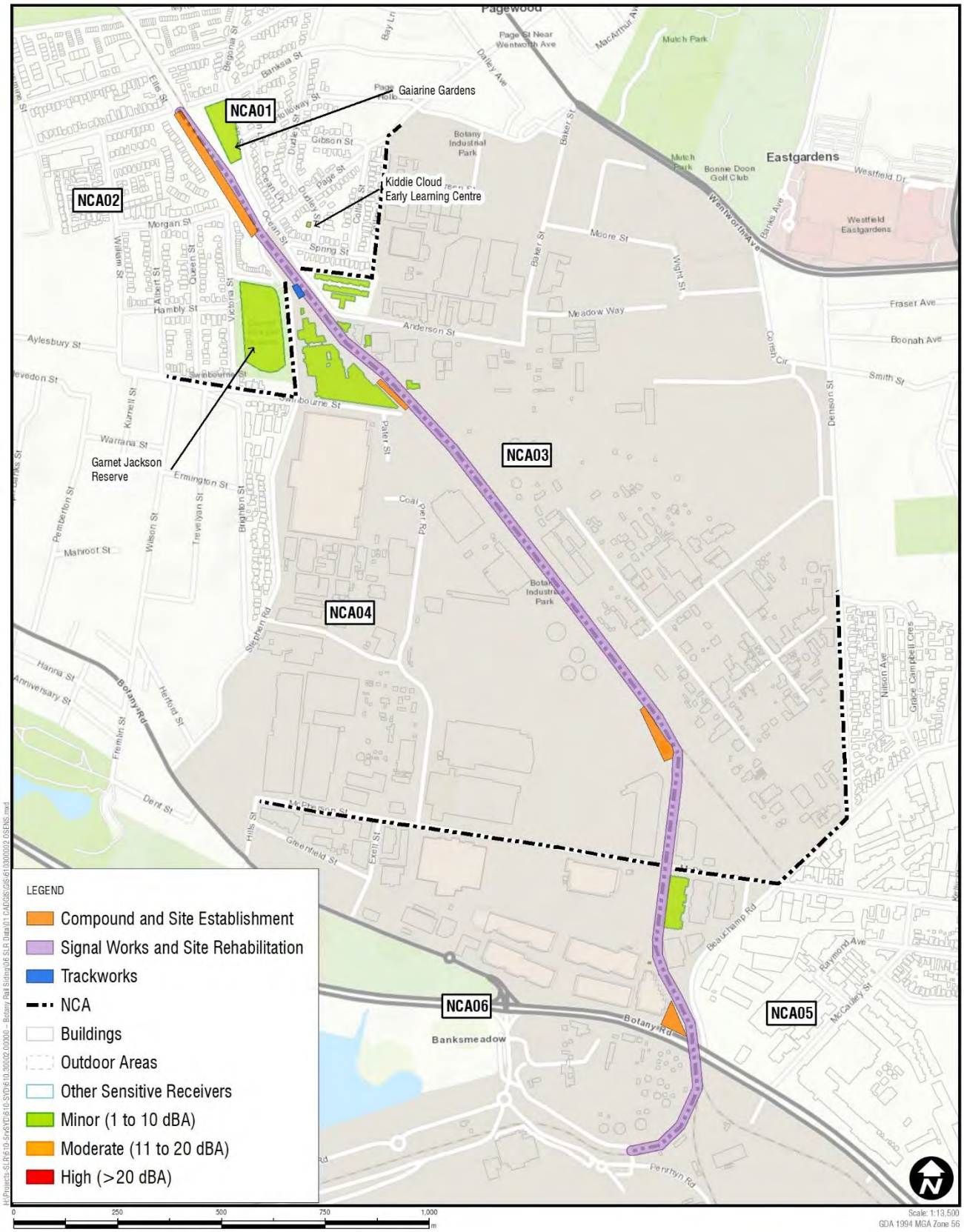


Table 26 Predicted Worst-case Impacts – 'Other Sensitive' Receivers

ID	Scenario Activity	Number of Receivers								
		Kiddie Cloud Early Learning Centre			Garnet Jackson Reserve			Gaiarine Gardens		
		1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	-	-	-	-	-	-	1	-	-
02	Compound Operation	-	-	-	-	-	-	-	-	-
03	Trackworks - Peak	-	1	-	1	-	-	-	-	-
04	Trackworks - Typical	-	-	-	-	-	-	-	-	-
05	Signal Works - Peak	-	-	-	-	-	-	-	-	-
06	Signal Works - Typical	-	-	-	-	-	-	-	-	-
07	Site Rehabilitation/Decommissioning	-	-	-	-	-	-	-	-	-
Key to Impacts	● Marginal to minor (1 to 10 dB)	◆ Moderate (11 dB to 20 dB)			■ High (>20 dB)					

The above assessment shows that:

- 'Moderate' impacts are seen at Kiddie Cloud Early Learning Centre in NCA01 along with 'minor' impacts at Garnet Jackson Reserve during *Trackworks – Peak*. 'Minor' impacts are also seen at Gaiarine Gardens during *Site Establishment*.
- The majority of commercial receivers are predicted to be subject to construction noise levels which comply with the NMLs, however, 'minor' impacts are predicted at some of the nearest commercial receivers to the works when noisy works are nearby.

5.5 Sleep Disturbance

A sleep disturbance screening assessment has been completed for the construction works and is contained in the assessment tables in **Appendix C**. Review of the predictions shows that the sleep disturbance screening criterion is likely to be exceeded when night works are occurring near to residential receivers. The receivers which would potentially be affected by sleep disturbance impacts are generally the same receivers where 'high' night-time impacts have been predicted (see **Section 5.1** and **5.2**).

The requirements for night-time works would be confirmed as the proposal progresses and detailed construction planning information becomes available. Construction mitigation and management measures are discussed further in **Section 8.1**.

5.6 Construction Ground-borne Noise

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. Ground-borne noise impacts should be considered where the ground-borne noise levels are higher than noise transmitted through the air, such as where buildings near to construction works have high performing facades which attenuate the airborne component.

The receivers are sufficiently distant from the works for ground-borne noise impacts to be minimal. Where residential receivers are located near to construction works, airborne noise levels would typically be dominant over the ground-borne component.

5.7 Construction Traffic Noise Assessment

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are on construction vehicle routes.

Construction traffic would access the site via the following roads:

- Banksia Street and Swinbourne Street in NCA01
- Ocean Street in NCA02
- McPherson Street in NCA04
- Penrhyn Road in NCA06.

Existing and proposed construction haulage traffic volumes on these routes are currently unknown. The following qualitative comments are made regarding the potential impacts:

- McPherson Street and Penrhyn Road are routes through commercial areas with low sensitivity to potential changes in road traffic noise due to construction vehicles.
- Banksia Street, Swinbourne Street and Ocean Street, however, have adjacent residential receivers and existing traffic volumes on these roads are likely to be relatively low. Construction traffic using these haulage routes may therefore result in noticeable increases in road traffic noise, especially if they are used during the evening or night-time period.

Mitigation and management measures for construction traffic are discussed in **Section 8.1**.

6 Impacts during Operation

Operational rail noise impacts have been predicted for all identified sensitive receivers in the study area. The operational impacts are discussed in the following sections.

The methodology and various inputs to the operational assessment are outlined in **Section 4.4**.

6.1 Residential Receivers

The predicted rail noise levels at residential receivers are summarised in **Table 27** for the 2024 at-opening and 2034 future design scenarios using the assumptions outlined in **Section 4.4**. The tables show the highest noise levels in each NCA, which is typically at receivers nearest to the alignment. Details on the number of triggered receivers in each NCA is also provided.

The impacts from the proposal are predicted to be greatest in the 2034 future design scenario due to this timeframe generally having more trains than in 2024 at project opening if the Botany Rail Duplication project is approved. Receivers are generally most affected by the proposal in the night-time in 2034 and this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation (if any).

Table 27 Summary of the Botany Yard Bi-Directional Signalling Works Predicted Operational Rail Noise Levels at Residential Receivers in each NCA

NCA	Side	Predicted Noise Level (dBA)[1]												Total Triggers[3]
		Daytime $L_{Aeq(15hour)}$				Night-time $L_{Aeq(9hour)}$				Maximum L_{Amax}[2]				
		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		
		Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	
Criteria[4]		*65*	*65*	*65*	*65*	*60*	*60*	*60*	*60*	*85*	*85*	*85*	*85*	-
NCA01	Up	65	65	65	66	65	65	65	66	94	94	94	94	0
NCA02	Down	66	66	67	68	66	66	67	68	96	96	96	96	0
NCA03[5]	Up	-	-	-	-	-	-	-	-	-	-	-	-	-
NCA04	Down	53	53	54	55	53	53	54	55	78	78	78	78	0
NCA05	Up	42	42	42	43	42	42	42	43	69	69	69	69	0
NCA06	Down	<30	<30	<30	<30	<30	<30	<30	<30	35	35	35	35	0
													TOTAL	0

Note 1: The results are for the receiver with the highest predicted noise level in the controlling 2034 'with project' scenario in each NCA for the daytime, night-time and maximum noise levels. As such the daytime, night-time and maximum results may be for a different receiver in the same NCA. The receiver with the highest predicted 2034 'with project' noise level may not be subject to the largest increase in noise from the proposal in that NCA. The predicted increases are discussed in the following sections.

Note 2: Maximum refers to the L_{Amax} noise level and applies to both the daytime and night-time.

Note 3: Mitigation measures should be investigated for receivers that are predicted to experience noise levels above both the RING absolute and increase trigger levels.

Note 4: RING residential noise trigger level criteria for redeveloped rail projects.

Note 5: NCA does not contain residential receivers.

The results above show the following:

- Existing rail noise levels in the study area are already relatively high in NCA01 and NCA02 where receivers are close to the tracks.
- The proposal is not predicted to substantially increase rail noise levels in the study area for the 2024 '*At-Opening*' scenario. Increases in daytime and night-time noise levels are predicted for residential receivers in NCA06 but the predicted noise levels are far below the background noise level in this NCA and over 55 dB below the RING absolute trigger level.
- Minor increases are predicted at receivers in NCA04, NCA05 and NCA06 for the 2034 '*Design Year*' scenario. Worst-case increases of around 1 dB are predicted for daytime and night-time L_{Aeq} noise levels due a higher volume of trains with the proposal (see **Section 4.4.1**)
- Signalling and track upgrades are predicted to result in a reduction in locomotive idling noise from trains in the Gelco Siding of around 5 dB at receivers in NCA01 and NCA02. This reduction in idling noise levels does not influence the overall rail noise levels for receivers in this region, however, which are controlled by train passby noise.
- No residential receivers are predicted to exceed both the RING absolute and increase trigger levels meaning there is no requirement to consider airborne noise mitigation for residential receivers.

6.2 Other Sensitive Receivers

The predicted noise levels for the identified 'other sensitive' receivers are shown in **Table 28** for the controlling 2034 scenario.

Table 28 Botany Yard Bi-Directional Signalling Works Other Sensitive Receiver Triggers – 2034

NCA	Receiver	Noise Level (dBA)[1]					
		Predicted Level			Change in Noise from Project (With Project minus Without Project)		
		Day	Night	Max	Day	Night	Max
Passive Recreation Areas							
Criteria – Redeveloped[3]		***65***	*n/a*	*n/a*	***2.0***	*n/a*	*n/a*
NCA01	Gaiarine Gardens	67	-	-	-0.9	-	-
Active Recreation Areas							
Criteria – Redeveloped[3]		***65***	*n/a*	*n/a*	***2.0***	*n/a*	*n/a*
NCA02	Garnet Jackson Reserve	64	-	-	-0.6	-	-
Educational							
Criteria – Redeveloped[2,3]		***55***	*n/a*	*n/a*	***2.0***	*n/a*	*n/a*
NCA01	Kiddie Cloud Early Learning Centre	58	-	-	-0.7	-	-

Note 1: The results represent the facade of the receiver with the highest noise level increase.

Note 2: Criteria is the corresponding external level.

Note 3: Criteria is an $L_{Aeq(1hour)}$.

The results above show the following:

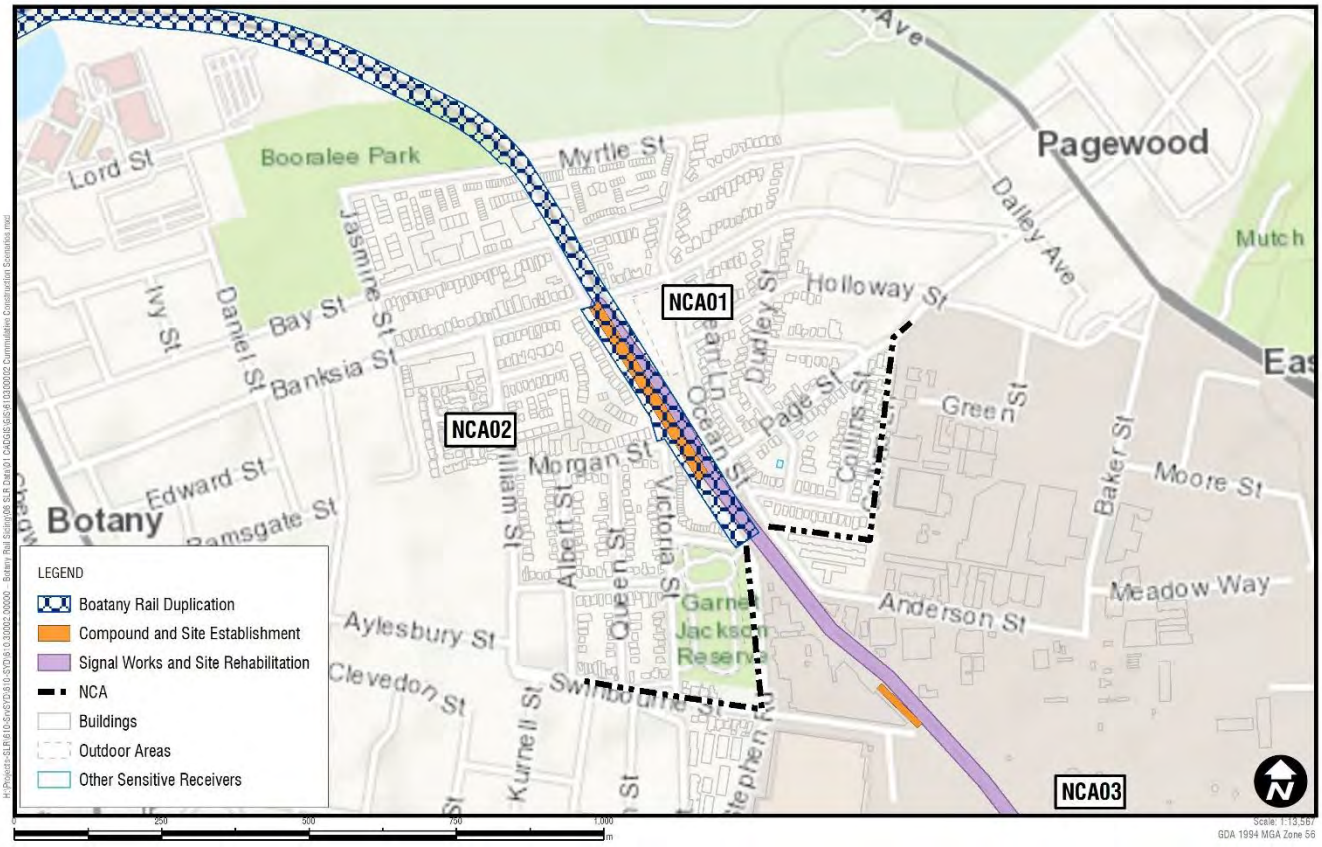
- The proposal is not expected to substantially alter existing rail noise levels at 'other sensitive' receivers.
- Daytime average noise levels are predicted to reduce slightly (by less than 1 dB) which is due to the proposal removing nearby turnouts.
- Freight locomotive idling noise is predicted to be reduced by up to 5 dB for these receivers, however, the overall rail noise levels do not reduce by this amount as noise levels are controlled by train passby noise.
- No 'other sensitive' receivers are predicted to exceed the RING trigger levels and consideration of airborne noise mitigation is not required.

7 Cumulative Impacts

7.1 Cumulative Construction Noise Impacts

Cumulative construction noise impacts can occur where multiple works are being completed near to a particular receiver. The indicative construction program schedules Botany Yard Bi-Directional Signalling Works to occur at the same time at Botany Rail Duplication works. Both project areas are shown in **Figure 10**.

Figure 10 Botany Yard Bi-Directional Signalling Works and Botany Rail Duplication Works



The above shows that the project areas overlap near NCA01 (NCA07 in the Botany Rail Duplication EIS) and NCA02 (NCA08 in the Botany Rail Duplication EIS) meaning cumulative construction noise impacts may occur if construction on both projects is carried at the same time near this area.

7.1.1 Potential Impacts

The Botany Rail Duplication EIS has been referenced to determine the worst-case construction noise impacts from that project. These are shown in **Table 29** together the worst-case impacts from Botany Yard Bi-Directional Signalling Works.

Table 29 Worst-case Predicted Noise Levels from Botany Yard Bi-Directional Signalling & Botany Rail Duplication

ID	Scenario	Activity	Predicted Worst-case Noise Level (dBA)	
			NCA01/NCA07	NCA02/NCA08
Botany Rail Duplication EIS – Predicted Noise Levels				
1a	Enabling Works	Billboard Demolition	<30	<30
1b		Utilities	84	82
1c		Veg. Clearing & Property Adjust.	89	87
2a	Compounds	Establishment	61	74
2b		Operations	50	63
3a	Bridge Works	Demolition (inc. breaker)	50	51
3b		Construction	43	44
4a	Retaining Walls	Construction	42	44
5a	Trackworks	Peak	87	85
5b		Typical	65	63
6a	Signalling (inc. CSR)		74	72
6b	Testing, Commissioning & Finishing		75	73
Botany Yard Bi-Directional Signalling Works – Predicted Noise Levels				
01	Site Establishment		63	74
02	Compound Operation		52	63
03	Trackworks - Peak		70	71
04	Trackworks - Typical		49	50
05	Signal Works - Peak		65	67
06	Signal Works - Typical		56	58
07	Site Rehabilitation/Decommissioning		58	60

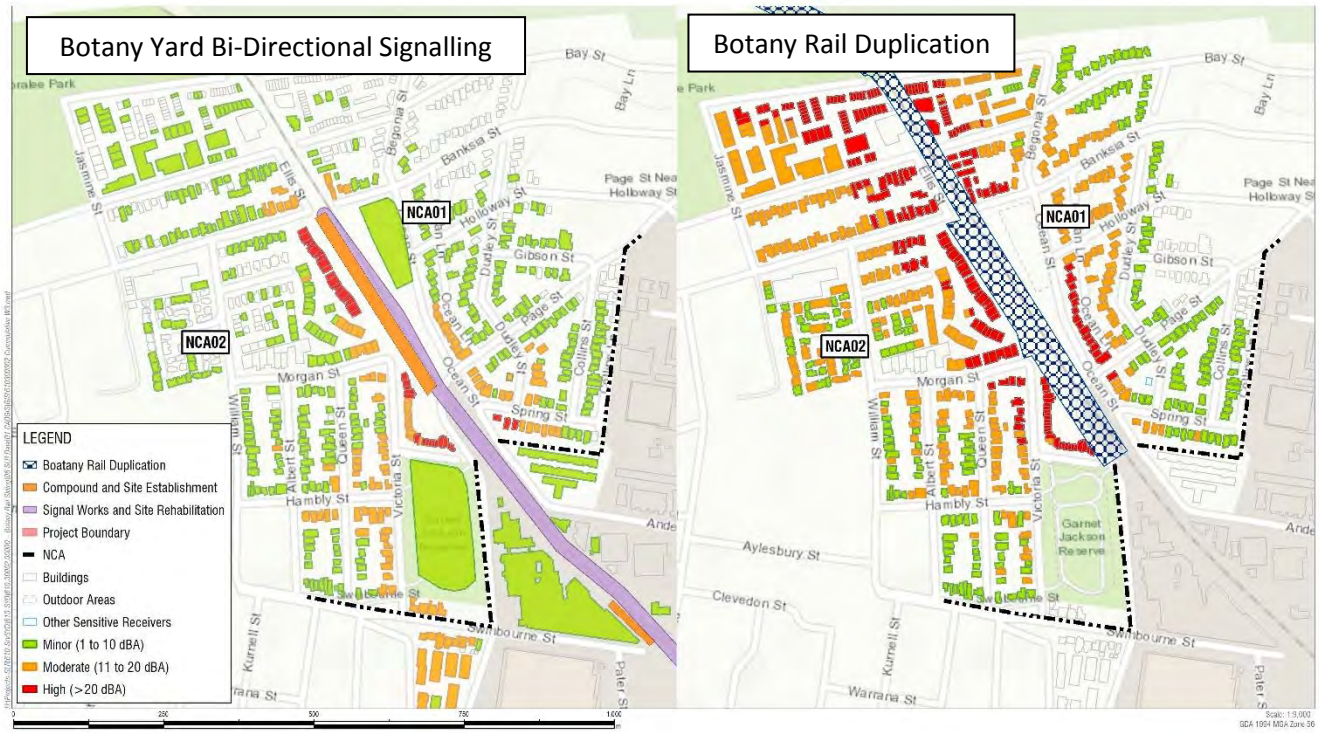
The above shows that:

- Botany Rail Duplication works are expected to result in higher worst-case noise levels and impacts in NCA01 and NCA02 than Botany Yard Bi-Directional Signalling Works. The highest noise levels are seen during *Enabling Works – Vegetation Clearing and Property Adjustment* and *Trackworks – Peak* as part of Botany Rail Duplication, which is due to these works using noise intensive equipment such as concrete saws near to residential receivers in NCA01 and NCA02.
- *Trackworks – Peak* are also required as part of Botany Yard Bi-Directional Signalling Works, however, they are only required in one location (to the south of Banksia Road). This location is not immediately adjacent to residential receivers, meaning noise levels at the nearest receivers are expected to be lower.

- It is also noted that both projects propose to use the same Banksia Street compound and the noise levels predicted from *Compound – Operation* are similar for both sets of works. Residential receivers are located in close proximity to the western boundary of this compound and could be impacted by extended cumulative impacts if the compound is regularly used for a long total duration across both projects.

The worst-case night-time impacts during all construction scenarios from both projects are shown in **Figure 11**. The figure shows that Botany Rail Duplication is generally expected to result in higher noise levels and impacts than Botany Yard Bi-Directional Signalling Works.

Figure 11 Worst-case Impacts from Botany Yard Bi-Directional Signalling and Botany Rail Duplication Works



7.1.2 Summary of Potential Cumulative Impacts

The indicative construction program schedules the Botany Yard Bi-Directional Signalling to occur at the same time as Botany Rail Duplication meaning works would likely happen at the same time on both projects.

The worst-case construction impacts are expected to be controlled by Botany Rail Duplication works as the noisiest scenarios for that project are required to be undertaken closer to the nearest receivers in NCA01 and NCA02.

When less noisy works are being completed by Botany Rail Duplication at the same time and in a similar location as Botany Yard Bi-Directional Signalling Works there is potential for cumulative impacts from concurrent works on both projects. Since the construction scenarios would generally require similar items of equipment, concurrent construction could theoretically increase noise levels in this report by around 3 dB (ie a logarithmic adding of two sources of noise at the same level).

The likelihood of worst-case noise levels being generated by two different works at the same time is, however, considered low and rather than increase construction noise levels, the impact of concurrent works would generally be a potential increase in the duration, and annoyance, of noise impacts on the affected receivers. There is also potential for loss of respite where works occur for consecutive days or nights across both projects.

In practice, construction noise levels in any one location would vary and would be frequently much lower than the worst-case predictions presented in this report due to construction phasing moving works around and in many cases only a few items of equipment being used at any one time.

It is noted that it could be preferred by the affected community for works to occur on both projects at the same time so that the total duration of the works from both projects is reduced.

7.2 Cumulative Operational Impacts

The Botany Yard Bi-Directional Signalling and the Botany Rail Duplication project are expected to be delivered at the same time. There is potential for cumulative operational rail noise impacts from the combined effect of both projects after they are built, particularly from freight locomotive idling characteristics which change as a result of the Botany Rail Duplication project.

7.2.1 Freight Locomotive Idling

The expected changes to freight locomotive idling in the study area from both Botany Yard Bi-Directional Signalling Works and the Botany Rail Duplication are shown in **Table 23**. The worst-case anticipated train idling events have been used in this assessment to conservatively predict the potential noise impacts. This increase in train idling numbers is the result of increased network capacity provided by the Botany Rail Duplication project.

Table 30 Train Idling Operations

Location	Without Project				Botany Yard Bi-Directional Signalling				Botany Rail Duplication			
	Daytime		Night-time		Daytime		Night-time		Daytime		Night-time	
	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)	No. Trains	Idling Duration (mins)
Gelco Siding	1	12	1	12	1	2	1	2	2	2	2	2
Botany Yard Departures	24	30	14	30	24	30	14	30	35	30	21	30
Botany Yard Arrivals	24	30	14	30	24	30	14	30	35	30	21	30

Note: Average idling duration specified per idling event.

The number of trains required to idle in Botany Yard is expected to increase by approximately 50 percent as a result of the Botany Rail Duplication project. Changes to freight locomotive idling are considered mostly likely to influence potential cumulative noise levels.

The increase in the number of idling events associated with the Botany Rail Duplication would likely result in a proportionate increase in the number of wagon breaking, bunching, and stretching noise events. The potential increase in the frequency of these noise events would not, however, affect cumulative noise level impacts because these noise sources are assessed under the RING L_{Amax} noise trigger levels[1].

7.2.2 Predicted Cumulative Impacts

Cumulative operational rail noise impacts from the operation of both the Botany Yard Bi-Directional Signalling and Botany Rail Duplication have been assessed against the requirements of the RING.

The predicted cumulative rail noise levels at residential receivers are summarised in **Table 31** for the 2024 opening year and 2034 future design scenarios using the assumptions outlined in **Section 4.4** and **Section 7.2.1**. The table shows the highest noise levels in each NCA, which is typically at receivers nearest to the alignment. Details on the number of any triggered receivers in each NCA is also provided.

[1] Assessment methodology consistent with the NSW Rail Noise Database and the ARTC Noise Modelling and Mitigation Guideline.

Table 31 Summary of Cumulative Operational Rail Noise Levels at Residential Receivers in each NCA

NCA	Side	Predicted Noise Level (dBA)[1]												Total Triggers[3]
		Daytime $L_{Aeq(15hour)}$				Night-time $L_{Aeq(9hour)}$				Maximum L_{Amax}[2]				
		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		At Opening (2024)		Design Year (2034)		
		Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	
Criteria[4]		*65*	*65*	*65*	*65*	*60*	*60*	*60*	*60*	*85*	*85*	*85*	*85*	-
NCA01	Up	65	65	65	66	65	65	65	66	94	94	94	94	0
NCA02	Down	66	66	67	68	66	66	67	68	96	96	96	96	0
NCA03[5]	Up	-	-	-	-	-	-	-	-	-	-	-	-	-
NCA04	Down	53	54	54	55	53	54	54	55	78	78	78	78	0
NCA05	Up	42	42	42	43	42	42	42	43	69	69	69	69	0
NCA06	Down	<30	<30	<30	<30	<30	<30	<30	<30	35	35	35	35	0
													TOTAL	0

Note 1: The results are for the receiver with the highest predicted noise level in the controlling 2034 'with project' scenario in each NCA for the daytime, night-time and maximum noise levels. As such the daytime, night-time and maximum results may be for a different receiver in the same NCA. The receiver with the highest predicted 2034 'with project' noise level may not be subject to the largest increase in noise from the proposal in that NCA. The predicted increases are discussed in the following sections.

Note 2: Maximum refers to the L_{Amax} noise level and applies to both the daytime and night-time.

Note 3: Mitigation measures should be investigated for receivers that are predicted to experience noise levels above both the RING absolute and increase trigger levels.

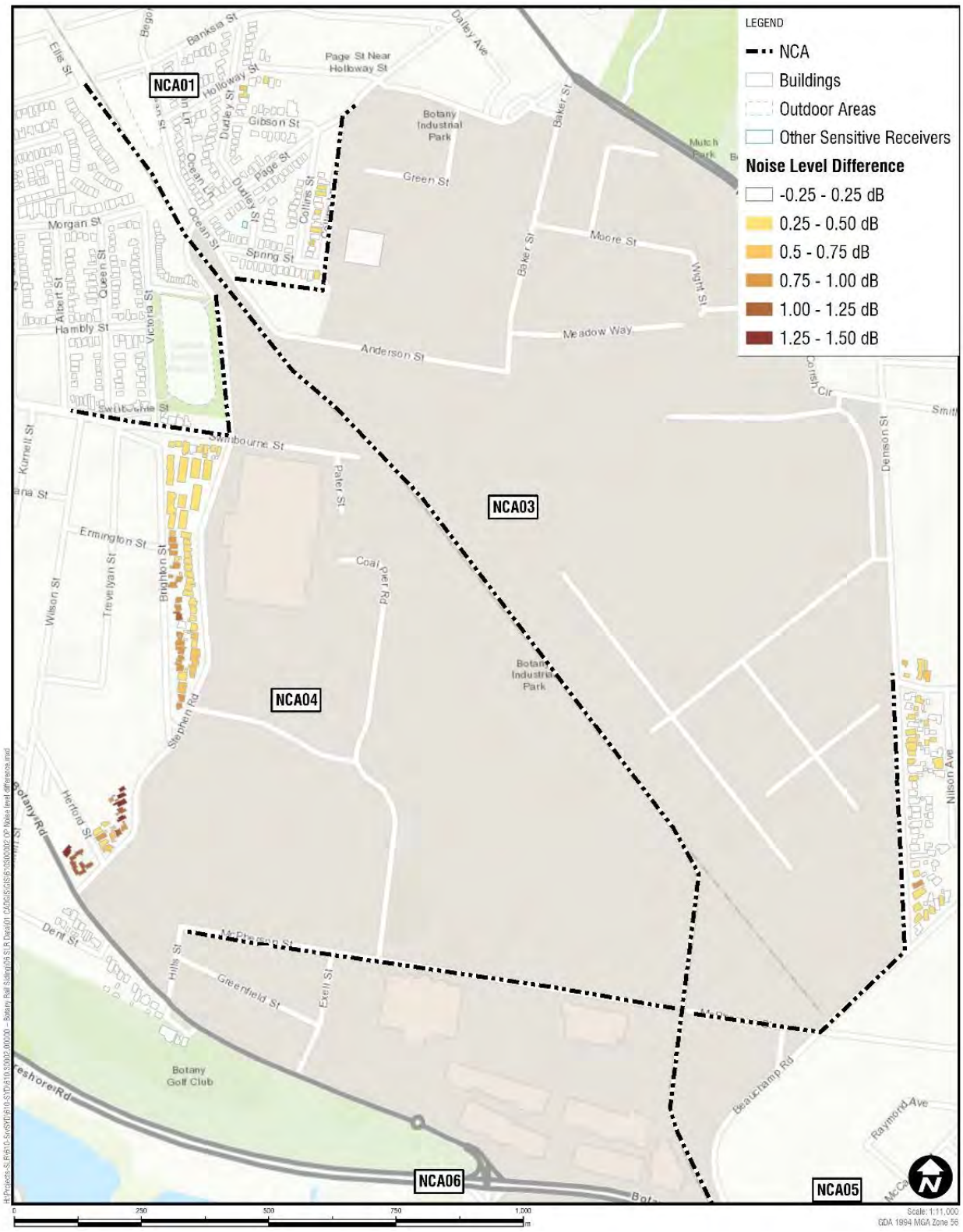
Note 4: RING residential noise trigger level criteria for redeveloped rail projects.

Note 5: NCA does not contain residential receivers.

The above shows cumulative impacts are expected to be largely consistent with the Botany Yard Bi-Directional Signalling predictions in **Table 27**. No residential receivers are predicted to exceed both the RING absolute and increase trigger levels in the cumulative scenario, meaning consideration of airborne noise mitigation for cumulative impacts is not required.

The additional freight locomotives idling in Botany Yard are not predicted to substantially increase the overall rail noise levels at the majority receivers. Minor increases of around 1 dB are predicted for certain distant residential receivers in NCA04 and NCA05 (see **Figure 12**), however, noise levels at these receivers are predicted to be compliant with the RING absolute after the proposal is built. Cumulative noise levels in NCA01 and NCA02 are generally expected to largely be no different to noise levels from Botany Yard Bi-Directional Signalling only.

Figure 12 Difference in Night-time $L_{Aeq(9hour)}$ Overall Noise Levels



8 Management of Impacts

8.1 Approach to Management of Impacts

Mitigation measures for the proposal will be managed through the following:

- Project specific Construction Environmental Management Plan (CEMP) for main construction works
- ARTC's environmental management system for operation of the proposal.

8.2 Approach to Construction Impacts

The ICNG acknowledges that due to the nature of construction works it is inevitable that there will be impacts where construction is near to sensitive receivers. Examples of potential mitigation and management measures which could be applied to the proposal to minimise the impacts are provided below.

Construction impacts would be managed through a Construction Noise and Vibration Management Plan (CNVMP) Sub-Plan as part of the CEMP. This plan would include site specific Construction Noise and Vibration Impact Statements (CNVIS) prepared for all works outside Standard Construction Hours likely to exceed the relevant NMLs, activities likely to result in Highly Noise Affected receivers and/or activities likely to generate vibration levels at receivers in excess of the relevant criteria. These statements provide a detailed assessment of the potential impacts from the work and define the site specific mitigation and management measures to be used to control the impacts, particularly where evening or night-time works are required.

8.2.1 List of Construction Mitigation Measures

The assessment of the construction works predicts that impacts are likely during certain activities in some locations of the proposal where receivers are nearby. On the basis of the predicted impacts, **Table 32** lists the mitigation measures that will be incorporated into the relevant management plans to minimise the impacts from construction of the proposal. Items where further investigation has been recommended in later stages of the proposal are also listed.

Table 32 Construction Mitigation Measures

Item	Discussion and Recommendations
Project Specific Measures	
Construction Noise and Vibration Management Sub-Plan	A CNVMP will be prepared as a sub plan to the CEMP before any construction works begin. This will include: • Identification of nearby sensitive receivers • Description of works, construction equipment and hours of work • Criteria for the proposal and any relevant licence and approval conditions • Any requirements for noise and vibration monitoring • Details of how community consultation and notification would be completed • Procedures for handling complaints • Details on how respite would be applied where ongoing high impacts are seen at certain receivers. The CNVMP will also consider cumulative construction impacts and define a suitable management approach.

Item	Discussion and Recommendations
Noise impacts during out of hours work	Out of hours work would be undertaken in accordance with the requirements of an applicable Environmental Protection Licence (EPL) and/or Conditions of Approval, including any notification procedures.
Construction noise exceedances	The assessment has identified that high impacts are likely when works are close to residential receivers in NCA01 and NCA02, particularly when noise intensive equipment such as concrete saws or ballast tampers are in use during evening and night-time periods. Where noisy works are required near to sensitive receivers in NCA01 and NCA02, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions and restrictions on working hours during these periods are generally not feasible.
Sleep disturbance	The need for consecutive night-time works and likelihood for sleep disturbance impacts will be reviewed during detailed design. Where impacts are considered likely, appropriate noise mitigation will be applied which takes into consideration factors such as the existing facade performance of affected residential receivers. Appropriate respite would be provided to affected receivers to limit impacts from night-time works in the same location, as required by the conditions of approval.
Compounds with long term works	Hoarding, or other shielding structures, will be used where receivers are near to compounds (such as the Banksia Street Compound) or worksites with long term works. To provide effective noise mitigation, the hoarding should break line-of-sight from the nearest receivers to the works, noting that some affected receivers are multi-storey, and be of solid construction with minimal gaps. Hoarding for construction sites is typically around 3 m in height.
Compound layout	Noise generating items in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound.
Compound between Banksia Street and Stephen Road	Noise impacts are predicted for the Banksia Street compound due to the proximity of the nearest receivers. The use of this compound site during out of hours works will be avoided as far as practicable. It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use this compound.
Monitoring	Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the measurements should to confirm their effectiveness.
Construction traffic	Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches: • Vehicle movements will be away from sensitive receivers and during less sensitive times, where possible • The speed of vehicles will be limited and will avoid the use of engine compression brakes • On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times • Restriction of heavy vehicles idling near to residential receivers.
Community preference	In locations where 'moderate' or 'high' impacts are predicted (see **Table 25**), engagement with the affected communities will be undertaken during detailed design to determine their preference for mitigation and management measures.

Item	Discussion and Recommendations
Cumulative construction impacts	Cumulative construction impacts may affect residential receivers in NCA01 and NCA02 due to concurrent construction works with Botany Rail Duplication. It is noted that both Botany Signalling Works and Botany Rail Duplication propose to use the Banksia Street compound and residential receivers are immediately adjacent to the western boundary of this site The potential cumulative impacts from Botany Yard Bi-Directional Signalling Works and other major projects will be investigated further as the proposal progresses. Specific additional management and mitigation measures designed to address potential impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community. Where works on multiple projects are occurring outside of Standard Construction Hours in similar areas there is potential for increased impacts at nearby receivers. Co-ordination will occur between the various projects to minimise concurrent works in the same areas, where possible, and to ensure appropriate respite is applied to the affected receivers. It is noted that it could be preferred by the affected community for works to occur on both Botany Yard Bi-Directional Signalling Works and Botany Rail Duplication at the same time so that the total duration of the works from both projects is reduced.
General Measures	
Implement community consultation measures	Community consultation measures will be included in the CNVMP, including: • Periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.
Site inductions will be included in the CNVMP	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios/phone calls on speaker on site. No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.
Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during Standard Construction Hours (see **Table 18**). Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, where possible.
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts.

Item	Discussion and Recommendations
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Noise-emitting plant will be directed away from sensitive receivers, where possible.
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries will occur *as far as possible* from sensitive receivers. Site access points and roads will be selected to as possible away from sensitive receivers. Dedicated loading/unloading areas will be shielded if close to sensitive receivers. Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.
Silencers on Mobile Plant	Where possible noise from mobile plant will be reduced through additional: • Residential grade mufflers • Damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced.
Shield stationary noise sources such as pumps, compressors, fans, etc	Stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings would be unlikely to benefit.

8.3 Approach to Operational Impacts

The proposal is not predicted to result in any exceedances of the RING trigger levels meaning there is no requirement to consider mitigation for the operational rail noise impacts.

Within six months of commencement of operation, validation monitoring should, however, be undertaken to confirm the operational noise predictions and impacts presented in this assessment.

9 Conclusion

9.1 Construction Noise and Vibration

- As the nearest receivers to the proposal are relatively close in some areas the worst-case construction noise impacts from the proposal are expected to be consistent with most major infrastructure projects in urban areas and are likely to be 'high' at certain times. The highest impacts would be when works requiring noise intensive equipment, such as concrete saws or ballast tampers, are in use near to receivers.
- The worst-case construction noise impacts on **residential receivers** are limited to receivers in Pagewood and Botany, in NCA01 and NCA02. Residential receivers in NCA04 are also impacted but to a lesser degree. The other catchments either have no residential receivers or receivers are sufficiently far from the works to minimise the impacts.
- 'High' impacts are likely at the nearest receivers when noise intensive equipment is in use. Noise intensive equipment would, however, only be required for relatively short periods and noise levels and impacts during typical works would be significantly lower.
- 'Minor' worst-case impacts are generally seen at the nearest **commercial receivers** to the rail corridor when noise intensive equipment is in use. The sensitivity of the affected receivers is, however, expected to be low.
- The proposal would apply all feasible and reasonable work practices to reduce the potential impacts. Specific strategies have been developed and would be detailed in the Construction Environmental Management Plan for the proposal. Site specific Construction Noise and Vibration Management Plans and Construction Noise and Vibration Impact Statements would also be developed before any works begin.
- The Botany Yard Bi-Directional Signalling Works are expected to occur at the same time as Botany Rail Duplication works and the project areas overlap near NCA01 and NCA02. The worst-case construction impacts are expected to be controlled by Botany Rail Duplication as the noisiest scenarios for that project are required to be undertaken closer to the nearest receivers in NCA01 and NCA02.

  When less noisy works are being completed by Botany Rail Duplication at the same time and in a similar location as Botany Yard Bi-Directional Signalling Works there is, however, potential for cumulative impacts from concurrent works on both projects. Concurrent works have the potential to increase the duration, and annoyance, of noise impacts on the affected receivers. There is also potential for loss of respite where works occur for consecutive days or nights across both projects.

  It is noted that the affected community may, however, prefer for works to occur concurrently on both Botany Yard Bi-Directional Signalling and Botany Rail Duplication so that the total duration of the works from both projects is reduced.

9.2 Operational Rail Noise

- The proposal involves the removal, installation and modification of signals within Botany Yard. Track and civil works are also required at certain isolated locations within Botany Yard.
- The proposal is predicted to result in rail noise levels which are generally consistent (ie within around 1 dB) with existing noise levels. Larger increases are predicted at receivers which are further back from the alignment, however, noise levels at these receivers are predicted to be compliant with the absolute criteria in the *Rail Noise Infrastructure Guideline* (RING).
- Signalling and track upgrades are predicted to result in a reduction in locomotive idling noise of around 5 dB at receivers in NCA01 and NCA02 for operations in the Gelco Siding.
- The proposal is not predicted to result in any exceedances of the trigger levels outlined in the RING meaning there is no requirement to consider mitigation for the operational rail noise impacts.
- Cumulative operational rail noise impacts from the operation of Botany Rail Duplication and Botany Yard Bi-Directional Signalling are expected to be largely consistent with the Botany Yard Bi-Directional Signalling predictions alone and no receivers are predicted to exceed the trigger levels.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

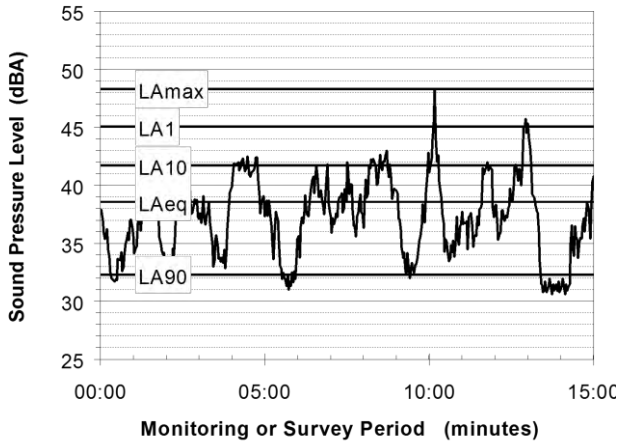
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

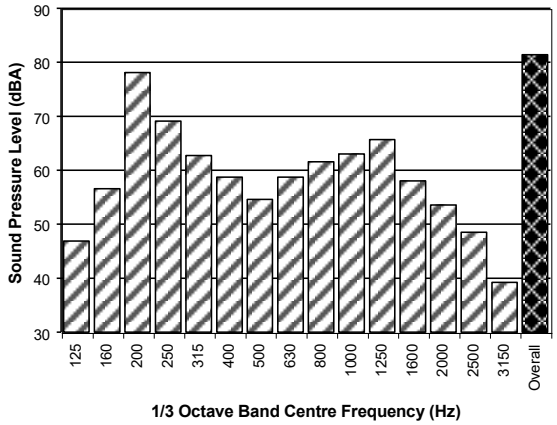
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

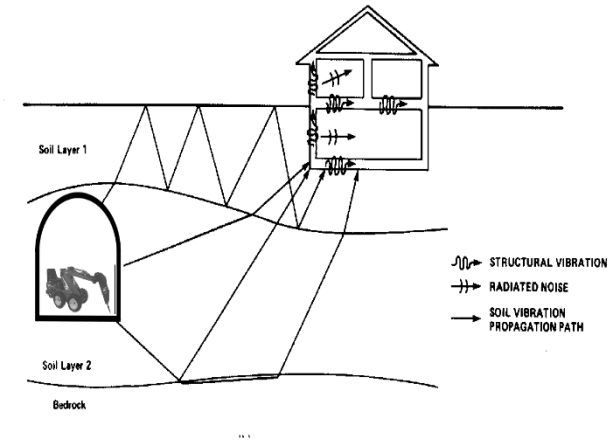
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

APPENDIX B

Noise Monitoring Data

Noise Monitoring Location	L.06	Map of Noise Monitoring Location
Noise Monitoring Address	**13 Morgan Street, Botany**	

Logger Device Type: Svantek 957, Logger Serial No: 20667
Sound Level Meter: Brüel and Kjær 2250L, Sound Level Meter Serial No: 2414604

Ambient noise logger deployed at residential address 13 Morgan Street, Botany.

Attended noise measurements indicate the ambient noise environment at this location is influenced by distant road traffic and industrial noise. Frequent light-vehicle pass-bys on Morgan Street and aircraft flyovers also contribute to the noise levels at this location.

Attended Measurement Noise Levels (LAmax):
05/07/2018: Light-vehicle traffic: 50-52 dBA. Aircraft Flyovers: 70-71 dBA

Ambient Noise Logging Results – NPfI Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L_{10}	L_1
Daytime	39	56	56	65
Evening	41	53	52	59
Night-time	37	51	47	57

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	-	-
Night-time (10pm-7am)	-	-

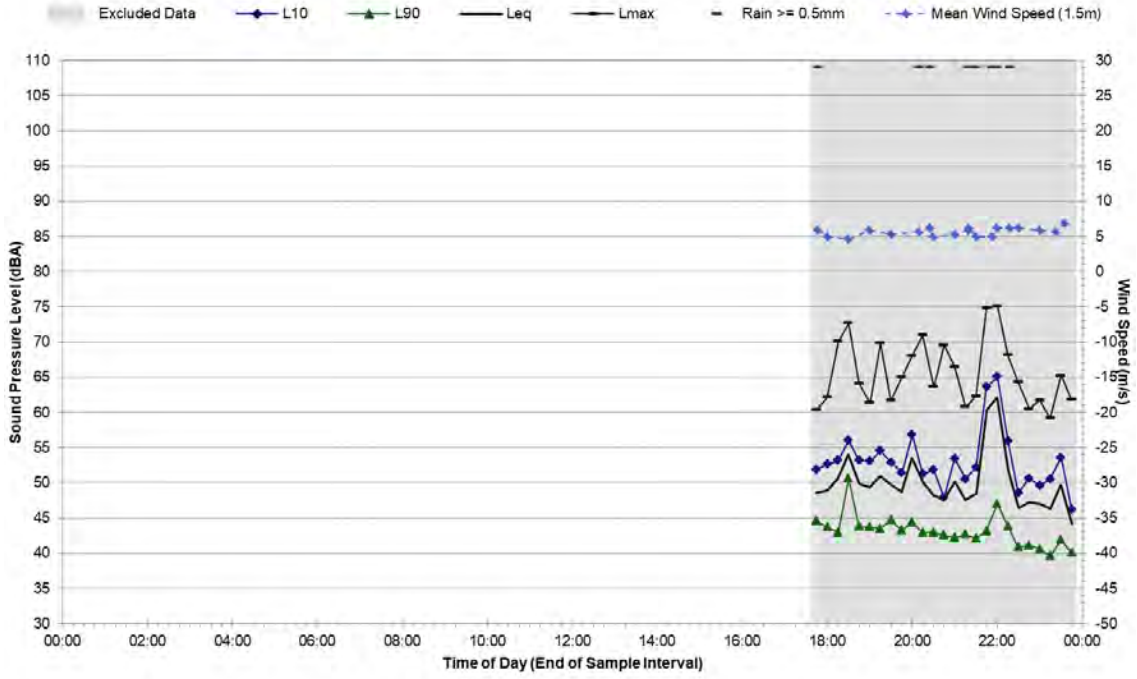
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
05/07/2018	14:00	43	55	75

Photo of Noise Monitoring Location

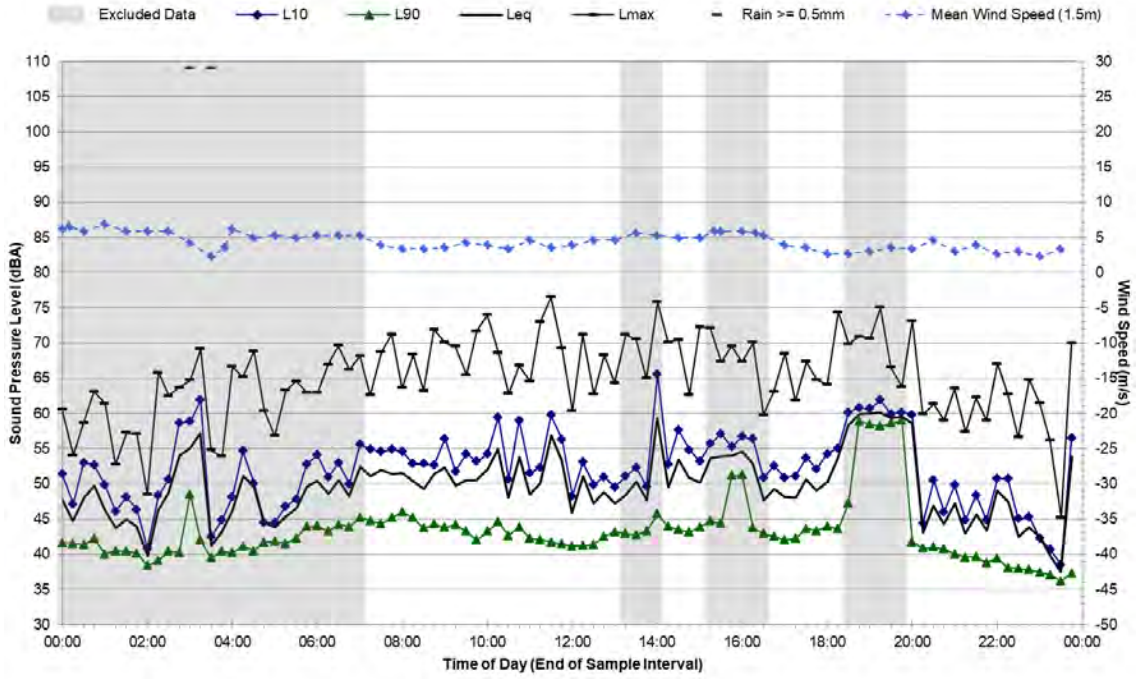
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Tuesday, 19 June 2018



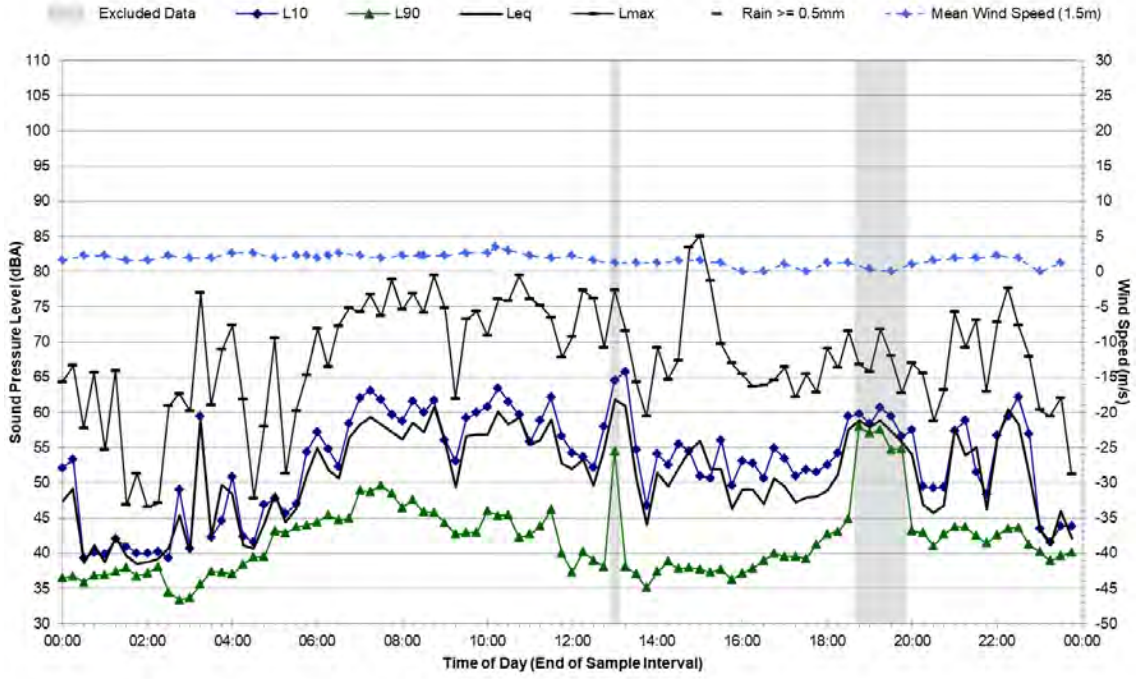
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Wednesday, 20 June 2018



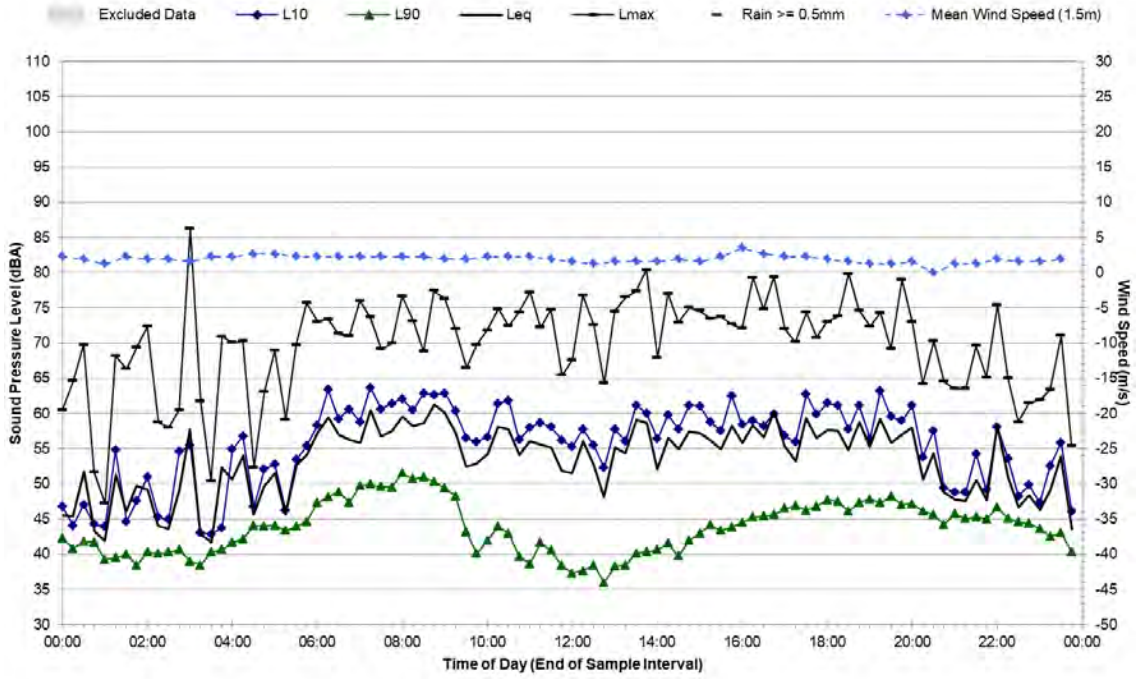
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Thursday, 21 June 2018



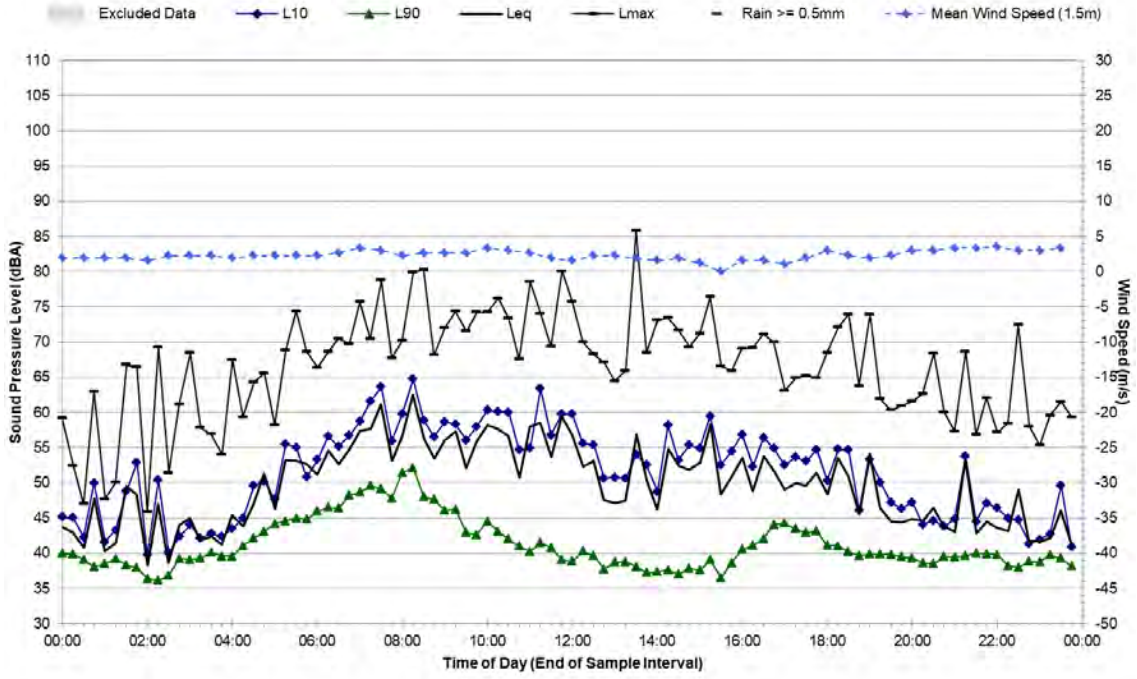
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Friday, 22 June 2018



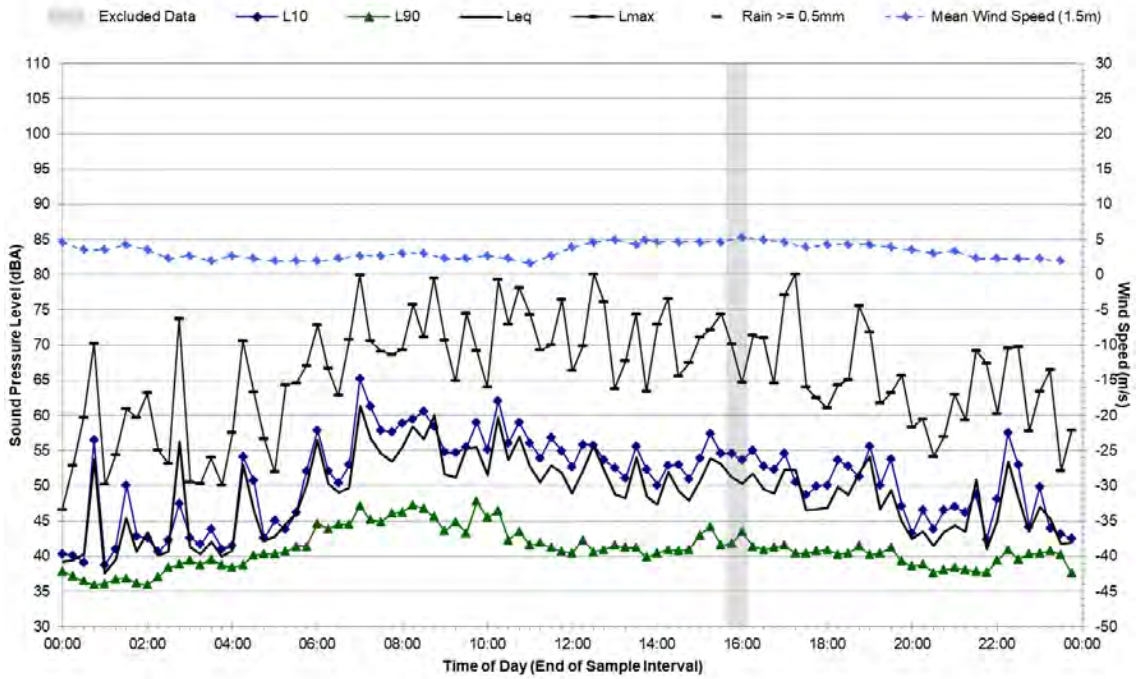
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Saturday, 23 June 2018



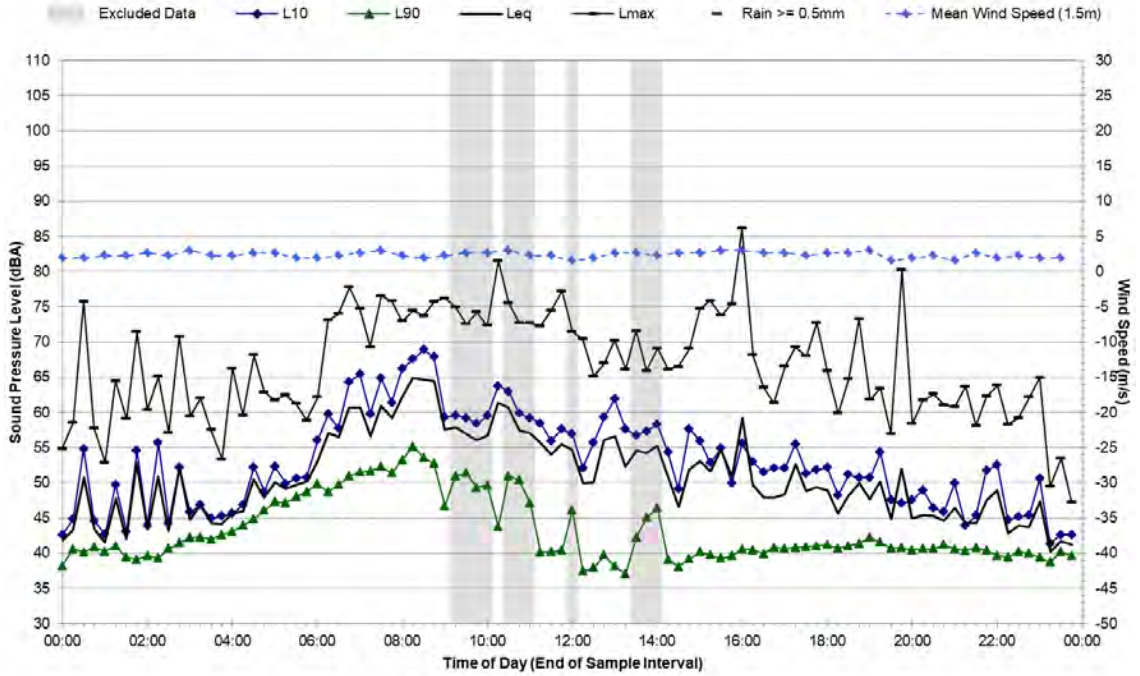
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Sunday, 24 June 2018



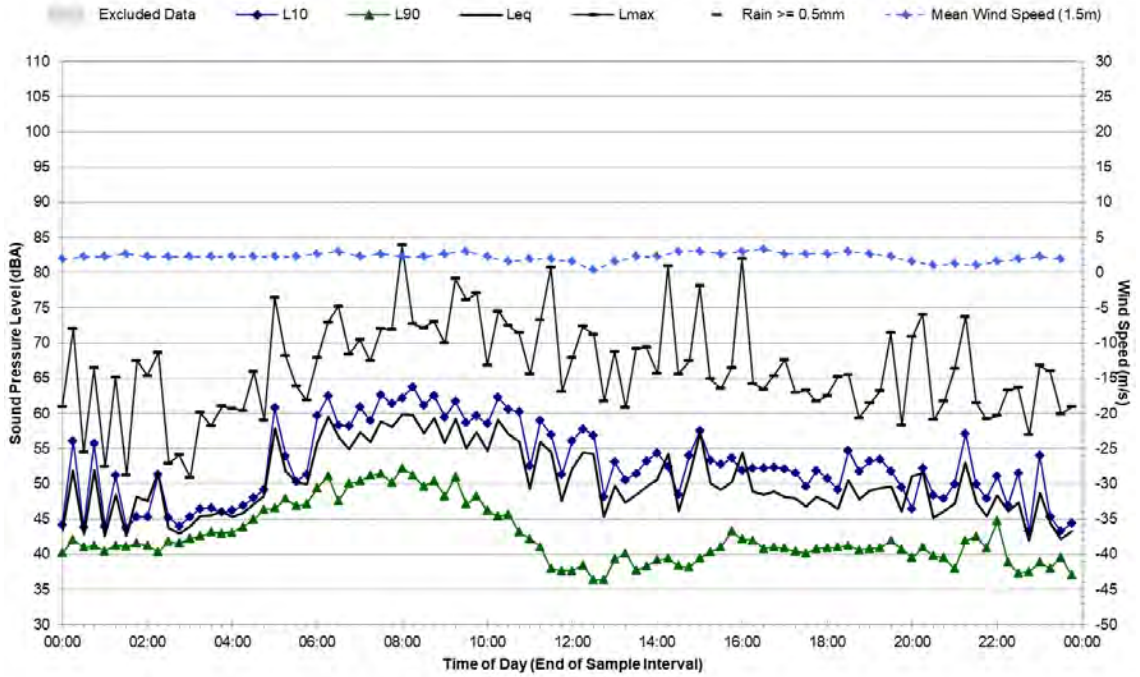
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Monday, 25 June 2018



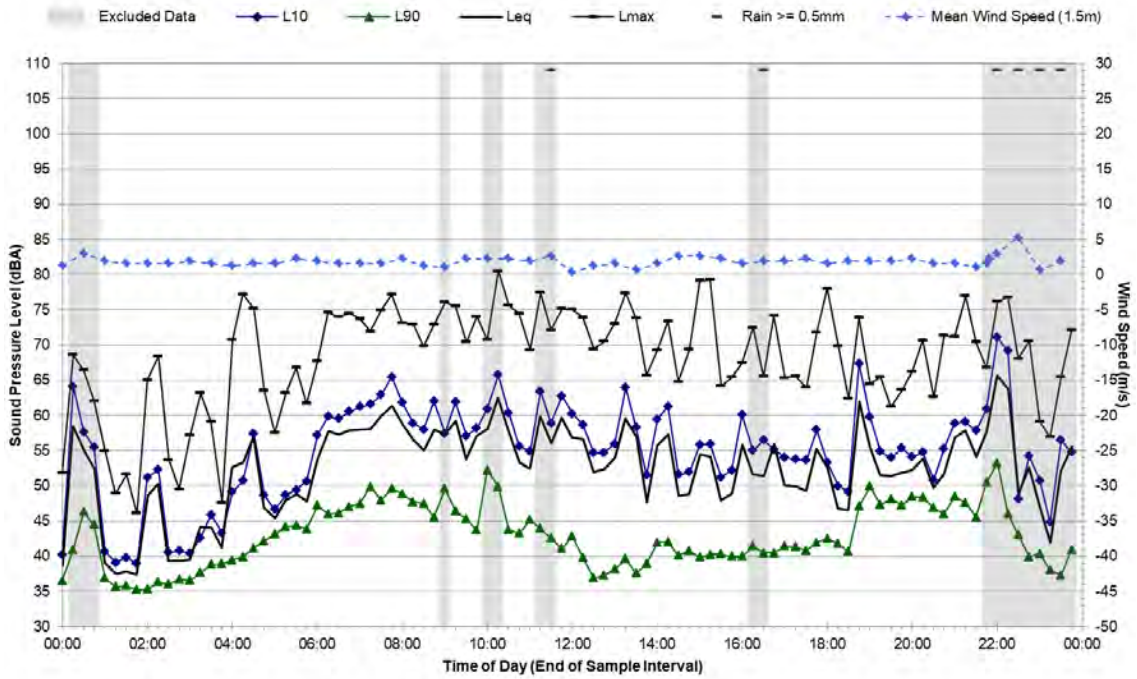
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Tuesday, 26 June 2018



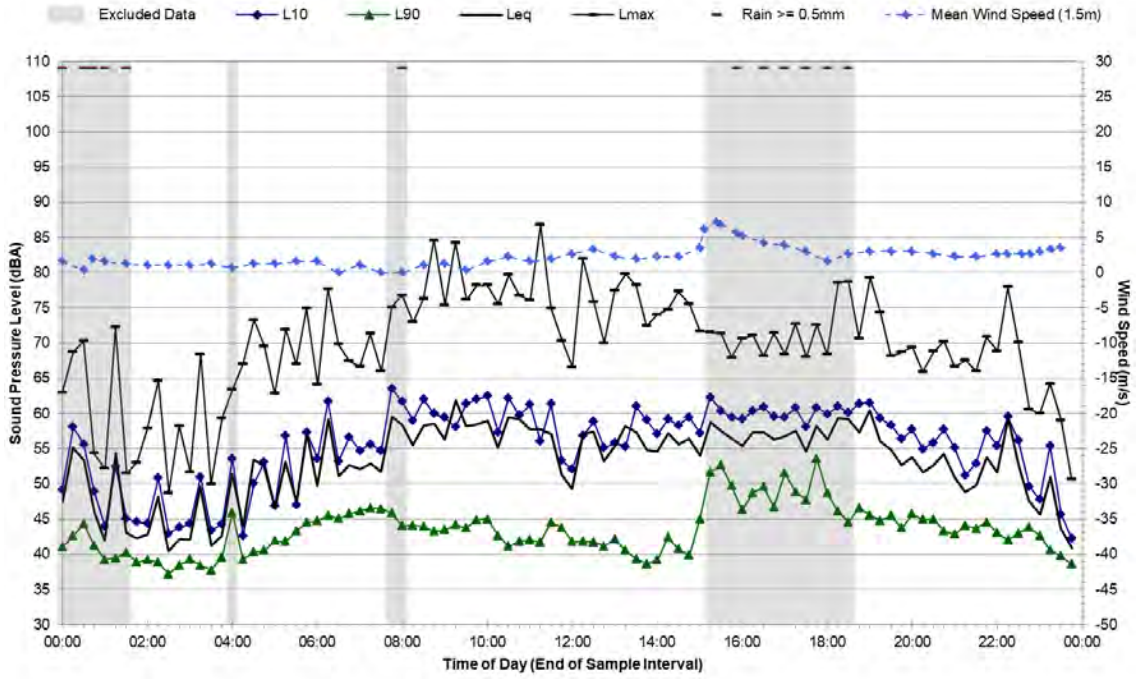
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Wednesday, 27 June 2018



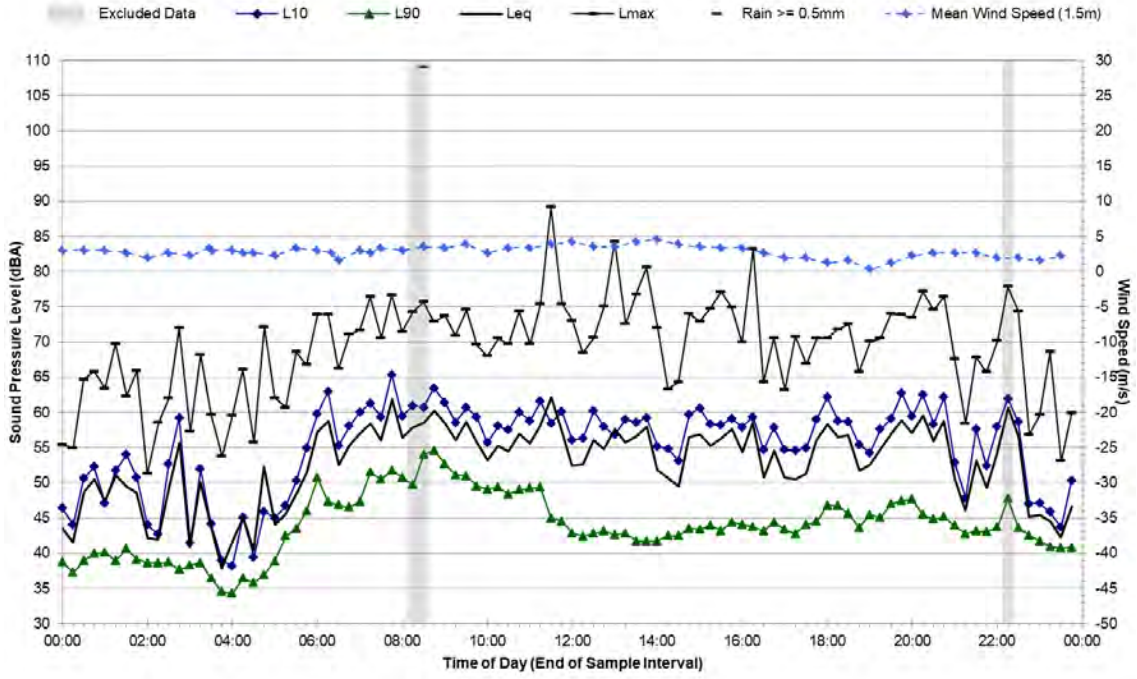
Statistical Ambient Noise Levels

13 Morgan Street, Botany - Thursday, 28 June 2018



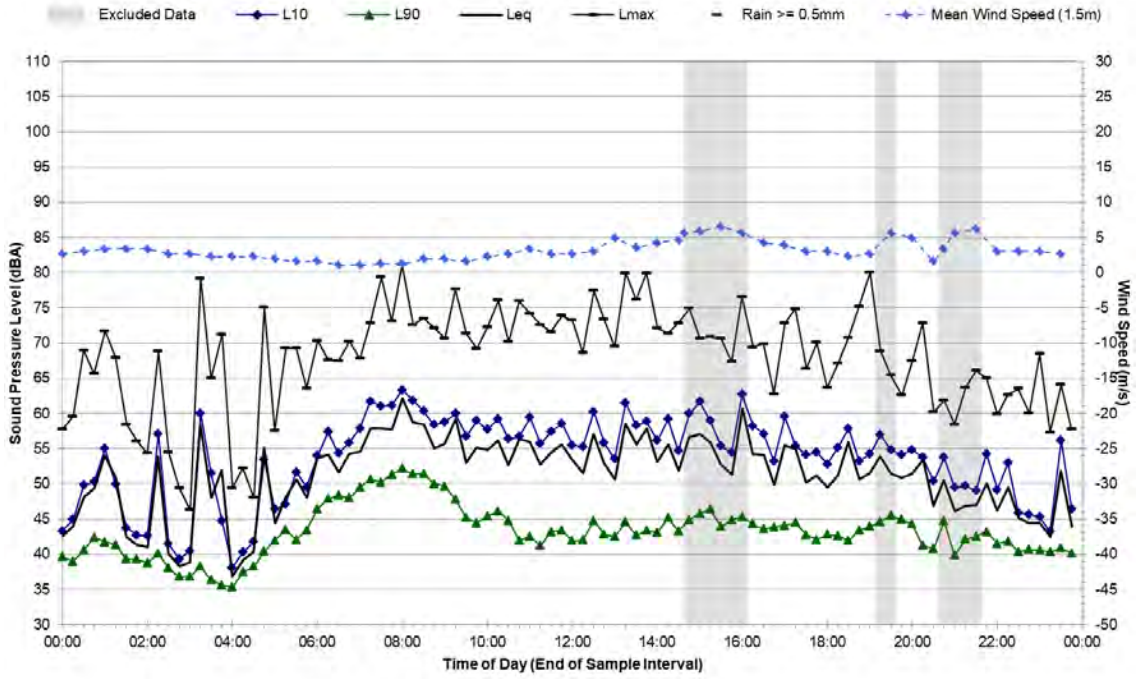
Statistical Ambient Noise Levels

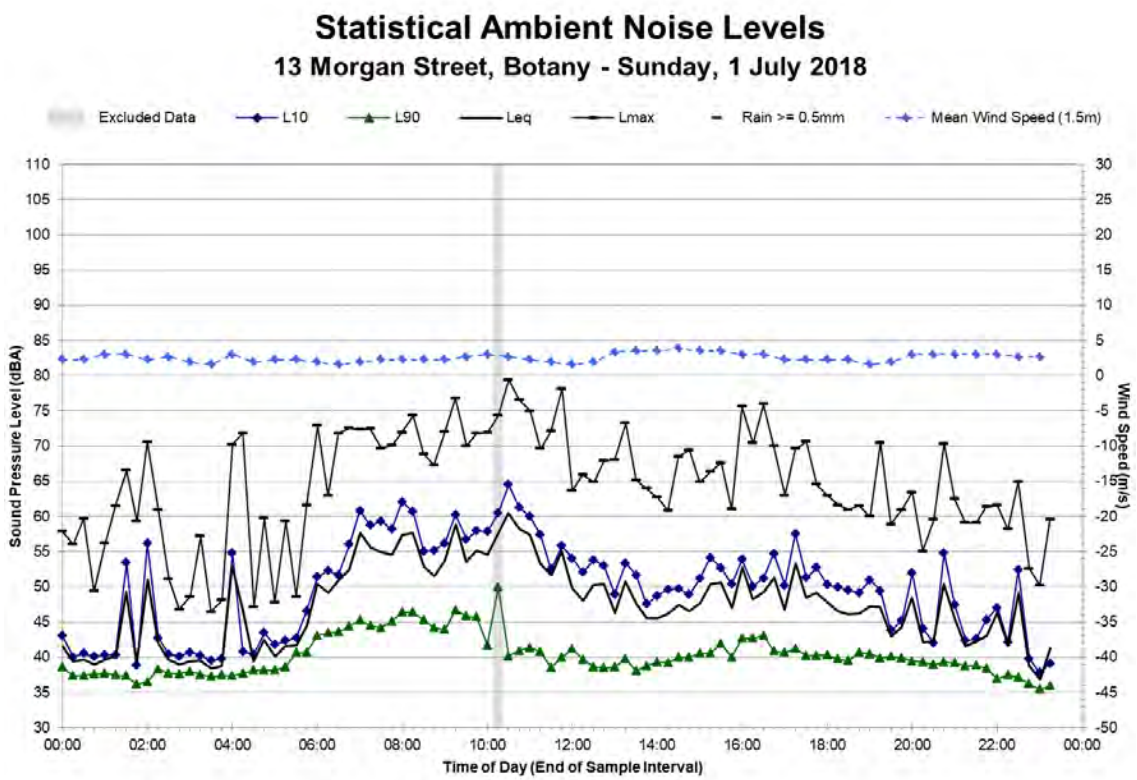
13 Morgan Street, Botany - Friday, 29 June 2018



Statistical Ambient Noise Levels

13 Morgan Street, Botany - Saturday, 30 June 2018




Statistical Ambient Noise Levels
13 Morgan Street, Botany - Sunday, 1 July 2018
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

SNoise Monitoring Location	L.07
Noise Monitoring Address	**38 Ocean Street, Pagewood**

Logger Device Type: Svantek 957, Logger Serial No: 3003389
Sound Level Meter: Brüel and Kjær 2250L, Sound Level Meter Serial No: 2487418

Ambient noise logger deployed at residential address 38 Ocean Street, Pagewood.

Attended noise measurements indicate the ambient noise environment at this location is influenced by local road traffic noise from Ocean Street. Train pass bys and aircraft flyovers also contribute to the ambient noise levels at this location.

Attended Measurements Noise Levels (LAmax):
09/10/2018: Light-vehicle traffic on Ocean Street: 58 dBA. Helicopter flyby: 73 dBA. Train pass by: 61 dBA.
Birds and insects intermittently audible.

Map of Noise Monitoring Location

Ambient Noise Logging Results – NPfI Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	46	58	59	65
Evening	46	54	55	61
Night-time	43	54	52	59

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	-	-
Night-time (10pm-7am)	-	-

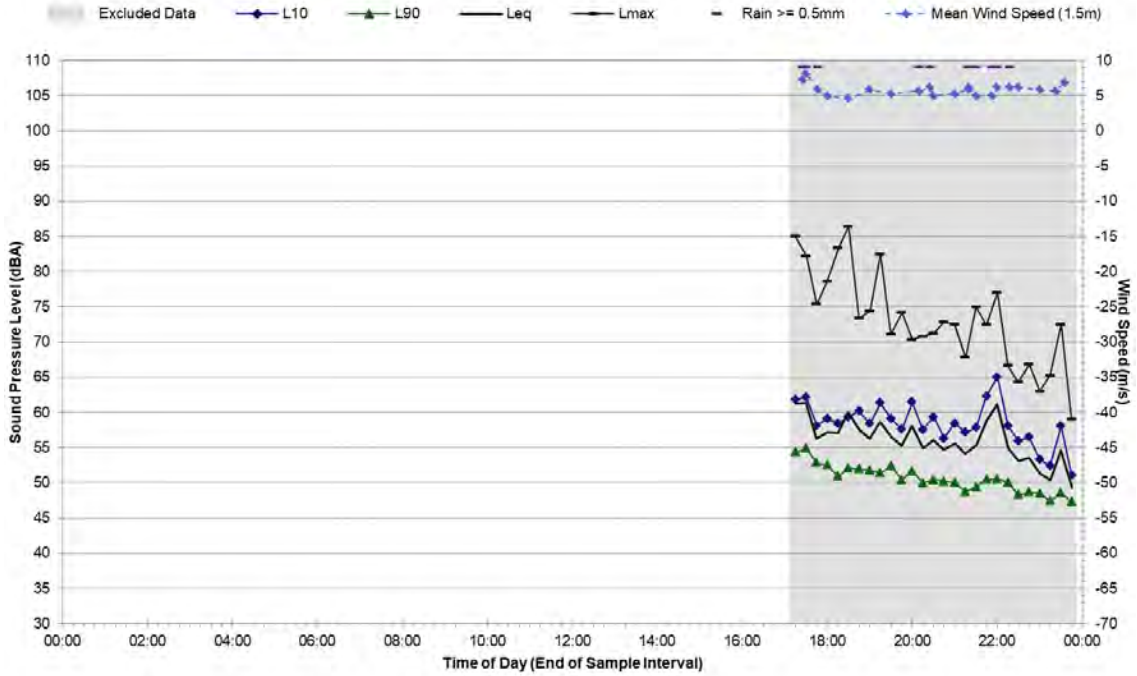
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
09/10/2018	13:20	48	57	77

Photo of Noise Monitoring Location

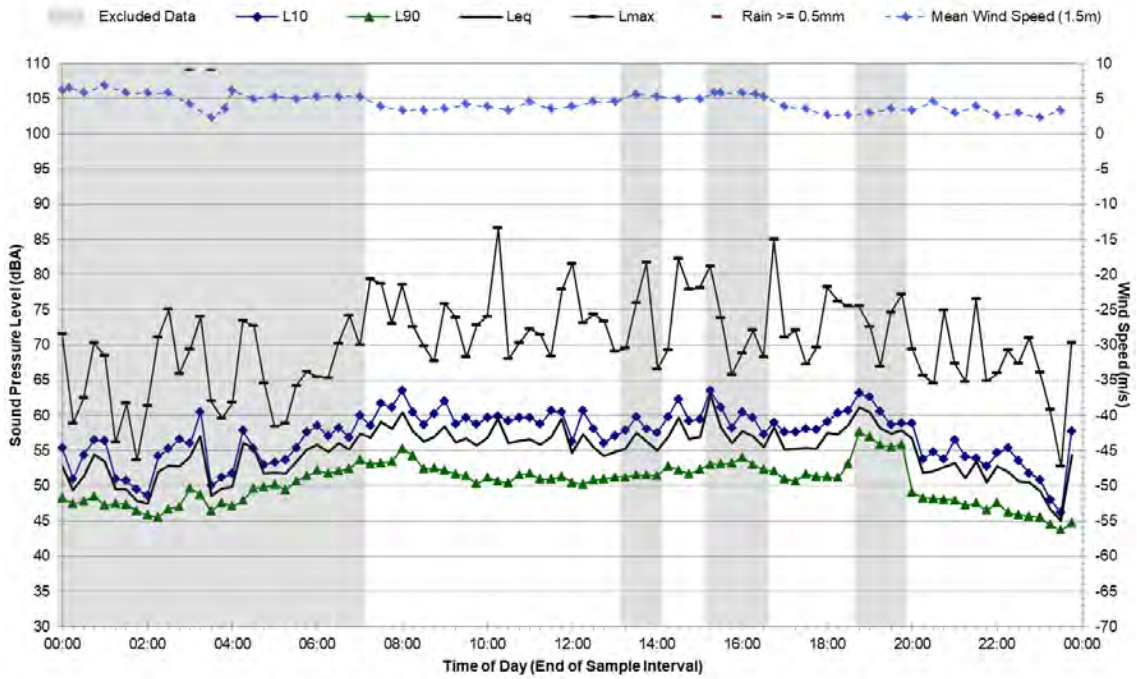
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Tuesday, 19 June 2018



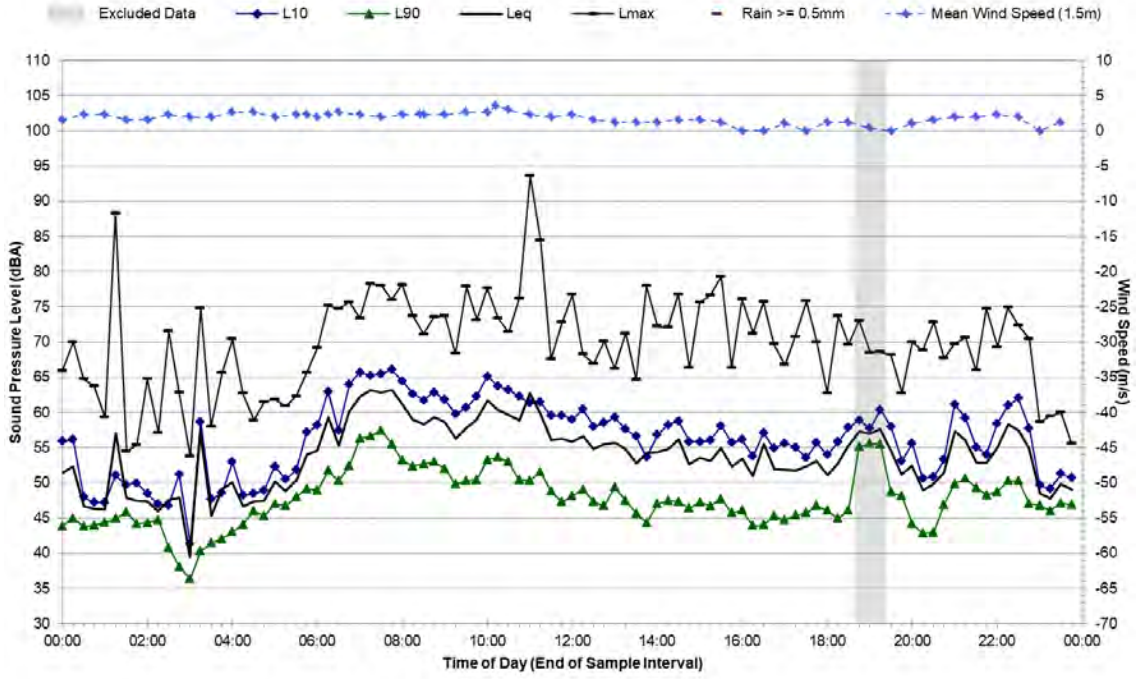
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Wednesday, 20 June 2018



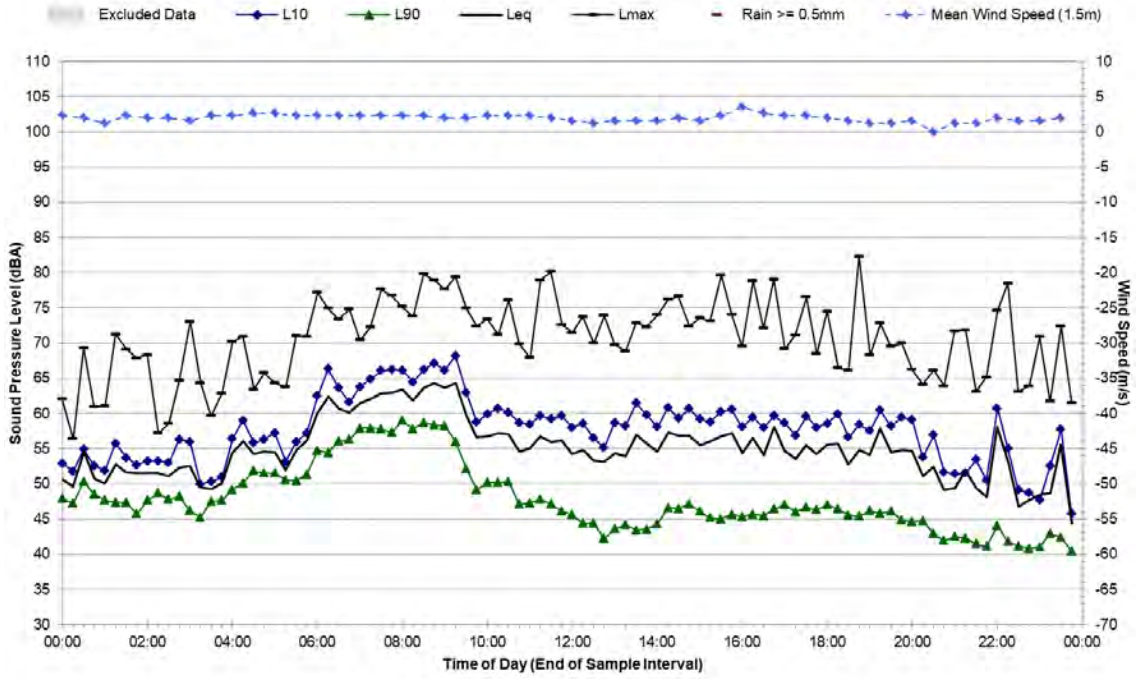
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Thursday, 21 June 2018



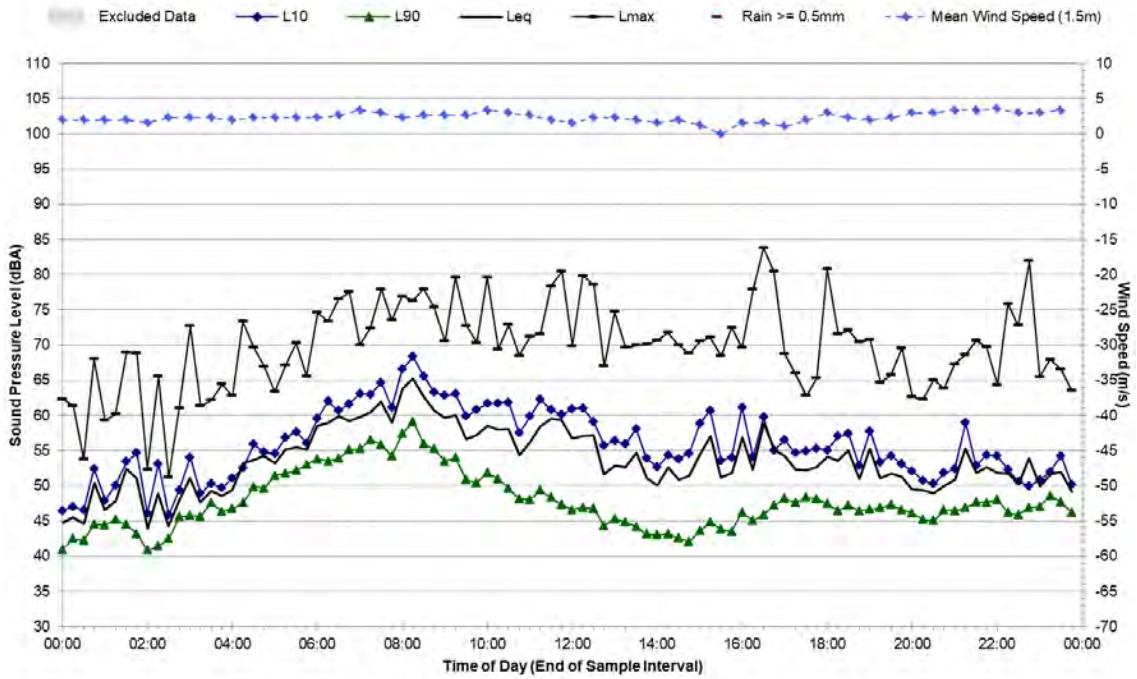
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Friday, 22 June 2018



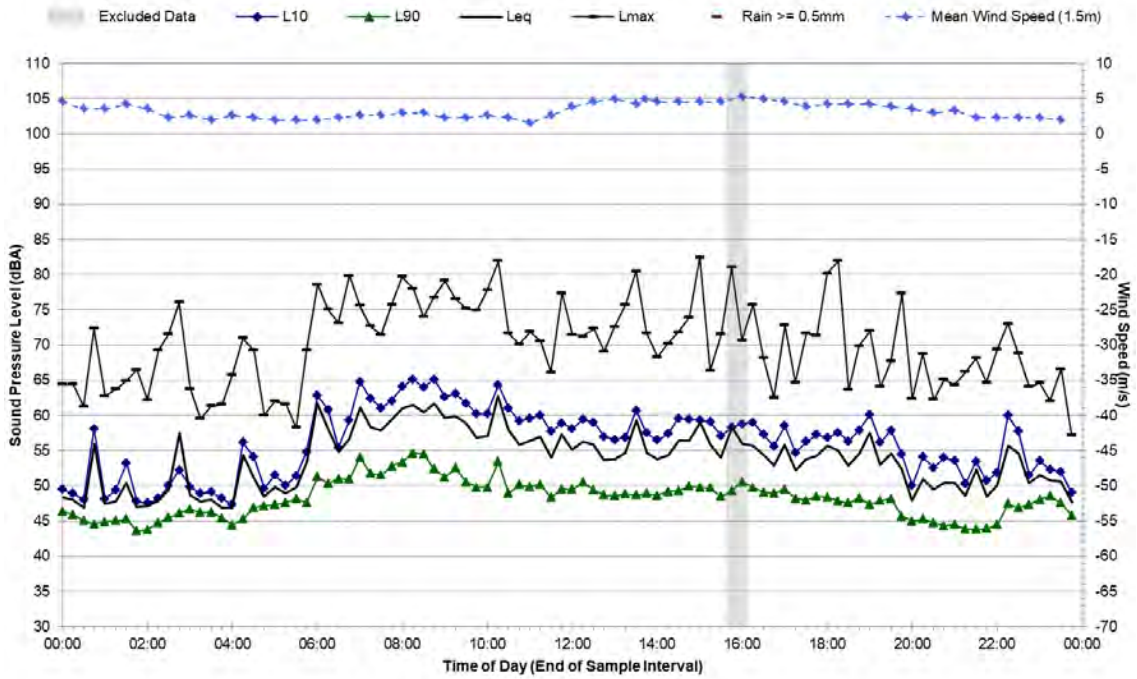
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Saturday, 23 June 2018



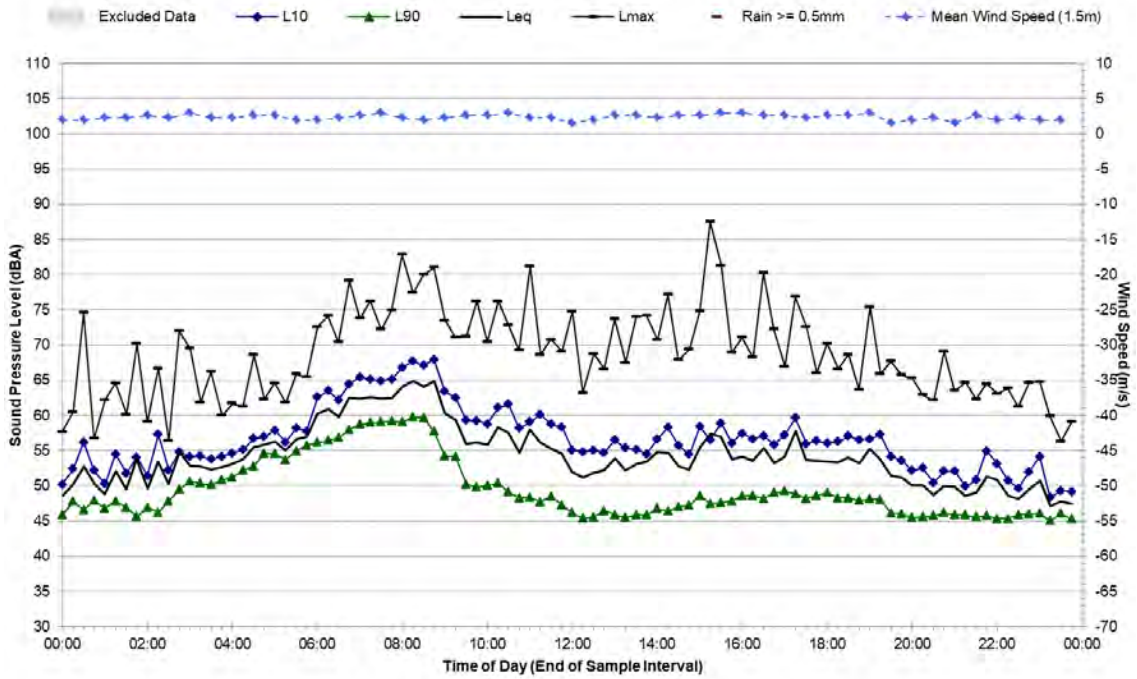
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Sunday, 24 June 2018



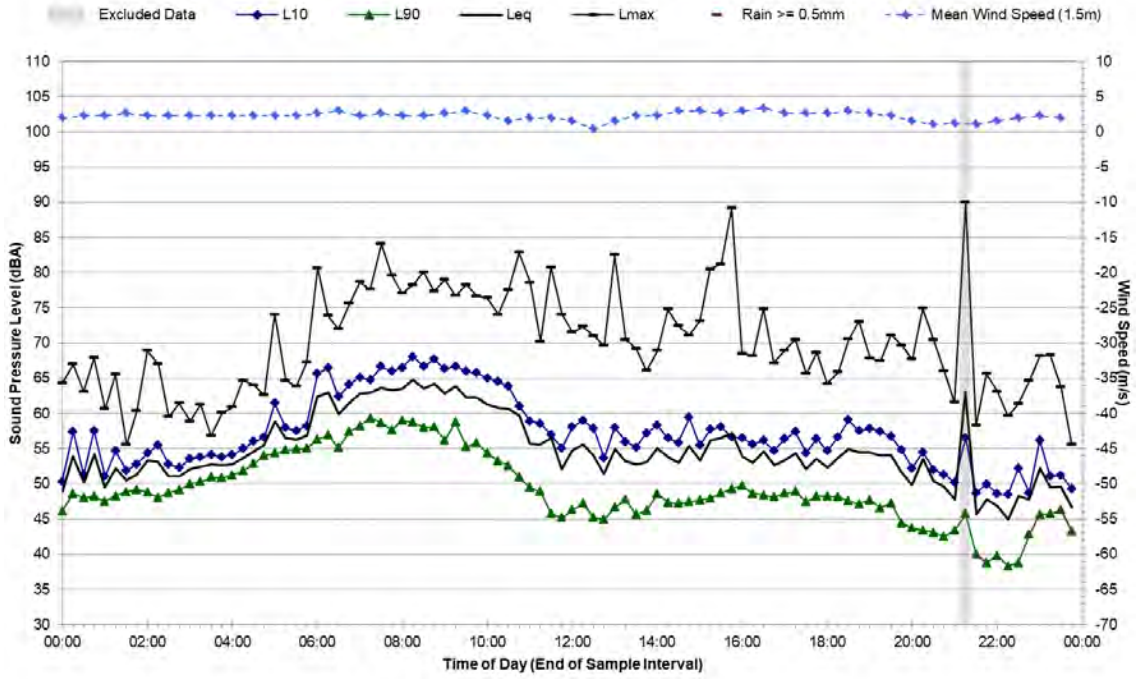
Statistical Ambient Noise Levels

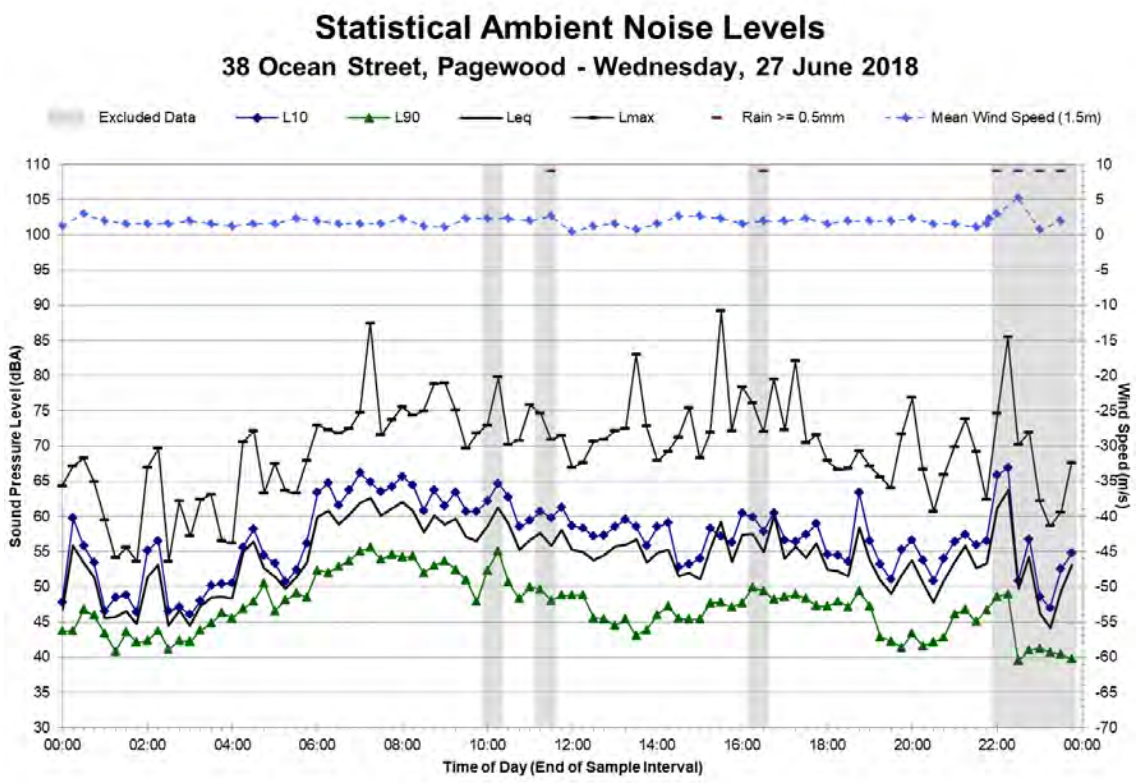
38 Ocean Street, Pagewood - Monday, 25 June 2018

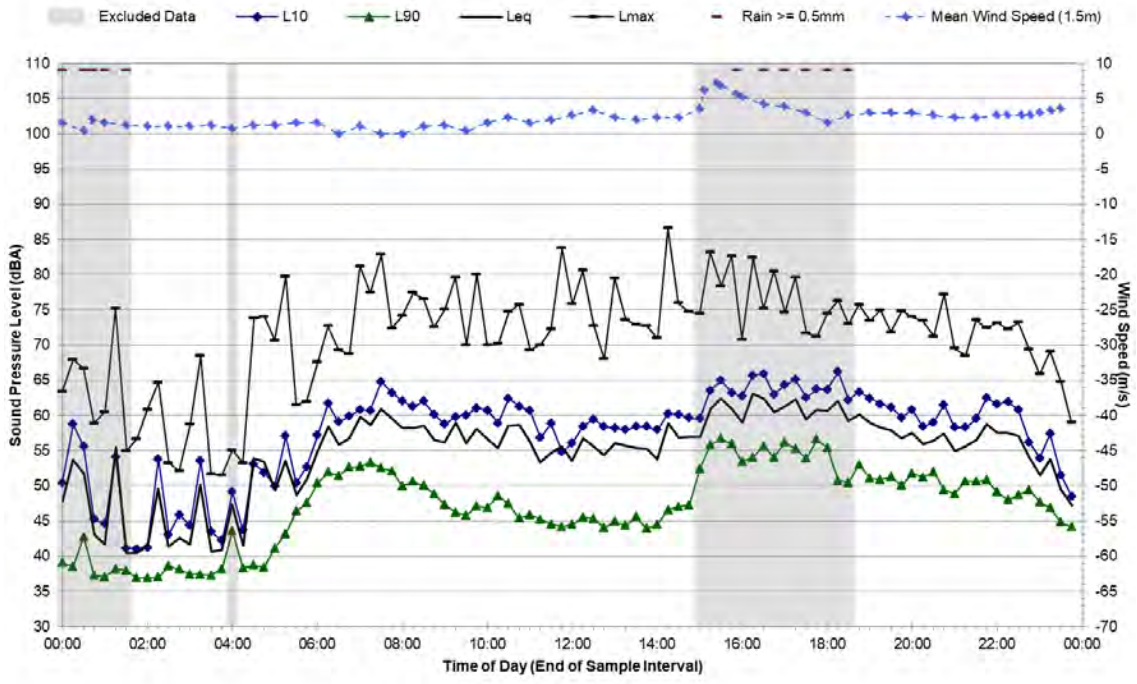


Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Tuesday, 26 June 2018

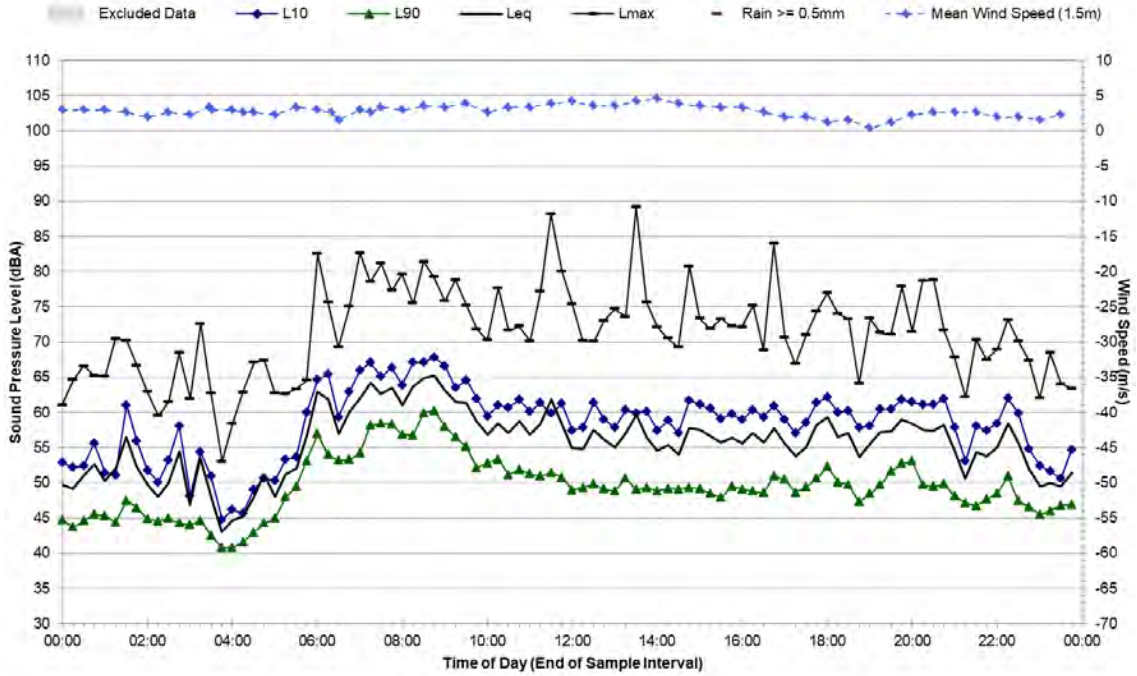



Statistical Ambient Noise Levels
38 Ocean Street, Pagewood - Wednesday, 27 June 2018
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
38 Ocean Street, Pagewood - Thursday, 28 June 2018
Excluded Data
L10
L90
Leq
Lmax
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

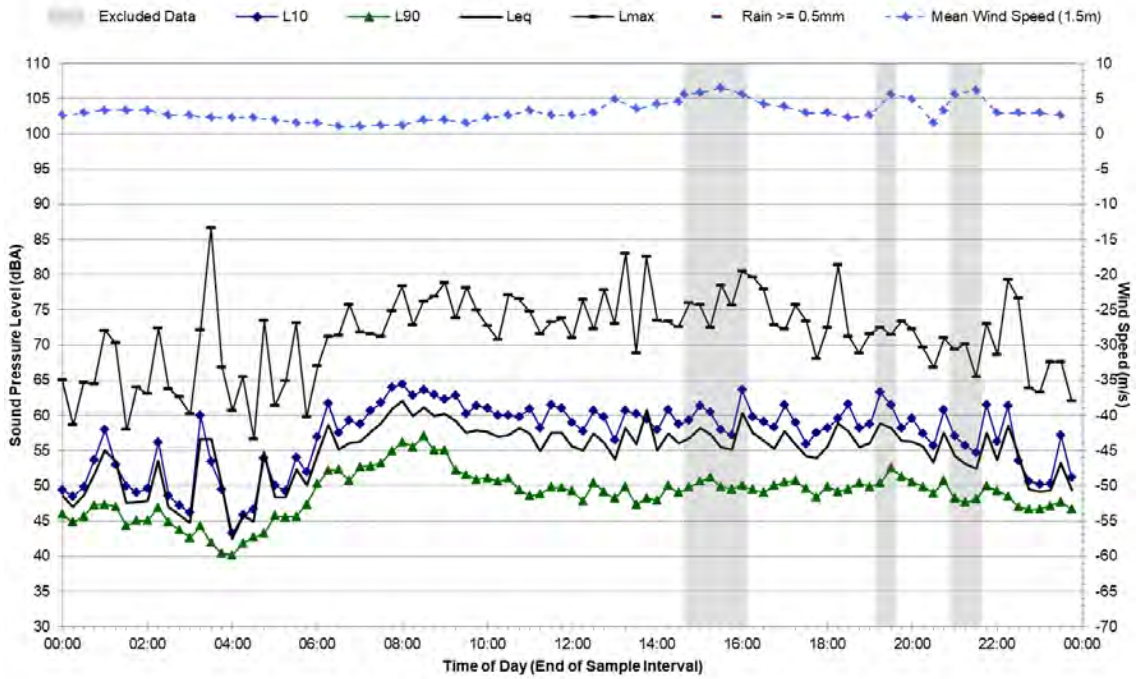
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Friday, 29 June 2018



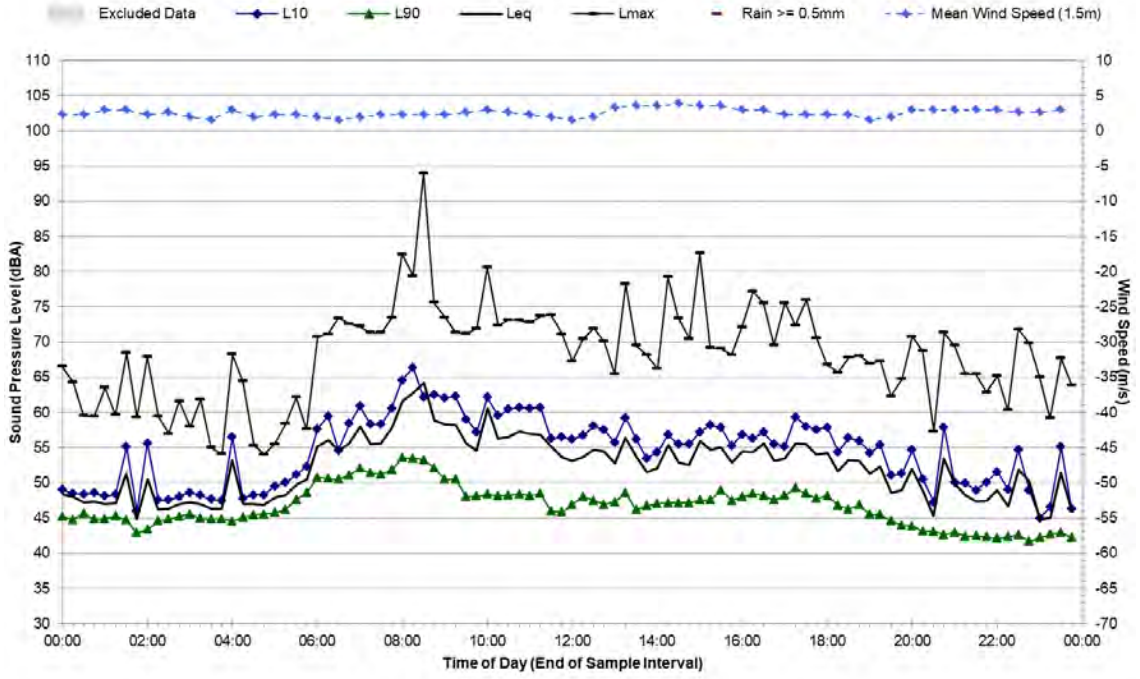
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Saturday, 30 June 2018



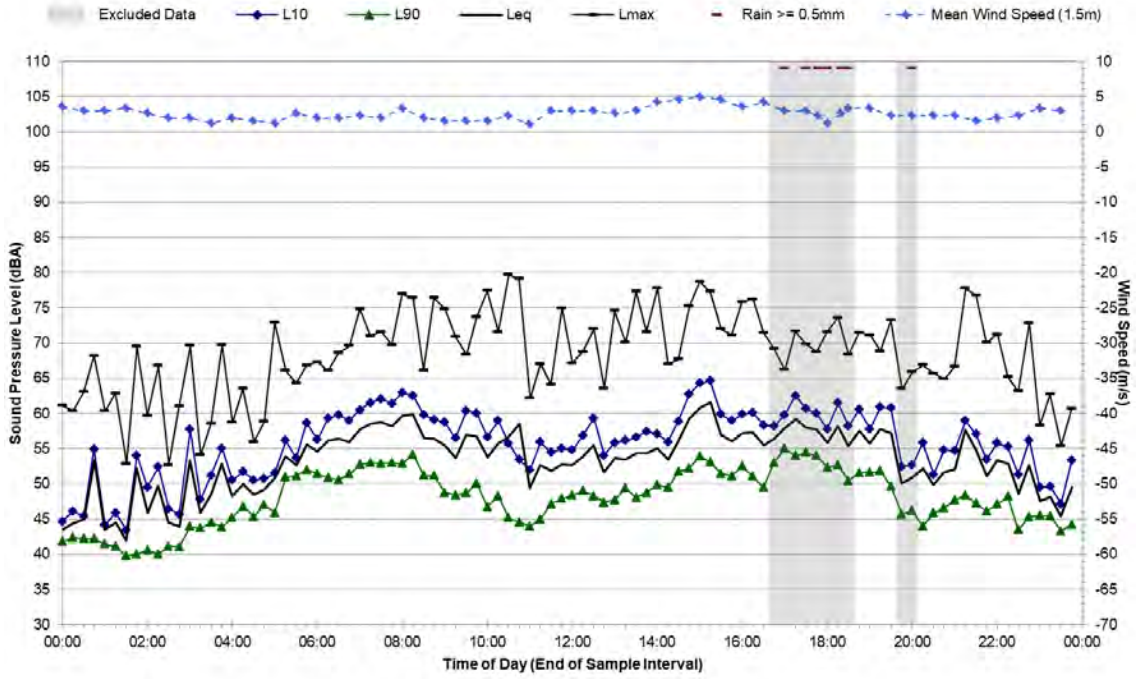
Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Sunday, 1 July 2018



Statistical Ambient Noise Levels

38 Ocean Street, Pagewood - Monday, 2 July 2018



APPENDIX C

Construction Information

Table 1 Equipment Lists and Sound Power Levels

Equipment		Ballast Tamper[1]	Bobcat	Concrete Mixer Truck	Concrete Saw[1]	Excavator (14 tonne)	Excavator (22 tonne)	Front End Loader	Generator (small)	Hand Tools	Mobile Crane - Franna	Mobile Crane (400 tonne)	Semi Trailer	Super Sucker	Support Vehicle	Test Train	Truck
SWL LAeq(15min)[2]		118	104	103	119	97	99	104	93	94	98	106	106	100	98	105	107
Ref	**Scenario**																
01	Site Establishment		X	X			X			X		X					
02	Compound Operation						X			X							
03	Trackworks - Peak	X			X	X		X	X	X			X			X	X
04	Trackworks - Typical					X				X							
05	Signal Works - Peak					X			X		X			X	X		X
06	Signal Works - Typical					X				X							
07	Site Rehabilitation/Decommissioning					X				X	X						

Note 1: Equipment classed as 'annoying' in the ICNG and requires an additional 5 dB correction.

Note 2: Sound power level data is taken from the DEFRA Noise Database, TfNSW *Construction Noise and Vibration Strategy*, RMS *Construction and Vibration Guideline*.

Table 2 Predicted Worst-case Construction Noise Levels (dBA) – Residential Receivers

Period	ID	Scenario Activity	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06
Daytime	01	Site Establishment	63	74	-	43	42	-
	02	Compound Operation	52	63	-	32	31	-
	03	Trackworks - Peak	70	71	-	56	41	-
	04	Trackworks - Typical	49	50	-	35	<30	-
	05	Signal Works - Peak	65	67	-	45	41	-
	06	Signal Works - Typical	56	58	-	36	32	-
	07	Site Rehabilitation/Decommissioning	58	60	-	38	34	-
Evening	01	Site Establishment	-	-	-	-	-	-
	02	Compound Operation	52	63	-	32	31	-
	03	Trackworks - Peak	70	71	-	56	41	-
	04	Trackworks - Typical	49	50	-	35	<30	-
	05	Signal Works - Peak	65	67	-	45	41	-
	06	Signal Works - Typical	56	58	-	36	32	-
	07	Site Rehabilitation/Decommissioning	-	-	-	-	-	-
Night-time	01	Site Establishment	-	-	-	-	-	-
	02	Compound Operation	52	63	-	32	31	-
	03	Trackworks - Peak	70	71	-	56	41	-
	04	Trackworks - Typical	49	50	-	35	<30	-
	05	Signal Works - Peak	65	67	-	45	41	-
	06	Signal Works - Typical	56	58	-	36	32	-
	07	Site Rehabilitation/Decommissioning	-	-	-	-	-	-

Table 3 Predicted Worst-case NML Exceedances (dB) – Residential Receivers

Period	ID	Scenario Activity	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06
Daytime	01	Site Establishment	7	25	-	-	-	-
	02	Compound Operation	-	14	-	-	-	-
	03	Trackworks - Peak	14	22	-	7	-	-
	04	Trackworks - Typical	-	1	-	-	-	-
	05	Signal Works - Peak	9	18	-	-	-	-
	06	Signal Works - Typical	-	9	-	-	-	-
	07	Site Rehabilitation/Decommissioning	2	11	-	-	-	-
Evening	01	Site Establishment	-	-	-	-	-	-
	02	Compound Operation	1	19	-	-	-	-
	03	Trackworks - Peak	19	27	-	12	-	-
	04	Trackworks - Typical	-	6	-	-	-	-
	05	Signal Works - Peak	14	23	-	1	-	-
	06	Signal Works - Typical	5	14	-	-	-	-
	07	Site Rehabilitation/Decommissioning	-	-	-	-	-	-
Night-time	01	Site Establishment	-	-	-	-	-	-
	02	Compound Operation	4	21	-	-	-	-
	03	Trackworks - Peak	22	29	-	14	-	-
	04	Trackworks - Typical	1	8	-	-	-	-
	05	Signal Works - Peak	17	25	-	3	-	-
	06	Signal Works - Typical	8	16	-	-	-	-
	07	Site Rehabilitation/Decommissioning	-	-	-	-	-	-

Table 4 Predicted Worst-case Construction Noise Levels (dBA) – Commercial Receivers

Period	ID	Scenario Activity	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06
When in use	01	Site Establishment	47	52	69	82	58	70
	02	Compound Operation	36	41	58	71	47	59
	03	Trackworks - Peak	55	50	76	76	41	40
	04	Trackworks - Typical	34	<30	55	55	<30	<30
	05	Signal Works - Peak	45	51	73	73	72	71
	06	Signal Works - Typical	36	42	64	64	63	62
	07	Site Rehabilitation/Decommissioning	38	44	66	66	65	64

Table 5 Predicted NML Exceedances, All Receiver Types – NCA01

ID	Scenario	Number of Receivers																
		Total	HNA[1]	With NML Exceedance[2]														
				Standard Daytime			Out of Hours Works[3]											
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	335	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	335	-	-	-	-	1	-	-	1	-	-	13	-	-	1	-	-
03	Trackworks - Peak	335	-	38	5	-	84	16	-	84	15	-	118	23	3	112	20	1
04	Trackworks - Typical	335	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
05	Signal Works - Peak	335	-	22	-	-	52	2	-	52	2	-	61	16	-	61	10	-
06	Signal Works - Typical	335	-	-	-	-	5	-	-	5	-	-	20	-	-	1	-	-
07	Site Rehabilitation/Decommissioning	335	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

Table 6 Predicted NML Exceedances, All Receiver Types – NCA02

ID	Scenario	Number of Receivers															
		Total	HNA[1]	With NML Exceedance[2]													
				Standard Daytime			Out of Hours Works[3]										
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	489	-	56	29	19	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	489	-	29	15	-	38	28	-	38	28	-	42	32	1	35	26	-
03	Trackworks - Peak	489	-	110	22	1	228	52	4	228	52	4	251	70	11	232	65	6
04	Trackworks - Typical	489	-	1	-	-	3	-	-	3	-	-	6	-	-	1	-	-
05	Signal Works - Peak	489	-	48	32	-	96	43	14	96	43	14	127	37	27	113	38	24
06	Signal Works - Typical	489	-	41	-	-	38	24	-	38	24	-	43	27	-	41	-	-
07	Site Rehabilitation/Decommissioning	489	-	51	2	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

Table 7 Predicted NML Exceedances, All Receiver Types – NCA03

ID	Scenario	Number of Receivers																
		Total	HNA[1]	With NML Exceedance[2]														
				Standard Daytime			Out of Hours Works[3]											
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03	Trackworks - Peak	243	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
04	Trackworks - Typical	243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05	Signal Works - Peak	243	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
06	Signal Works - Typical	243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	Site Rehabilitation/Decommissioning	243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

Table 8 Predicted NML Exceedances, All Receiver Types – NCA04

ID	Scenario	Number of Receivers															
		Total	HNA[1]	With NML Exceedance[2]													
				Standard Daytime			Out of Hours Works[3]										
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	162	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	162	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
03	Trackworks - Peak	162	-	24	-	-	47	6	-	45	6	-	44	14	-	45	11	-
04	Trackworks - Typical	162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05	Signal Works - Peak	162	-	1	-	-	2	-	-	1	-	-	13	-	-	5	-	-
06	Signal Works - Typical	162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	Site Rehabilitation/Decommissioning	162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

Table 9 Predicted NML Exceedances, All Receiver Types – NCA05

ID	Scenario	Number of Receivers																
		Total	HNA[1]	With NML Exceedance[2]														
				Standard Daytime			Out of Hours Works[3]											
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03	Trackworks - Peak	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04	Trackworks - Typical	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05	Signal Works - Peak	479	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
06	Signal Works - Typical	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	Site Rehabilitation/Decommissioning	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

Table 10 Predicted NML Exceedances, All Receiver Types – NCA06

ID	Scenario	Number of Receivers																
		Total	HNA[1]	With NML Exceedance[2]														
				Standard Daytime			Out of Hours Works[3]											
							Daytime OOH			Evening			Night-time			Sleep Disturbance		
				1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
01	Site Establishment	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02	Compound Operation	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03	Trackworks - Peak	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04	Trackworks - Typical	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05	Signal Works - Peak	51	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
06	Signal Works - Typical	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	Site Rehabilitation/Decommissioning	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted noise at residential receiver is 75 dBA or greater).
Note 2: Based on worst-case predicted noise levels.
Note 3: OOH = Out of hours.

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APPENDIX C DATABASE SEARCHES

C.1 NON-ABORIGINAL HERITAGE

Search Results

10 results found.

Botany Bay Foreshore Rd	Botany, NSW, Australia	(Nomination now ineligible for PPAL) National Heritage List
Botany Fire Station 3 Banksia St	Botany, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Botany Post Office 2 Banksia St	Botany, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Botany Post Office 2 Banksia St	Botany, NSW, Australia	(Listed place) Commonwealth Heritage List
Botany Swamps Southern Cross Dr	Mascot, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Sir Joseph Banks Hotel (former) 23 Anniversary Rd	Botany, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Southern & Western Suburbs Ocean Outfall Sewers Perimeter Rd	Sydney Airport, NSW, Australia	(Interim List) Register of the National Estate (Non-statutory archive)
St Matthews Anglican Church Botany Rd	Botany, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Sydney (Kingsford Smith) Airport Group Airport Dr	Sydney Airport, NSW, Australia	(Interim List) Register of the National Estate (Non-statutory archive)
Sydney (Kingsford Smith) Airport Group Airport Dr	Sydney Airport, NSW, Australia	(Indicative Place) Commonwealth Heritage List

Report Produced: Fri May 8 13:17:41 2020

Search Results

1 result found.

Botany Swamps Southern Cross Dr	Mascot, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)

Report Produced: Fri Nov 15 12:33:32 2019

Botany Bay Local Environmental Plan 2013

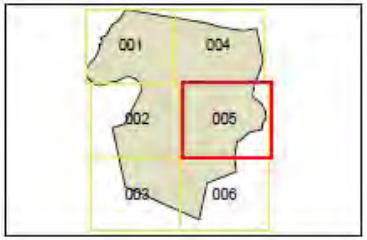
Heritage Map - Sheet HER_005

Heritage

- Conservation Area - General
- Item - General
- Item - Landscape

Cadastre

- Base data 5/11/2012 © Land and Property Information (LPI)



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Scale 1:10,000 @ A3

Projection GDA 1994 Zone 56

Map Identification number:

NSW Department of Planning, Industry and Environment

Home > Topics > Heritage places and items > Search for heritage

Search for NSW heritage

Return to search page where you can refine/broaden your search.

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

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- **Section 2** - contains heritage items listed by the **Heritage Council of NSW** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- **Section 3** - contains items listed by **local councils** on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and **State government agencies** under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search returned 2 records.

Item name	Address	Suburb	LGA	SHR
Botany Water Reserves	1024 Botany Road	Mascot	Botany Bay	01317
Sir Joseph Banks Hotel (former)	23 Anniversary Street	Botany	Botany Bay	00076

Section 3. Items listed by Local Government and State Agencies.

Your search returned 83 records.

Item name	Address	Suburb	LGA	Information source
Alignment Pin, Botany	Botany Road, SW cnr Fremlin Street	Botany	Botany Bay	SGOV
Banksmeadow Public School	Brighton Street	Botany	Botany Bay	LGOV
Banksmeadow Public School - Building B00A, B00B and B00S	60 Brighton Street	Botany	Botany Bay	SGOV
Birds Gully Stormwater Channel No 10	Avoca Street	Randwick To Botany Wetlands, Daceyville	Randwick	SGOV
Boarding House (front buildings)	1443 Botany Road	Botany	Botany Bay	LGOV

Booralee Park	Bounded by Sydenham Railway Line and Daniel, Bay, Lord, Myrtle and Jasmine Streets	Botany	Botany Bay	LGOV
Botany Fire Station	1-3 Banksia Street	Botany	Botany Bay	LGOV
Botany Fire Station	3 Banksia Street	Botany	Botany Bay	SGOV
Botany Public School	1076 Botany Road	Botany	Botany Bay	SGOV
Botany Public School - Buildings B00A, B00B and B00C	1076 Botany Road	Botany	Botany Bay	SGOV
Botany Public School (c.1869)	Botany Road	Botany	Botany Bay	LGOV
Botany Town Hall and Council Chambers	1423 Botany Road	Botany	Botany Bay	LGOV
Botany Township		Botany	Botany Bay	LGOV
Botany Township Heritage Conservation Area	Botany Township Botany Road	Botany	Botany Bay	LGOV
Botany Uniting Church	1355 Botany Road	Botany	Botany Bay	LGOV
Botany Water Reserve	Southern Cross Drive, Wentworth Avenue and Heffron Road	Botany, Pagewood, Eastlakes and Kensington	Botany Bay	SGOV
Botany Water Reserves				LGOV
Canary Island Date Palms (Phoenix canariensis)	23 Byrnes Street	Botany	Botany Bay	LGOV
Captain Cook Hotel	1114 Botany Road	Botany	Botany Bay	LGOV
Commercial / Residential Building	1226 Botany Road	Botany	Botany Bay	LGOV
Corner Store - Alto	50 - 52 Bay Street	Botany	Botany Bay	LGOV
Electricity Substation No. 153	14 Byrnes Street	Botany	Botany Bay	SGOV
Electricity Substation No. 153	14 Byrnes Street	Botany	Botany Bay	LGOV
Electricity Substation No. 340	3 William Street	Botany	Botany Bay	SGOV
Electricity Substation No. 340	3 William Street	Botany	Botany Bay	LGOV
	1094-1098 Botany Road	Botany		LGOV

Finnies Buildings			Botany Bay	
Former Headmasters Residence (Banksmeadow Public School)	60 Brighton Street	Botany	Botany Bay	LGOV
Hippo's Friends Child Care Centre	1082 Botany Road	Botany	Botany Bay	LGOV
House	1447 Botany Road	Botany	Botany Bay	LGOV
House	8 Banksia Street	Botany	Botany Bay	LGOV
House	47 Banksia Street	Botany	Botany Bay	LGOV
House	145 Bay Street	Botany	Botany Bay	LGOV
House	147 Bay Street	Botany	Botany Bay	LGOV
House	50 Tenterden Road	Botany	Botany Bay	LGOV
House	54 Tenterden Road	Botany	Botany Bay	LGOV
House	16 Tenterden Road	Botany	Botany Bay	LGOV
House	31 Cranbrook Street	Botany	Botany Bay	LGOV
House	35 Cranbrook Street	Botany	Botany Bay	LGOV
House	37 Cranbrook Street	Botany	Botany Bay	LGOV
House	2 Woodstock Street	Botany	Botany Bay	LGOV
House	1365 Botany Road	Botany	Botany Bay	LGOV
House	135 Bay Street	Botany	Botany Bay	LGOV
House	6 Banksia Street	Botany	Botany Bay	LGOV
House	16 Bay Street	Botany	Botany Bay	LGOV
House	19 Bay Street	Botany	Botany Bay	LGOV
House	7 Banksia Street	Botany	Botany Bay	LGOV
House	84 Tenterden Road	Botany	Botany Bay	LGOV
	1424 Botany Road	Botany		LGOV

House - Helena			Botany Bay	
House (The White House)	151 Bay Street	Botany	Botany Bay	LGOV
House Group	165-179 Bay Street	Botany	Botany Bay	LGOV
House Group	10-14 Bay Street	Botany	Botany Bay	LGOV
House Group	21-23 Salisbury Street	Botany	Botany Bay	LGOV
House Group	1268-1270 Botany Road	Botany	Botany Bay	LGOV
House Group	63-65 Tenterden Road	Botany	Botany Bay	LGOV
House Group	45-57 Bay Street	Botany	Botany Bay	LGOV
House Group	1158-1168 Botany Road	Botany	Botany Bay	LGOV
John Brotchie Kindergarten	1361 Botany Road	Botany	Botany Bay	LGOV
John Brotchie Nursery School	1361 Botany Road	Botany	Botany Bay	SGOV
John Brotchie Nursery School - Building B00A	1361 Botany Road	Botany	Botany Bay	SGOV
Memorial Park	814 Botany Road	Mascot	Botany Bay	LGOV
Memorial Park	814 Botany Road	Botany	Botany Bay	LGOV
New Market Hotel	889 Botany Road	Rosebery	Botany Bay	LGOV
New Market Hotel	889 Botany Road	Botany	Botany Bay	LGOV
Police Station (circa 1871)	1441 Botany Road	Botany	Botany Bay	LGOV
Port Botany Revetment Wall	Prince of Wales Drive	Port Botany	Randwick	SGOV
Post Office (c.1923)	2 Banksia Street	Botany	Botany Bay	LGOV
Presbyterian Church of Australia and Manse	1561-1563 Botany Road	Botany	Botany Bay	LGOV
Residential Building	16 The Esplanade	Botany	Botany Bay	LGOV
Sandstone Kerb, Botany	Botany Road, NW & NE cnr Wilson Street	Botany	Botany Bay	SGOV

Sewage Pumping Station No 60 (SP0060)	McFall Street	Botany	Botany Bay	SGOV
Sewer Vent	Tenderden Road	Botany	Botany Bay	SGOV
Sir Joseph Banks Hotel (c.1840), Former	23 Anniversary Street	Banksmeadow	Botany Bay	LGOV
Sir Joseph Banks Hotel (c.1920)	1354 Botany Road	Botany	Botany Bay	LGOV
Sir Joseph Banks Park	Fremlin	Botany	Botany Bay	LGOV
St. Matthews Anglican Church (1862)	1331 Botany Road	Rosebery	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm	Northern side of Bay Street	Botany	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm	Brighton Street	Botany	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm, Brown Avenue, Botany	Brown Street	Botany	Botany Bay	LGOV
Streetscape - verge plantings of Canary Island Date Palms (and Hoop Pines)	Swinbourne Street (between William and Queen Streets)	Botany	Botany Bay	LGOV
Sydney Water Corporation - Sewer Vent	Tenterden Road	Botany	Botany Bay	LGOV
Sydney Water Corporation Sewage Pumping Station SP0060	McFall Street	Botany	Botany Bay	LGOV
Terrace Group	42-54 Daphne Street	Botany	Botany Bay	LGOV
Weatherboard House Group	18-20 Erith Street	Botany	Botany Bay	LGOV

There was a total of 85 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

NSW GOVERNMENT

NSW Department of Planning, Industry and Environment

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Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search returned 4 records.

Item name	Address	Suburb	LGA	SHR
Alexandra Canal		Alexandria	Botany Bay	01621
Botany Water Reserves	1024 Botany Road	Mascot	Botany Bay	01317
Sewage Pumping Station 38	General Holmes Drive	Mascot	Botany Bay	01344
Sir Joseph Banks Hotel (former)	23 Anniversary Street	Botany	Botany Bay	00076

Section 3. Items listed by Local Government and State Agencies.

Your search returned 212 records.

Item name	Address	Suburb	LGA	Information source
Alexandra Canal	Adjacent to Burrows Road	Alexandria, St. Peters, Mascot, Tempe	Sydney	SGOV
Alexandra Canal (including Sandstone Embankment)	Alexandra Canal	Mascot	Botany Bay	LGOV

Alignment Pin, Botany	Botany Road, SW cnr Fremlin Street	Botany	Botany Bay	SGOV
Bank Building, Former	686 Botany Road	Rosebery	Botany Bay	LGOV
Banksmeadow Public School	Brighton Street	Botany	Botany Bay	LGOV
Beckenham Memorial Church	1293-1295 Botany Road	Mascot	Botany Bay	LGOV
Birds Gully Stormwater Channel No 10	Avoca Street	Randwick To Botany Wetlands, Daceyville	Randwick	SGOV
Boarding House (front buildings)	1443 Botany Road	Botany	Botany Bay	LGOV
Bonnie Doon Golf Club House	Banks Avenue	Pagewood	Botany Bay	LGOV
Booralee Park	Bounded by Sydenham Railway Line and Daniel, Bay, Lord, Myrtle and Jasmine Streets	Botany	Botany Bay	LGOV
Botany Bay Hotel	1807 Botany Road	Banksmeadow	Botany Bay	LGOV
Botany Family Day Care	149 Coward Street	Mascot	Botany Bay	LGOV
Botany Fire Station	1-3 Banksia Street	Botany	Botany Bay	LGOV
Botany Fire Station	3 Banksia Street	Botany	Botany Bay	SGOV
Botany Public School (c.1869)	Botany Road	Botany	Botany Bay	LGOV
Botany Town Hall and Council Chambers	1423 Botany Road	Botany	Botany Bay	LGOV
Botany Township		Botany	Botany Bay	LGOV
Botany Township Heritage Conservation Area	Botany Township Botany Road	Botany	Botany Bay	LGOV
Botany Uniting Church	1355 Botany Road	Botany	Botany Bay	LGOV
Botany Water Reserve	Southern Cross Drive, Wentworth Avenue and Heffron Road	Botany, Pagewood, Eastlakes and Kensington	Botany Bay	SGOV
Botany Water Reserves				LGOV
Bunnerong Stormwater Channel Amplification	Lurline Bay	Maroubra	Botany Bay	SGOV
Bunnerong Stormwater Channel Amplification	Lurline Bay	Maroubra	Randwick	SGOV

Bunnerong Stormwater Channel No 11	Adjacent to Bunnerong Road	Hillsdale/Matraville	Botany Bay	SGOV
Canary Island Date Palms (Phoenix canariensis)	23 Byrnes Street	Botany	Botany Bay	LGOV
Captain Cook Hotel	1114 Botany Road	Botany	Botany Bay	LGOV
Carraville; Moville	3 Hicks Avenue	Mascot	Botany Bay	LGOV
Christian Fellowship Centre	40 King Street	Mascot	Botany Bay	LGOV
Collingwood	16 Hardie Street	Mascot	Botany Bay	LGOV
Commercial / Residential Building	1226 Botany Road	Botany	Botany Bay	LGOV
Commercial Building	1619 Botany Road	Banksmeadow	Botany Bay	LGOV
Commercial Building Group	1009-1021 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1193-1203 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1209-1223 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	891-917 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1171-1173 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1133-1135 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1187-1189 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1183-1185 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1175-1177 Botany Road	Mascot	Botany Bay	LGOV
Commercial Building Group	1-11 General Bridges Crescent	Daceyville	Botany Bay	LGOV
Commonwealth Water Pumping Station and Sewage Pumping Station No. 38	General Holmes Drive (west of Engine Pond, within the boundary of Sydney (Kingsford Smith Airport)	Mascot	Botany Bay	LGOV
Community Centre (Former)	3 Willis Crescent	Daceyville	Botany Bay	LGOV
Corner Store - Alto	50 - 52 Bay Street	Botany	Botany Bay	LGOV
	1007 Botany Road	Mascot		LGOV

Coronation Hall			Botany Bay	
Dacey Garden Reserve and Substation	Gardeners Road	Daceyville	Botany Bay	LGOV
Daceyville Garden Suburb Heritage Conservation Area		Daceyville	Botany Bay	LGOV
Daceyville Gardens Suburb (c 1912) - Superceded by Daceville Garden Suburb Heritage Conservation Area ID 5063190		Daceyville	Botany Bay	LGOV
Daceyville Public School	1 to 3 Joffre Crescent	Daceyville	Botany Bay	LGOV
Electricity Substation No. 147	1001 Botany Road	Mascot	Botany Bay	SGOV
Electricity Substation No. 153	14 Byrnes Street	Botany	Botany Bay	SGOV
Electricity Substation No. 153	14 Byrnes Street	Botany	Botany Bay	LGOV
Electricity Substation No. 163	34 Wentworth Avenue	Mascot	Botany Bay	SGOV
Electricity Substation No. 252	489 Gardeners Road	Rosebery	Botany Bay	SGOV
Electricity Substation No. 258	40 Robey Street	Mascot	Botany Bay	SGOV
Electricity Substation No. 340	3 William Street	Botany	Botany Bay	SGOV
Electricity Substation No. 340	3 William Street	Botany	Botany Bay	LGOV
Electricity Substation No.147	1001 Botany Road	Mascot	Botany Bay	LGOV
Finnies Buildings	1094-1098 Botany Road	Botany	Botany Bay	LGOV
Fire Station	139 Coward Street	Mascot	Botany Bay	LGOV
Former Headmasters Residence (Banksmeadow Public School)	60 Brighton Street	Botany	Botany Bay	LGOV
Former St. Michael's Church (now a Hall)	Haig Avenue	Daceyville	Botany Bay	LGOV
Former Sydney United Friendly Society Dispensary	45 Hardie Street	Mascot	Botany Bay	LGOV
Glanville Reserve including Streetscape - Verge	Glanville Avenue	Pagewood	Botany Bay	LGOV

Plantings of Canary Island Date Palm				
Harris Reserve	Bunnerong Road	Pagewood	Botany Bay	LGOV
Highhurstwood	125 Coward Street	Mascot	Botany Bay	LGOV
Hippo's Friends Child Care Centre	1082 Botany Road	Botany	Botany Bay	LGOV
House	1289 Botany Road	Mascot	Botany Bay	LGOV
House	1075 Botany Road	Mascot	Botany Bay	LGOV
House	117 Coward Street	Mascot	Botany Bay	LGOV
House	119 Coward Street	Mascot	Botany Bay	LGOV
House	1365 Botany Road	Botany	Botany Bay	LGOV
House	1447 Botany Road	Botany	Botany Bay	LGOV
House	147 Bay Street	Botany	Botany Bay	LGOV
House	135 Bay Street	Botany	Botany Bay	LGOV
House	145 Bay Street	Botany	Botany Bay	LGOV
House	6 Banksia Street	Botany	Botany Bay	LGOV
House	8 Banksia Street	Botany	Botany Bay	LGOV
House	47 Banksia Street	Botany	Botany Bay	LGOV
House	16 Bay Street	Botany	Botany Bay	LGOV
House	19 Bay Street	Botany	Botany Bay	LGOV
House	7 Banksia Street	Botany	Botany Bay	LGOV
House	30 Hardie Street	Mascot	Botany Bay	LGOV
House	85 Coward Street	Mascot	Botany Bay	LGOV
House	61 Hardie Street	Mascot	Botany Bay	LGOV
House		Rosebery		LGOV

	14 Harris Street		Botany Bay	
House	51 Harris Street	Rosebery	Botany Bay	LGOV
House	36 Hicks Avenue	Mascot	Botany Bay	LGOV
House	151 King Street	Mascot	Botany Bay	LGOV
House	159 King Street	Mascot	Botany Bay	LGOV
House	20 Johnson Street	Mascot	Botany Bay	LGOV
House	38 Johnson Street	Mascot	Botany Bay	LGOV
House	68 Johnson Street	Mascot	Botany Bay	LGOV
House	90 Johnson Street	Mascot	Botany Bay	LGOV
House	4 Macquarie Street	Rosebery	Botany Bay	LGOV
House	10 Miles Street	Mascot	Botany Bay	LGOV
House	16 Hicks Avenue	Mascot	Botany Bay	LGOV
House	24 Hicks Avenue	Mascot	Botany Bay	LGOV
House	23 Henley Street	Rosebery	Botany Bay	LGOV
House	110 Coward Street	Mascot	Botany Bay	LGOV
House	485 Gardeners Road	Rosebery	Botany Bay	LGOV
House	27 Gordon Street	Rosebery	Botany Bay	LGOV
House	70 Florence Avenue	Eastlakes	Botany Bay	LGOV
House	71 Frogmore Street	Mascot	Botany Bay	LGOV
House	45 Gordon Street	Rosebery	Botany Bay	LGOV
House	50 Gordon Street	Rosebery	Botany Bay	LGOV
House	121 Coward Street	Mascot	Botany Bay	LGOV
House	31 Cranbrook Street	Botany	Botany Bay	LGOV

House	35 Cranbrook Street	Botany	Botany Bay	LGOV
House	37 Cranbrook Street	Botany	Botany Bay	LGOV
House	66 Wellington Street	Mascot	Botany Bay	LGOV
House	64-66 Wellington Street	Mascot	Botany Bay	LGOV
House	1 Walker Avenue	Mascot	Botany Bay	LGOV
House	2 Woodstock Street	Botany	Botany Bay	LGOV
House	16 Tenterden Road	Botany	Botany Bay	LGOV
House	50 Tenterden Road	Botany	Botany Bay	LGOV
House	54 Tenterden Road	Botany	Botany Bay	LGOV
House	84 Tenterden Road	Botany	Botany Bay	LGOV
House	18 Johnson Street	Mascot	Botany Bay	LGOV
House	174 Sutherland Street	Mascot	Botany Bay	LGOV
House	27 Hicks Avenue	Mascot	Botany Bay	LGOV
House - Beverley	190 King Street	Mascot	Botany Bay	LGOV
House - Daktari	114 High Street	Mascot	Botany Bay	LGOV
House - Helena	1424 Botany Road	Botany	Botany Bay	LGOV
House - Verandale	87 Hardie Street	Mascot	Botany Bay	LGOV
House (front dwelling)	191 King Street	Mascot	Botany Bay	LGOV
House (The White House)	151 Bay Street	Botany	Botany Bay	LGOV
House Group	165-179 Bay Street	Botany	Botany Bay	LGOV
House Group	997-999 Botany Road	Mascot	Botany Bay	LGOV
House Group	10-14 Bay Street	Botany	Botany Bay	LGOV
House Group	45-57 Bay Street	Botany	Botany Bay	LGOV

House Group	1-3 Flora Street	Mascot	Botany Bay	LGOV
House Group	1158-1168 Botany Road	Botany	Botany Bay	LGOV
House Group	1268-1270 Botany Road	Botany	Botany Bay	LGOV
House Group	21-23 Salisbury Street	Botany	Botany Bay	LGOV
House Group	62-64 King Street	Mascot	Botany Bay	LGOV
House Group	144-148 King Street	Mascot	Botany Bay	LGOV
House Group	164-164A King Street	Mascot	Botany Bay	LGOV
House Group	63-65 Tenterden Road	Botany	Botany Bay	LGOV
House Group	15-17 Johnson Street	Mascot	Botany Bay	LGOV
House Group	37-39 Maloney Street	Rosebery	Botany Bay	LGOV
Jellicoe Park	Park Parade	Pagewood	Botany Bay	LGOV
John Brotchie Kindergarten	1361 Botany Road	Botany	Botany Bay	LGOV
Kerbs and Kerb Alignments	Bunnerong and Gardeners Roads	Daceyville	Botany Bay	SGOV
Lakes Hotel	305 Gardeners Road	Rosebery	Botany Bay	LGOV
Long Jetty, Botany Bay	Foreshore Road	Banksmeadow	Botany Bay	SGOV
Main Administration Building	Beauchamp Street	Banksmeadow	Botany Bay	LGOV
Marist Brothers School and Presbytery	Haig Avenue	Daceyville	Botany Bay	LGOV
Mascot (Botany Road) Underbridge		Mascot	Botany Bay	SGOV
Mascot (O'Riordan St) Underbridge		Mascot	Botany Bay	SGOV
Mascot (Robey Street) Underbridge		Mascot	Botany Bay	SGOV
Mascot (Shea's Ck) Underbridge		Mascot	Botany Bay	SGOV
Mascot Fire Station	139 Coward Street	Mascot	Botany Bay	SGOV

Mascot Park	Coward Street	Mascot	Botany Bay	LGOV
Mascot Public School Building Group	King Street	Mascot	Botany Bay	LGOV
Matraville Public School	310 Bunnerong Road	Hillsdale	Botany Bay	LGOV
Mature Ficus	818 Botany Road	Mascot	Botany Bay	LGOV
Mature Ficus	112 High Street	Mascot	Botany Bay	LGOV
Mature Hoop Pine	1055 Botany Road	Mascot	Botany Bay	LGOV
Memorial Park	814 Botany Road	Mascot	Botany Bay	LGOV
Memorial Park	814 Botany Road	Botany	Botany Bay	LGOV
National Bank Of Australasia, Former	1005 Botany Road	Rosebery	Botany Bay	LGOV
New Market Hotel	889 Botany Road	Rosebery	Botany Bay	LGOV
New Market Hotel	889 Botany Road	Botany	Botany Bay	LGOV
Orara	123 Coward Street	Mascot	Botany Bay	LGOV
Pier Hotel	1751 Botany Road	Banksmeadow	Botany Bay	LGOV
Police Station (circa 1871)	1441 Botany Road	Botany	Botany Bay	LGOV
Post Office (c.1923)	2 Banksia Street	Botany	Botany Bay	LGOV
Presbyterian Church of Australia and Manse	1561-1563 Botany Road	Botany	Botany Bay	LGOV
Railway bridge over Botany Road	Near McBurney Avenue	Mascot	Botany Bay	LGOV
Residential Building	16 The Esplanade	Botany	Botany Bay	LGOV
Ricketty Street Bridge	Ricketty Street	Mascot	Botany Bay	LGOV
Roxy Theatre (Former)	409 Gardeners Road	Rosebery	Botany Bay	LGOV
Ruins of the former Botany Pumping Station	Ross Smith Avenue	Mascot	Botany Bay	LGOV
Sandstone Kerb from Golf Course, Botany Road, Banksmeadow	Botany Road	Banksmeadow	Botany Bay	SGOV

Sandstone Kerb, Botany	Botany Road, NW & NE cnr Wilson Street	Botany	Botany Bay	SGOV
Sewage Pumping Station No 38 (SP0038)	Ross Smith Avenue	Mascot	Botany Bay	SGOV
Sewage Pumping Station No 53 (SP0053)	153 Coward Street	Mascot	Botany Bay	SGOV
Sewage Pumping Station No 60 (SP0060)	McFall Street	Botany	Botany Bay	SGOV
Sewer Vent	Tenderden Road	Botany	Botany Bay	SGOV
Shop	115 Coward Street	Mascot	Botany Bay	LGOV
Shop	95 Coward Street	Mascot	Botany Bay	LGOV
Single Storey Terrace Group	1239-1245 Botany Road	Mascot	Botany Bay	LGOV
Sir Joseph Banks Hotel (c.1840), Former	23 Anniversary Street	Banksmeadow	Botany Bay	LGOV
Sir Joseph Banks Hotel (c.1920)	1354 Botany Road	Botany	Botany Bay	LGOV
Sir Joseph Banks Park	Fremlin	Botany	Botany Bay	LGOV
Southern and Western Suburbs Ocean Outfall Sewer 1 (SWSOOS 1)	Marsh Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Botany Bay	SGOV
Southern and Western Suburbs Ocean Outfall Sewer 1 (SWSOOS 1)	Marsh Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Rockdale	SGOV
Southern and Western Suburbs Ocean Outfall Sewer 1 (SWSOOS 1)	Marsh Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Randwick	SGOV
Southern and Western Suburbs Ocean Outfall Sewer 2 (SWSOOS 2)	Eve Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Botany Bay	SGOV
Southern and Western Suburbs Ocean Outfall Sewer 2 (SWSOOS 2)	Eve Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Rockdale	SGOV
Southern and Western Suburbs Ocean Outfall Sewer 2 (SWSOOS 2)	Eve Street, Rockdale to Ocean Outfall, at Malabar	Rockdale To Malabar	Randwick	SGOV
St. Matthews Anglican Church (1862)	1331 Botany Road	Rosebery	Botany Bay	LGOV

St. Therese's Catholic Church Building Group	37 Sutherland Street	Rosebery	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm	Brighton Street	Botany	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm	Northern side of Bay Street	Botany	Botany Bay	LGOV
Streetscape - Verge plantings of Canary Island Date Palm, Brown Avenue, Botany	Brown Street	Botany	Botany Bay	LGOV
Streetscape - verge plantings of Canary Island Date Palms (and Hoop Pines)	Swinbourne Street (between William and Queen Streets)	Botany	Botany Bay	LGOV
Sydney (Kingsford Smith) Airport Group		Mascot	Botany Bay	LGOV
Sydney Water Corporation - Sewer Vent	Tenterden Road	Botany	Botany Bay	LGOV
Sydney Water Corporation Pumping Station SP0053	153 Coward Street	Mascot	Botany Bay	LGOV
Sydney Water Corporation Sewage Pumping Station SP0060	McFall Street	Botany	Botany Bay	LGOV
Tennyson Hotel	952 Botany Road	Mascot	Botany Bay	LGOV
Terrace Group	539-543 Gardeners Road	Rosebery	Botany Bay	LGOV
Terrace Group	42-54 Daphne Street	Botany	Botany Bay	LGOV
Terrace Group	523-537 Gardeners Road	Rosebery	Botany Bay	LGOV
Terrace Group	467-473 Gardeners Road	Rosebery	Botany Bay	LGOV
Terrace Group	192-204 King Street	Mascot	Botany Bay	LGOV
Terrace Group	150-160 King Street	Mascot	Botany Bay	LGOV
Uniting Church and Rectory	118 - 120 Coward Street	Mascot	Botany Bay	LGOV
Water and Sewerage Pumping Station	Sydney Airport	Mascot	Botany Bay	LGOV
Weatherboard House Group	18-20 Erith Street	Botany	Botany Bay	LGOV

There was a total of 216 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

C.2 Aboriginal Heritage

C.3 LAND ZONING

Botany Bay Local Environmental Plan 2013

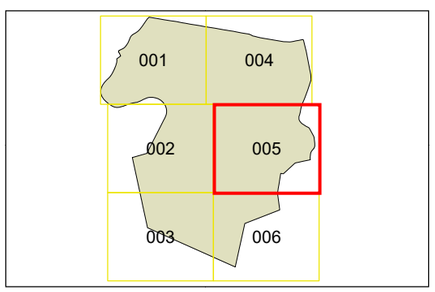
Land Zoning Map - Sheet LZN_005

Zone

B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B7	Business Park
IN1	General Industrial
IN2	Light Industrial
R2	Low Density Residential
R3	Medium Density Residential
R4	High Density Residential
RE1	Public Recreation
RE2	Private Recreation
SP1	Special Activities
SP2	Infrastructure
W3	Working Waterways
MD	SEPP (Major Development) 2005
DM	Deferred Matter

Cadastre

Base data 12/09/2014 © Land and Property Information (LPI)



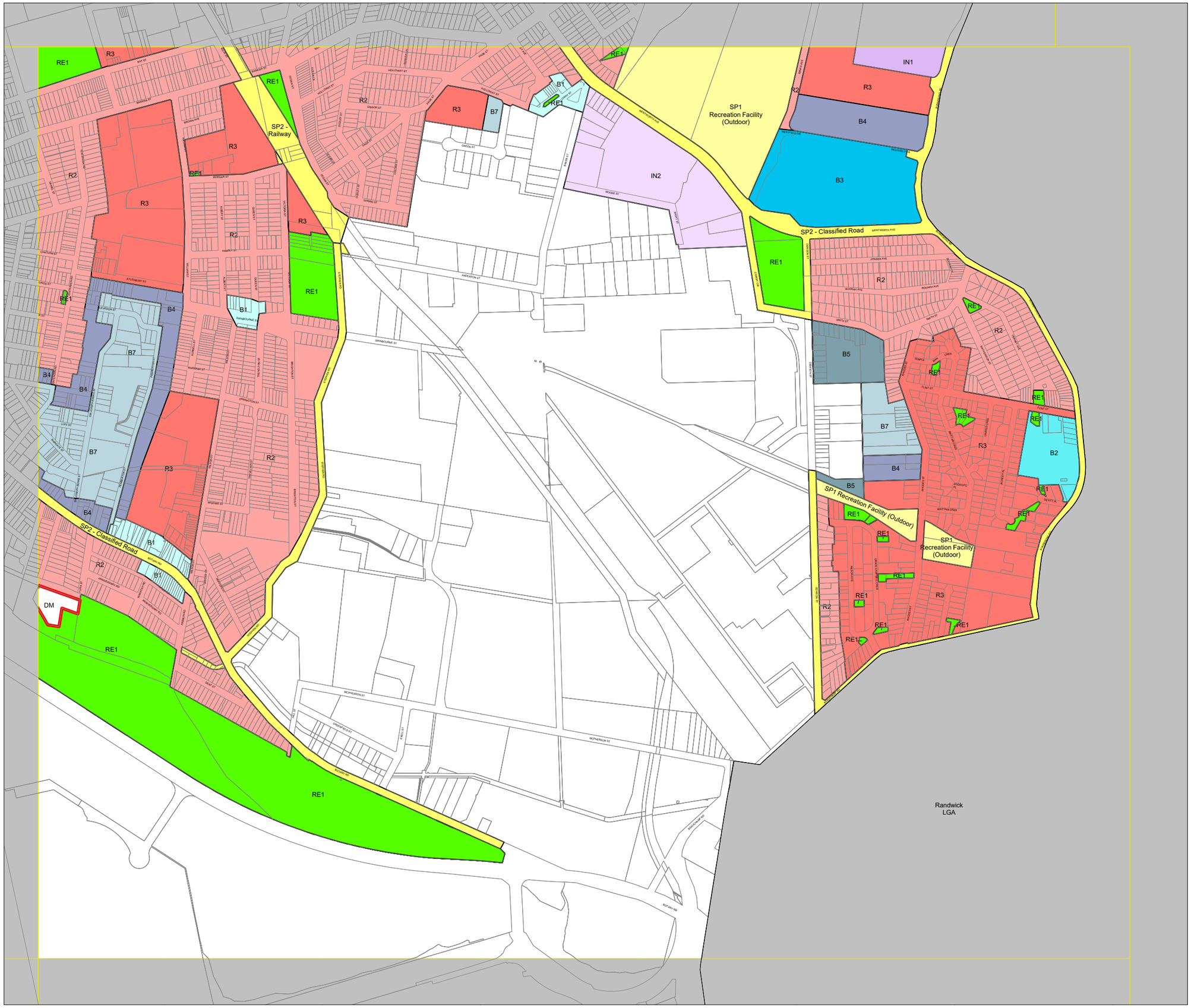
N

0 200 400 m

Scale 1:10,000 @ A3

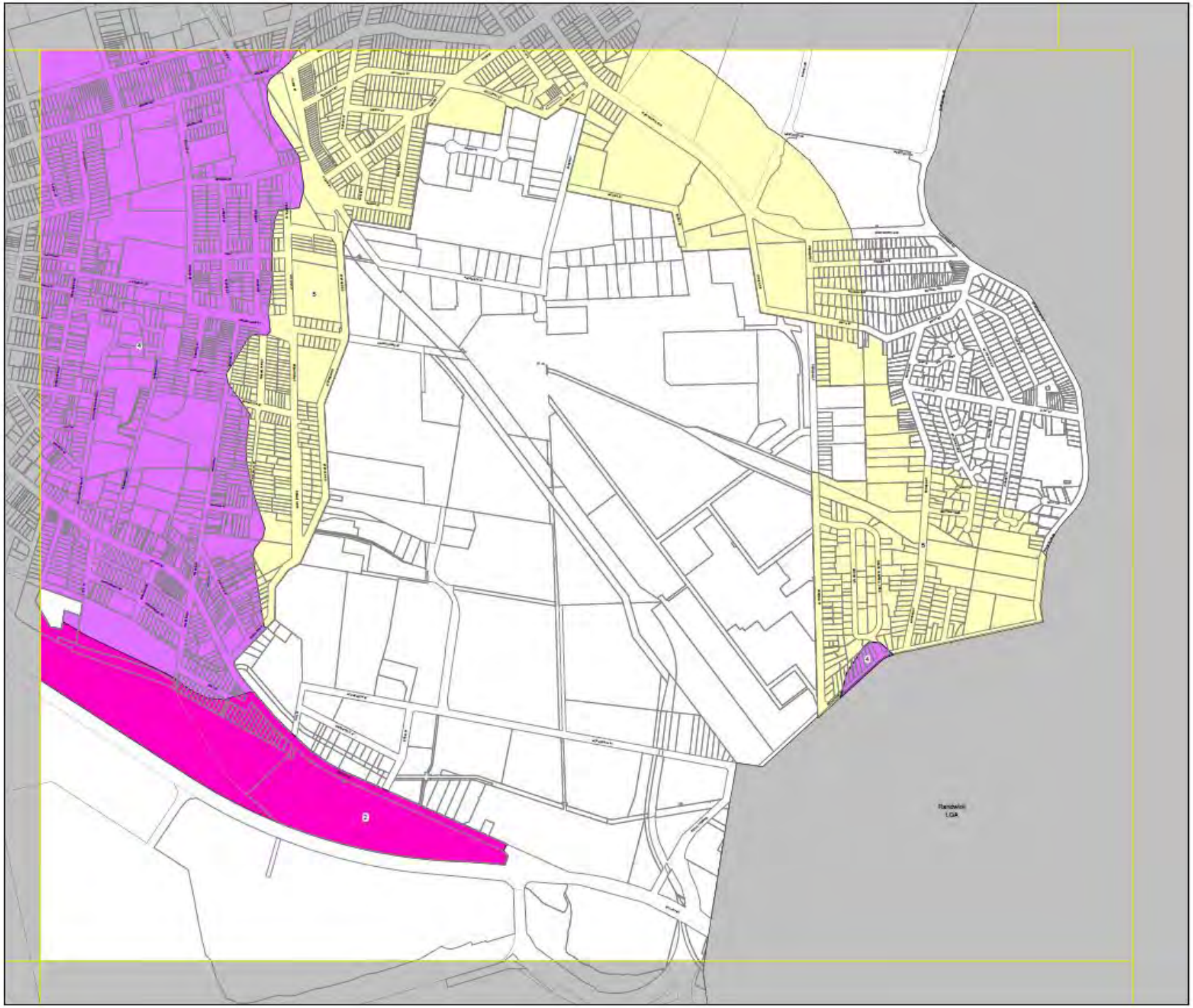
Projection GDA 1994 Zone 56

Map identification number:
1100_COM_LZN_005_010_20150722



Botany Bay Local Environmental Plan 2013

Acid Sulfate Soils Map - Sheet ASS_005

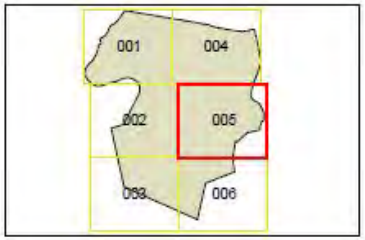


Acid Sulfate Soils

- 1 Class 1
- 2 Class 2
- 4 Class 4
- 5 Class 5

Cadastre

Base data 5/11/2012 © Land and Property Information (LPI)



N

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Scale 1:10,000 @ A3

Projection GDA 1994 Zone 56

Map identification number:

1100_COM_ASS_005_010_20130224

Randwick City Council
a sense of community

Randwick Local Environmental Plan 2012

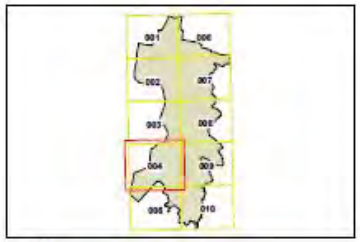
Land Zoning Map - Sheet LZN_004

Zone

- B1 Neighbourhood Centre
- B2 Local Centre
- E1 National Parks and Nature Reserves
- E2 Environmental Conservation
- IN2 Light Industrial
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU4 Primary Production Small Lots
- SP1 Special Activities
- SP2 Infrastructure
- MD SEPP (Major Development) 2005

Cadastre

Base data 01/01/2008 © Land and Property Information (LPI) Addendum data 12/11/2012
© Randwick City Council



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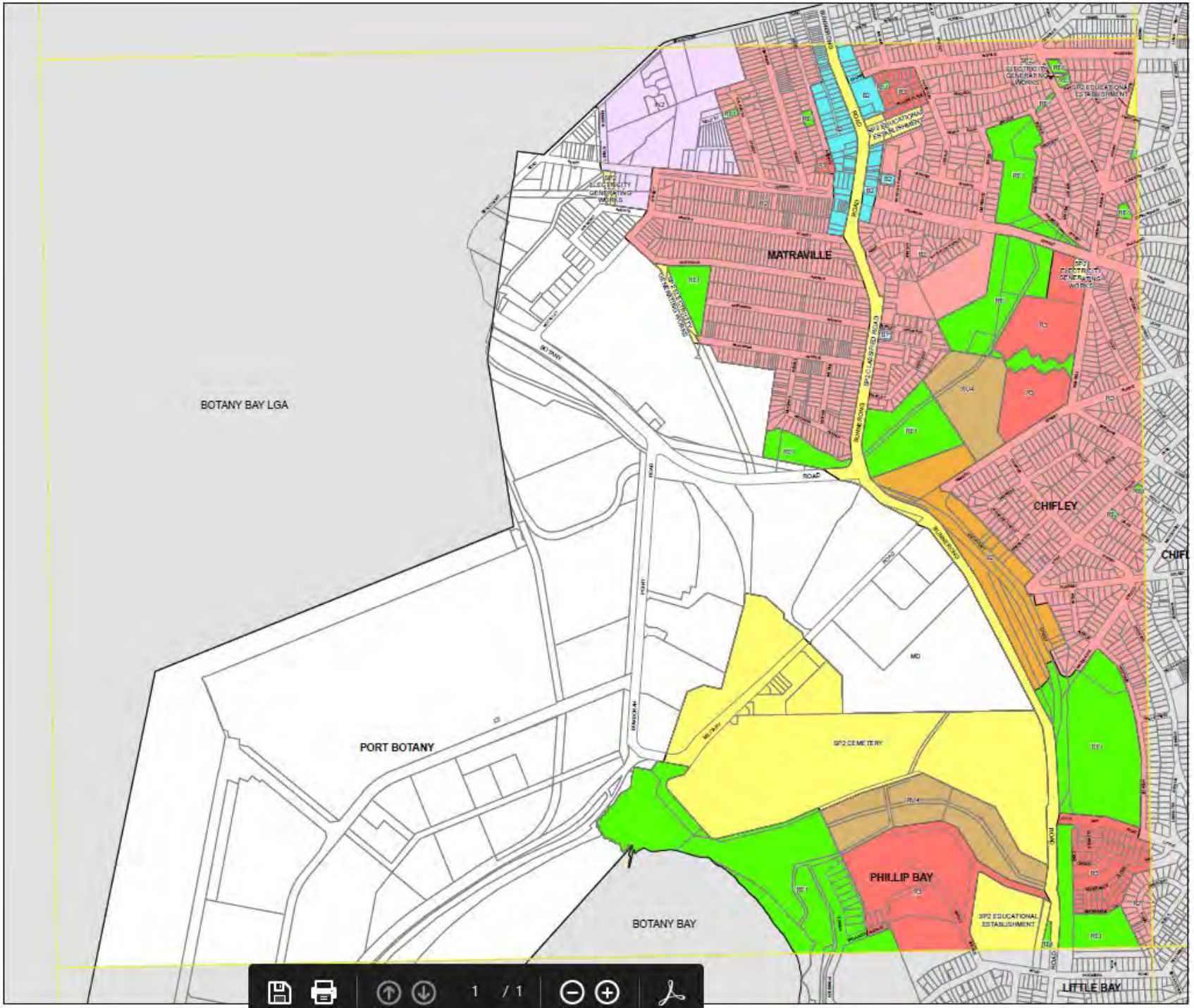
Projection: GDA 1994 MGA Zone 56

Scale: 1:10,000 @ A3

Map identification number: 6660_COM_LZN_004_010_20121113



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C.4 SOIL LANDSCAPES

xx	DISTURBED TERRAIN

Landscape— level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance, removal or burial of soil. Local relief <10 m, slopes <30%. Landfill includes soil, rock, building and waste materials. Original vegetation completely cleared, replaced with turf or grassland.

Soil— turfed fill areas commonly capped with up to 40 cm of sandy loam or up to 60 cm of compacted clay over fill or waste materials.

Limitations— dependent on nature of fill material. Mass movement hazard, unconsolidated low wet strength materials, impermeable soil, poor drainage, localised very low fertility and toxic materials.

LOCATION

Previous swamps, estuaries and wetlands. Previously estuarine shores of Port Jackson, along the lower reaches of the harbour foreshores (Parramatta and Georges Rivers). Large areas also occur on previously swampy areas at Circular Quay, Darling Harbour, Camellia, Silverwater, and Bunnerong power station. Fresh water swamps at Brookvale, Mona Vale, and North Narrabeen have also been filled.

Cut and fill areas. Examples of cut-and-fill for site levelling include Enfield railway marshalling yards and Randwick racecourse. Disused quarries occur in locations such as Ashfield, Homebush and Terrey Hills. Rubbish disposal dumps are located at Frenchs Forest, North Turramurra and Tempe. Areas levelled for heavy industry occur at Silverwater, Canterbury and Botany.

Numerous areas of disturbed terrain too small to represent at a scale of 1:100 000 are located throughout the Sydney Region.

LANDSCAPE

Geology

Artificial fill. Dredged estuarine sand and mud, demolition rubble, industrial and household waste. Also includes rocks and local soil materials.

Topography

Terrain disturbed by human activity. Local relief is usually <2 m, but occasionally up to 10 m. Most areas of disturbed ground have been levelled to slopes of <3%. In terraced cut and fill areas short rises may be steeper than 30%. Microtopography may be hummocky due to truck dumping of fill material.

Disturbed areas are often landscaped and artificially drained. Landform elements include berms, cut faces, embankments, mounds, pits and trenches.

Vegetation

This unit has been completely cleared. Disturbed terrain may be bare or covered with opportunist weeds such as cobbler's peg *Bidens pilosa*, purple top *Verbena bonariensis* and ribwort *Plantago lanceolata*. Most areas are eventually turned to grassland or lawn. Species typically include kikuyu *Pennisetum clandestinum*, couch *Cynodon dactylon* and paspalum *Paspalum dilatatum*.

Land use

Land use is varied and includes commercial and industrial complexes, sporting and recreational areas, quarries, and waste disposal sites. Commercial and business complexes are located at Circular Quay and Darling Harbour. Pyrmont, Glebe Island, Mortlake, Homebush, Silverwater, Camellia, Tempe, Regents Park and Artarmon have been developed for industry on this soil landscape. Many recreation areas are underlain by compacted waste in both wetland and disused quarry sites.

Former estuaries, swamps and lagoons at Bayview, Cammeray, Manly Vale, Rose Bay, Double Bay, The Spit and Hurstville Grove have been drained and filled for use as recreational areas.

Old quarries are located at Artarmon, Homebush, North Ryde, Tempe and Allawah.

Existing Erosion

Erosion varies markedly according to site characteristics including slope, aspect and exposure. In general, severe sheet and rill erosion often occur at quarries, gravel pits and places where unconsolidated or disturbed material remains without a protective cover of vegetation, asphalt or concrete.

SOILS

Dominant Soil Materials

xx1— Loose black sandy loam. This is black loamy sand to loam-fine-sandy with loose apedal single-grained structure and sandy fabric. It is used for topsoiling turf and often corresponds to the lowland Nepean River alluvium or Elderslie soil series of Walker (1960). Local sands have also been used for topdressing. This material occurs as topsoil (A1 horizon).

The material is brittle when dry and crumbly when moist. The colour ranges from a dark brown to black (10YR 3/3-10YR 2/1) or brown (10YR 4/6). It is often water repellent and a surface crust may be present. The pH ranges from moderately acid (pH 5.0) to neutral (pH 7.5). Roots are common to abundant when turfed and ironstone nodules are occasionally present.

xx2— Compacted mottled clay. This is a mottled, compacted sandy clay loam to medium clay with an apedal massive to moderately pedal structure. It generally has been compacted to form an impermeable isolating cap over potentially hazardous buried materials.

Peds when present are often platy and smooth-faced. Colour is highly variable and mottles are common. The pH is also variable, ranging from extremely acid (pH 3.5) to slightly alkaline (pH 8.0). Platy or concretionary ironstones are occasionally present and roots are absent.

xx3— Variable transported fill. This material is commonly referred to as fill and may consist of any type of soil or regolith material. It often includes demolition rubble and industrial and household wastes. Colour, texture, structure, fabric, degree of compaction, porosity and pH vary markedly.

xx4— Dark dredged muds and sands. This material consists of dark dredged sands, sandy loams to silty clay loams and sandy clays with apedal single-grained to massive structure and sandy fabric. This material occurs as subsoil.

Colour varies from black (10YR 2/1) to a yellowish-brown (2.5Y 5/2). Charcoal, shells or shell fragments are commonly present. This material swells, is highly saline and neutral (pH 7.0) to moderately alkaline (pH 9.0) when first dredged, but with drainage and oxidation the salinity levels drop and acidity may increase dramatically.

Occurrence and Relationships.

Soils have been disturbed to a depth of at least 100 cm. Most of the original soil has either been removed, buried or greatly disturbed. In quarries, bedrock is often exposed. In landfill areas combinations of transported earth, weathered rock, dredged estuarine sediments as well as industrial, building and household wastes occur. Most disturbed areas are eventually artificially topsoiled and revegetated or covered by buildings, concrete or bitumen.

The occurrence and relationship of soil materials is highly variable. Some observed examples are given below.

Landscaped Terrace. Where the dark sandy loam (**xx1**) occurs it is as a 10-15 cm deep topsoil overlying either 30-80 cm of compacted mottled clay (**xx2**) or several metres of variable transported fill (**xx3**) or dark dredged muds and sands (**xx4**). Multi-layered lenses of compacted **xx2** and **xx3** can occur. Total soil depth is several metres. Plant roots are often restricted to prepared topsoils.

Truck dumped hummocks. Several metres of unconsolidated hummocks of **xx3** overlie many metres of compacted multi-layered lenses of **xx3** and **xx4**. Near estuaries **xx3** and **xx4** are occasionally mixed together. Total soil depth is several metres.

Excavated areas. In excavated areas soil materials are usually absent.

LIMITATIONS TO DEVELOPMENT

Urban Capability

Capable of urban development with special restrictive conditions.

Rural Capability

Once grassed and stabilised this unit may be capable of being grazed, but is not capable of cultivation.

Landscape Limitations

Mass movement hazard (steep locations)
Seasonal waterlogging (localised)
Erosion hazard (localised)
Steep slopes (localised)
Non-cohesive soil (localised)
Rock outcrop (localised)

Soil Limitations

xx1 Highly permeable
Low available water capacity
Hardsetting surface (localised)
Low fertility

xx2 Low wet strength
Low fertility
Low available water capacity
Stoniness

xx3 Unconsolidated materials
Low fertility
Highly toxic (localised)
High organic matter (localised)
Strongly acid or alkaline (localised)

xx4 Unconsolidated materials (localised)
Saline
Sodic
Low available water capacity
Low fertility
Erodibility (localised)
Moderately alkaline
Acid sulfate potential

Fertility

The fertility of **xx1** is inherently low, but this material is often fertilised. Other soil materials have very low fertility.

Erodibility

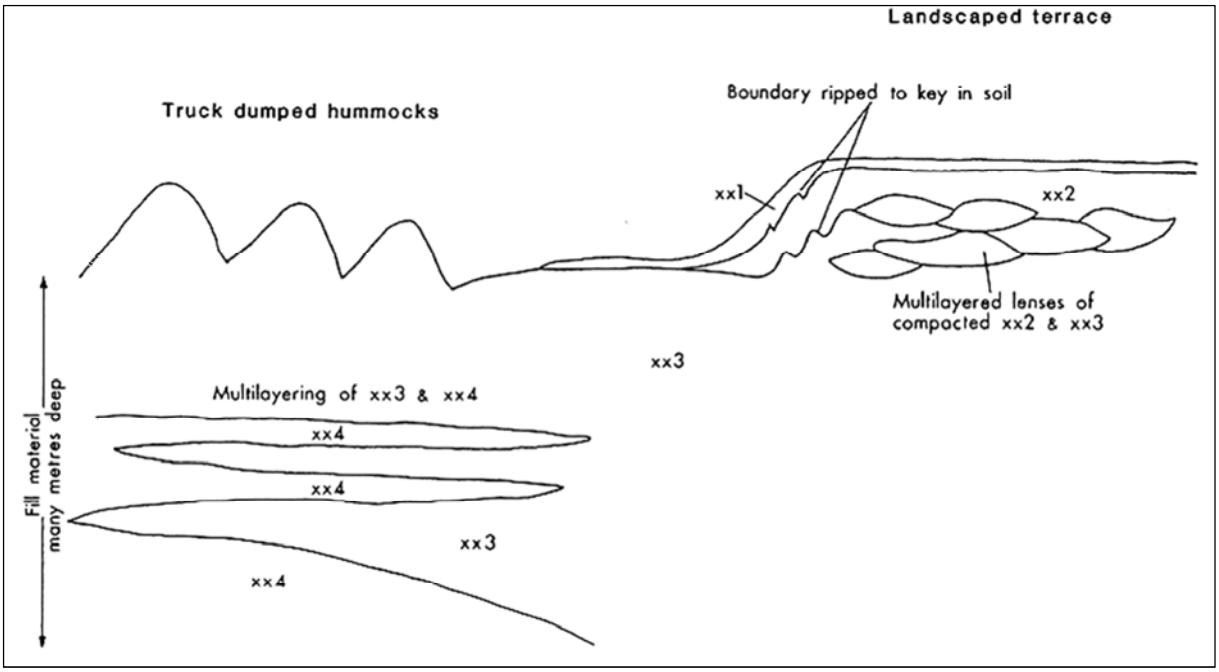
The erodibility of **xx1** is low as it consists dominantly of well drained coarse sand grains. The erodibility of the other soil materials is highly variable. Unconsolidated materials are often extremely erodible.

Erosion hazard

Non-concentrated flows produce highly variable erosion hazard, ranging from low to extreme. Calculated soil loss for the first twelve months of urban development ranges up to 30 t/ha for topsoil. Subsoil losses have not been calculated as they are highly variable. Soil erosion from concentrated flows ranges from low to high.

Surface Movement Potential

Highly variable, depending on materials and degree of compaction.



Schematic cross-section of Disturbed Terrain soil landscape illustrating the occurrence and relationship of the dominant soil materials.

tg	TUGGERAH	Aeolian

Landscape— gently undulating to rolling coastal dunefields. Local relief to 20 m, slope gradients generally 1-10%, but occasionally up to 35%. North— south oriented dunes with convex narrow crests, moderately inclined slopes and broad gently inclined concave swales. Extensively cleared open-forest and eucalypt/apple woodland.

Soils— deep (>200 cm) *Podzols (Uc2.31, Uc2.32, Uc2.34)* on dunes and *Podzols/Humus Podzol intergrades (Uc2.23, Uc2.21, Uc2.3, Uc4.33)* on swales.

Limitations —extreme wind erosion hazard, non-cohesive, highly permeable soil, very low soil fertility, localised flooding and permanently high watertables.

LOCATION

The largest example is the extensive dune system of the Botany Lowlands. This includes the local government areas of Botany, Randwick and South Sydney. Other examples are found along the coast at Palm Beach, Narrabeen, Collaroy, Rose Bay, Bondi, Coogee, Kyeemagh, Brighton-le-Sands, Monterey, Ramsgate and Dolls Point.

LANDSCAPE

Geology

Quaternary (Holocene and Pleistocene) wind blown, fine to medium grained, well sorted marine quartz sand. Shell fragments are absent and the sand appears to be finer than sands found on foredunes and on beaches.

Topography

Gently undulating plains and rolling undulating rises of broad, level to very gently inclined, swales and dunes. Elevation is usually <20 m, although the northern part of the Botany Lowlands dunefield rises to elevations of up to 40 m. Local relief is <20 m. Dune sideslopes are gently to moderately inclined. Isolated steep rises with slopes up to 35% occur. Steep slopes are usually associated with undercutting of the toe of dunes or where wind-blown sand has been deposited at the base of obstacles such as outcrops of Hawkesbury Sandstone.

Coastal hind-dunes run sub-parallel to the coast. With increasing distance from the coast the dunes assume a north-south trend. Most rainfall infiltrates directly into the soil. Run off, when it occurs, collects in a series of depressions, lagoons and swamps.

Vegetation

Almost completely cleared dry sclerophyll eucalypt and apple woodland. Small patches remain, notably in Scarborough Park at Ramsgate. The original native vegetation probably formed dry sclerophyll tall open-woodland or forest. Dominant tree species are smooth-barked apple *Angophora costata*, Sydney peppermint *Eucalyptus piperita*, and old man banksia *Banksia aemula*. The shrubby sclerophyllous understorey contains many species including bracken *Pteridium esculentum*, Christmas bush *Ceratopetalum gummiferum*, woody pear *Xylomelum pyriforme*, and prickly moses *Acacia ulicifolia*.

Land use

Although mostly urban residential land development, much of Botany, Mascot, Zetland and Chifley have been developed for heavy industry. Recreational land use also occupies large areas. Examples are Centennial Park, Eastlakes golf course, Bonnie Doon golf course, Randwick racecourse, Rose Bay golf course. Few areas of vacant land remain.

Existing Erosion

No appreciable erosion occurs where slopes are low and a vigorous ground cover is maintained. Isolated blowouts caused by wind erosion occur in exposed areas where cover has been removed.

SOILS

Dominant Soil Materials

tg1— Loose speckled grey-brown loamy sand. This is grey-brown speckled sand to loamy sand with apedal single-grained structure and porous sandy fabric. It generally occurs as topsoil (A1 horizon).

This material consists of a mixture of small dark organic fragments and clean, well sorted, quartz sand grains. Colour ranges from brownish-grey (10YR 4/1) to brownish-black (10YR 2/3) or black (10YR 2/1) with increasing organic matter. It is characteristically water repellent. The pH is slightly acid (pH 6.0) to neutral (pH 7.0). Roots are abundant and charcoal fragments are often present. Stones are absent.

tg2— Bleached loose sand. This is bleached sand with apedal single-grained structure and porous sandy fabric. It occurs as an A2 horizon.

The surface condition is loose and the material is non-cohesive when dry and weakly coherent when moist. Dry colours are commonly bleached and moist colour ranges from light grey (7.5YR 8/1) and greyish-yellow (2.5Y 7/2) to dull yellow-orange (10YR 7/4). The pH ranges from moderately acid (pH 5.5) to neutral (pH 7.0). Charcoal and stones are absent and roots are rare.

tg3— Grey-brown mottled sand. This is mottled sand or loamy sand with apedal single-grained structure and loose sandy fabric. It occurs as subsoil in areas of poor drainage.

It is weakly coherent when moist and non-cohesive when either dry or saturated. Colours range from brownish-grey (10YR 6/1) to greyish-brown (7.5YR 4/2). Faint grey mottles become increasingly

common with depth. This material is seasonally waterlogged. The pH ranges from moderately acid (pH 5.5) to neutral (pH 7.0). Charcoal and stones are absent and roots are rare.

tg4— Black soft sandy organic pan. This is a black, soft, organic stained sand to loamy sand with apedal massive structure and sandy or, less commonly, earthy fabric. It often occurs as subsoil pan (B horizon) associated with **tg5**.

This material consists of quartz sand grains coated and weakly cemented with black organic compounds. Colour is commonly black (10YR 1.7/1) or brownish-black (10YR 3/1). The pH ranges from moderately acid (pH 5.5) to neutral (pH 7.0). This material requires up to a moderate force to disrupt and is often hardsetting on exposure. Stones, charcoal and roots are absent.

tg5— Brown soft sandy iron pan. This is brown soft iron stained sand to loamy sand with apedal massive structure and sandy or less commonly earthy, fabric. It generally occurs as subsoil (B horizon) and is commonly known as coffee rock.

This material consists of quartz sand grains coated and weakly cemented with yellow and red sesquioxides. Colour varies from bright yellowish- brown (10YR 7/6) to brown (10YR 4/6). Dark brown and orange mottles are common. This material requires a moderate force to disrupt and is often hardsetting on exposure. The pH ranges from moderately acid (pH 5.5) to neutral (pH 7.0). Roots are rare, and stones and charcoal are absent.

tg6— Yellow massive sand. This is yellow-orange sand to clayey sand with apedal single-grained or apedal massive structure and sandy or earthy fabric. It usually occurs as deep subsoil (B horizon).

This material consists of clay-coated quartz sand grains that are compacted, but not cemented. Colour varies from light yellow (2.5Y 7/4) to dull yellow-orange (10YR 7/3). The pH ranges from strongly acid (pH 4.5) to neutral (pH 7.0). Stones, charcoal and roots are absent.

Associated Soil Materials

Poorly drained swales have dark brown or black, organic rich topsoil materials that resemble **wa1**.

Occurrence and Relationships

Dunes. Usually 30 cm of loose, speckled, grey-brown loamy sand (**tg1**) overlies >100 cm of bleached loose sand (**tg2**). **tg2** has a piped and convoluted boundary with intermixed black soft sandy organic pan (**tg4**) and brown soft sandy iron pan (**tg5**) materials. These can be up to 50 cm deep. More than 200 cm of yellow massive sand (**tg6**) occurs as deep subsoil. Boundaries are sharp to clear. Total soil depth exceeds 300 cm (*Podzols* (*Uc2.31, Uc2.32, Uc2.34*)).

Swales. Up to 25 cm of **tg1** overlies >30 cm of **tg2**. **tg3** occurs below **tg2** usually at the level of the capillary fringe of the watertable. **tg4** underlies **tg3** and is normally closely associated with the watertable. Occasionally **tg5** is present between **tg4** and **tg6**. **tg6** occurs below **tg4** and may be several metres thick. Boundaries are sharp except for the boundary between **tg2** and **tg3**, which is gradual. Total soil depth exceeds 200 cm (*Podzols and Humus Podzol intergrades* (*Uc2.23, Uc2.21 and Uc2.3*)).

LIMITATIONS TO DEVELOPMENT

Urban Capability

Low to moderate capability for urban development.

Rural Capability

Not relevant.

Landscape Limitations

Wind erosion hazard
Waterlogging (localised)

Steep slopes (localised)
Flood hazard (localised)
Non-cohesive soils

Soil Limitations

tg1 Low available water capacity
High organic matter (localised)
Low fertility

tg2 Low available water capacity
Very low fertility
Strongly acid

tg3 Low available water capacity
Very low fertility
Salinity (localised)
Hardsetting

tg4 Low available water capacity
Hardsetting
Very low fertility
Strongly acid
Very high aluminium toxicity

tg5 Low available water capacity
Hardsetting
Very low fertility
Very strongly acid
Salinity (localised)
High aluminium toxicity

tg6 Low available water capacity
Very low fertility
Strongly acid

Fertility

The general fertility is low to very low. All soil materials have low available water capacity, low CEC and very low nutrient status. Soils are strongly acid and **tg4** and **tg5** have a high aluminium toxicity.

Erodibility

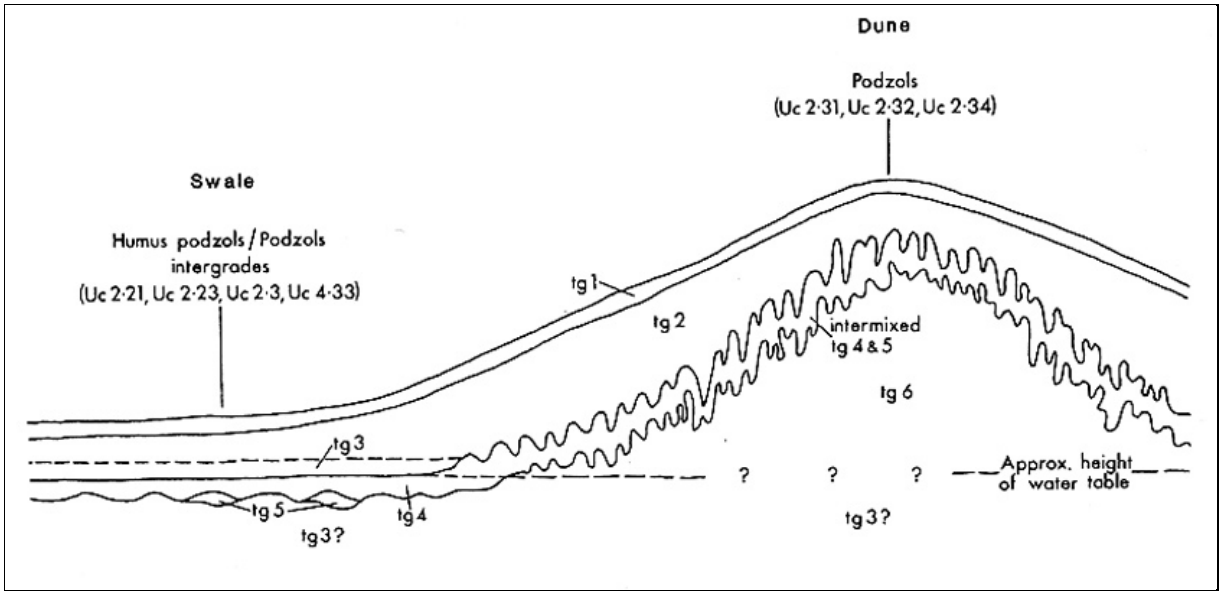
The soil materials **tg1**-**tg3**, and **tg6** have low erodibility as they consist of highly permeable, coarse sand grains. However, their lack of cohesion makes them very susceptible to erosion from concentrated flows. Soft pan materials **tg4** and **tg5** are weakly cemented by iron oxide or aluminium organic compounds and have a very low erodibility.

Erosion Hazard

The erosion hazard for non-concentrated flows ranges from low to moderate. Calculated soil loss for the first twelve months of urban development ranges up to 14 t/ha for topsoil and 35 t/ha for exposed subsoil. The erosion hazard for concentrated flows and wind is very high to extreme.

Surface Movement Potential

The sandy soil materials are stable.



Schematic cross-section of Tuggerah soil landscape illustrating the occurrence and relationship of the dominant soil materials.

C.5 CONTAMINATION SEARCHES

Home Contaminated land Record of notices

Search results

Your search for:Suburb: BOTANY

Matched 3 notices relating to 1 site.

Search Again

Refine Search

Suburb	Address	Site Name	Notices related to this site
BOTANY	49-61 Stephen ROAD	Nuplex Resins	3 current

Page 1 of 1

4 February 2020

Home Contaminated land Record of notices

Search results

Your search for: Suburb: BANKSMEADOW

Matched 47 notices relating to 5 sites.

Search Again

Refine Search

Suburb	Address	Site Name	Notices related to this site
BANKSMEADOW	1801 Botany ROAD	Discovery Cove, Former Ampol Rail Terminal	1 current
BANKSMEADOW	Coal Pier ROAD	Former Mobil Banksmeadow Terminal	1 former
BANKSMEADOW	Port Feeder ROAD	Orica Botany (Pre-2003 Regulation)	12 former
BANKSMEADOW	16-20 Beauchamp ROAD	Orica Botany Groundwater Project	8 current and 21 former
BANKSMEADOW	McPherson Street and Nant STREET	Section of ICI Southlands	4 former

Page 1 of 1

4 February 2020

Search results

Your search for: LGA: RANDWICK CITY COUNCIL

Matched 45 notices relating to 8 sites.

Search Again

Refine Search

Suburb	Address	Site Name	Notices related to this site
BANKSMEADOW	McPherson Street and Nant STREET	Section of ICI Southlands	4 former
MATRAVILLE	515 Bunnerong ROAD	7-Eleven Service Station Matraville	2 current
MATRAVILLE	Bunnerong/Military ROADS	Ampol Matraville Refinery	9 former
MATRAVILLE	Bumborah Point ROAD	Bunnerong Power Station	5 former
MATRAVILLE	133 -149 Beauchamp ROAD	Former Golden Fleece Terminal No1	7 former
MATRAVILLE	151 Beauchamp ROAD	Former Golden Fleece Terminal No2	2 former
RANDWICK	126-130 Barker STREET	7-Eleven Service Station	2 current and 12 former
RANDWICK	33-37 Carrington ROAD	Service Station, Randwick	4 current

Page 1 of 1

14 May 2020

Browse | Search by Map | Search by Form

Search by Map

Navigate the map to locate a facility and view its report for the selected reporting year. Markers with numbers indicate the number of facilities in an area. Markers with no numbers indicate the location of an individual facility. At higher zoom levels, the number of markers with numbers will decrease. Click on a facility marker (a marker with no numbers) to view a facility's annual report.

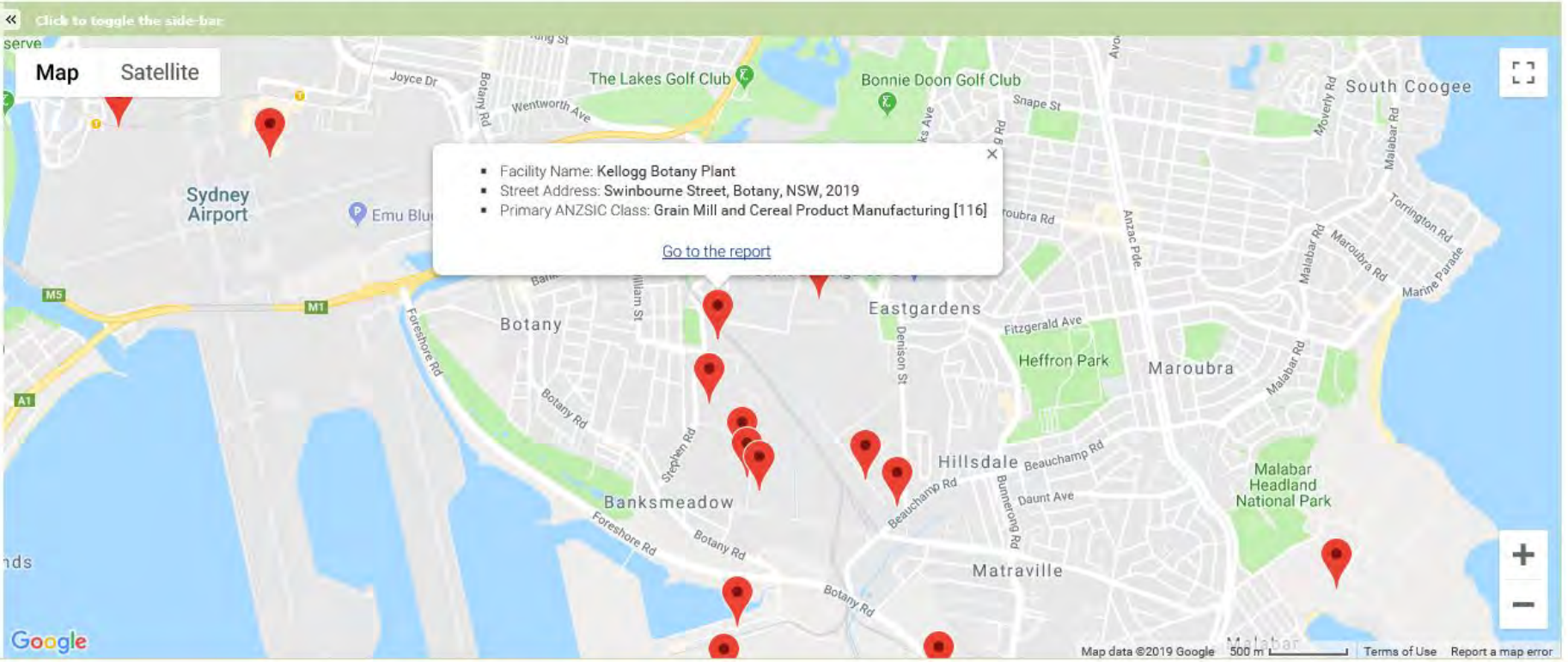
Search options

Reporting year: 2017/2018

Shape selection:

Facilities selected: 0

Search | Reset



Display time: 0.018s

Australian Government
Department of the Environment and Energy

National Pollutant Inventory

- Summary
- Emissions
- Transfers
- Download
- Map

2017/2018 report for ALLNEX RESINS AUSTRALIA PTY LTD, Allnex Resins Botany - Botany, NSW

A list of Substances for an individual report.

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Acrylic acid	0.95	0.95				**0.95**
Ammonia (total)	250	250				**250**
Carbon monoxide	3,200		3,200			**3,200**
Ethylene glycol (1,2-ethanediol)	220	220				**220**
Methyl methacrylate	140	140				**140**
Oxides of Nitrogen	5,300		5,300			**5,300**
Particulate Matter 10.0 um	390		390			**390**
Particulate Matter 2.5 um	380		380			**380**
Polycyclic aromatic hydrocarbons (B[a]Peq)	0.021		0.021			**0.021**
Styrene (ethenylbenzene)	1,200	1,200				**1,200**
Sulfur dioxide	37		37			**37**
Toluene (methylbenzene)	960	960	0.19			**960**
Toluene-2,4-diisocyanate	0.032	0.032				**0.032**
Total Volatile Organic Compounds	85,000	85,000	330			**85,000**
Xylenes (individual or mixed isomers)	2,900	2,900	0.13			**2,900**

[1] All emission/transfer quantities are displayed to two significant figures. Displayed emission totals may not exactly equal the sum of their individual emissions.
[2] Air Total = Air Point + Air Fugitive

Australian Government
Department of the Environment and Energy

National Pollutant Inventory

- Summary
- Emissions
- Transfers
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2017/2018 report for CALTEX AUSTRALIA PETROLEUM PTY LTD, Caltex Banksmeadow Terminal - Banksmeadow, NSW

A list of Substances for an individual report.

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Benzene	240	240				**240**
Cumene (1-methylethylbenzene)	240	240				**240**
Cyclohexane	130	130				**130**
Ethanol	150	150				**150**
Ethylbenzene	50	50				**50**
n-Hexane	860	860				**860**
Styrene (ethenylbenzene)	0.00	0.00				**0.00**
Toluene (methylbenzene)	700	700				**700**
Total Volatile Organic Compounds	110,000	110,000				**110,000**
Xylenes (individual or mixed isomers)	250	250				**250**

[1] All emission/transfer quantities are displayed to two significant figures. Displayed emission totals may not exactly equal the sum of their individual emissions.
[2] Air Total = Air Point + Air Fugitive

Export to: CSV

NPI

Australian Government
Department of the Environment and Energy

National Pollutant Inventory

- Summary
- Emissions
- Transfers
- Download
- Map

2017/2018 report for ORICA AUSTRALIA PTY LTD, Groundwater Treatment Plant - Matraville, NSW

A list of Substances for an individual report.

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Acetic acid (ethanoic acid)	78		78		0.010	**78**
Ammonia (total)	13	4.1	8.6		0.030	**13**
Arsenic & compounds	0.027		0.027			**0.027**
Beryllium & compounds	0.033		0.033			**0.033**
Cadmium & compounds	0.0030		0.0030			**0.0030**
Carbon monoxide	690		690			**690**
Chlorine & compounds	140		140		0.0040	**140**
Chromium (III) compounds	1.5		1.5			**1.5**
Chromium (VI) compounds	2.2		2.2			**2.2**
Copper & compounds	0.60		0.60			**0.60**
1,2-Dichloroethane	300	0.050	300		0.00010	**300**
Fluoride compounds	14		14			**14**
Hydrochloric acid	350	0.30	350		0.090	**350**
Hydrogen sulfide	19	0.050	19		0.090	**19**
Lead & compounds	0.16		0.16			**0.16**

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Magnesium oxide fume	2.9		2.9			**2.9**
Mercury & compounds	0.0030		0.0030			**0.0030**
Nickel & compounds	11		11			**11**
Oxides of Nitrogen	38,000		38,000			**38,000**
Particulate Matter 10.0 um	1000		1000			**1000**
Particulate Matter 2.5 um	530		530			**530**
Polychlorinated dioxins and furans (TEQ)	0.00000040		0.00000040			**0.00000040**
Polycyclic aromatic hydrocarbons (B[a]Peq)	0.0070		0.0070			**0.0070**
Sulfur dioxide	310		310			**310**
Total Volatile Organic Compounds	630	0.050	630			**630**

[1] All emission/transfer quantities are displayed to two significant figures. Displayed emission totals may not exactly equal the sum of their individual emissions.
[2] Air Total = Air Point + Air Fugitive

Export to: CSV

NPI

- NPI Home
- NPI Database Search

Search Criteria

- Source Type = Facility (Industry)
- Include subthreshold facility data = Yes
- Reporting year = 2017/2018
- State = National
- Substance = All
- Facility Name/ID like 138
- Destination type = All

Edit Criteria

Key

Links to an another web site
Opens a pop-up window

Display time: 0.015s

Australian Government
Department of the Environment and Energy

National Pollutant Inventory

2017/2018 report for KELLOGG (AUST.) PTY LTD, Kellogg Botany Plant - Botany, NSW

A list of Substances for an individual report.

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Arsenic & compounds	0.021	0.00	0.021			**0.021**
Beryllium & compounds	0.00010	0.00	0.00010			**0.00010**
Cadmium & compounds	0.12	0.00	0.12			**0.12**
Carbon monoxide	9,000	52	8,900			**9,000**
Chromium (III) compounds	0.15	0.00	0.15			**0.15**
Chromium (VI) compounds	0.00	0.00	0.00			**0.00**
Copper & compounds	0.090	0.00	0.090			**0.090**
Fluoride compounds	0.00	0.00	0.00			**0.00**
Hydrochloric acid	0.00	0.00	0.00			**0.00**
Lead & compounds	0.053	0.00	0.053			**0.053**
Magnesium oxide fume	0.00	0.00	0.00			**0.00**
Mercury & compounds	0.028	0.00	0.028			**0.028**
Nickel & compounds	0.22	0.00	0.22			**0.22**
Oxides of Nitrogen	11,000	80	11,000			**11,000**
Particulate Matter 10.0 um	5,100	0.010	5,100			**5,100**
Particulate Matter 2.5 um	790	0.010	790			**790**
Polychlorinated dioxins and furans (TEQ)	0.00	0.00	0.00			**0.00**

Substance	Air Total (kg)[1][2]	Air Fugitive (kg)[1]	Air Point (kg)[1]	Land (kg)[1]	Water (kg)[1]	Total (kg)[1]
Polycyclic aromatic hydrocarbons (B[a]Peq)	0.068	0.00	0.068			**0.068**
Sulfur dioxide	120	0.070	120			**120**
Total Volatile Organic Compounds	600	11	580			**600**

[1] All emission/transfer quantities are displayed to two significant figures. Displayed emission totals may not exactly equal the sum of their individual emissions.
[2] Air Total = Air Point + Air Fugitive

Export to: CSV

NPI

- NPI Home
- NPI Database Search

Search Criteria

- Source Type = Facility (Industry)
- Include subthreshold facility data = Yes
- Reporting year = 2017/2018
- State = National
- Substance = All
- Facility Name/ID like 430
- Destination type = All

Edit Criteria

Key

Links to an another web site
Opens a pop-up window

Display time: 0.022s

APPENDIX D CLAUSE 228 CHECKLIST

A checklist of factors that should be considered in the assessment of impacts prior to its determination is included within Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. This clause identifies sixteen issues that need to be addressed. The following text provides summary details of each of the issues, the majority of which have been addressed within the body of this document.

Table D-1 Clause 228 Factors

Factor	Impact
a. Any environmental impact on a community? The proposal would have minor impacts on the community during construction. This includes temporary noise and traffic issues. These impacts are manageable with the recommended safeguards and management measures recommended in Section 6.4.	Short term negative
b. Any transformation of a locality? The proposal would result in changes to the locality through the construction of new signalling infrastructure and rail tracks (crossover). The proposal would be unlikely to transform the locality as the area is an existing railway precinct within a predominantly industrial area.	Short term negative
c. Any environmental impact on the ecosystems of the locality? Impacts to ecosystems in the locality were considered in the Biodiversity Assessment (Appendix A). No impact to the ecosystem is predicted to occur as a result of the proposal.	Nil
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? There would be a minor reduction in the aesthetic quality of the locality due to the construction of new signalling infrastructure, rail track and changes to surrounding rail embankments. These changes would be consistent with existing infrastructure at the proposal site.	Short term negative
e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There would be no impacts on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.	Nil
f. Any impact on the habitat of protected fauna (within the meaning of the *Biodiversity Conservation Act 2016*)? Minimal habitat for protected fauna is present within the proposed works site that has been previously disturbed. Higher quality habitat is located in surrounding areas; however, some mobile threatened species including microbats and migratory shorebirds may occasionally visit the study area to investigate potential foraging opportunities. During construction, there is low to very low potential for impact on protected fauna. Measures to reduce impacts have been recommended in Section 6.2, primarily involving confining the works areas and impacts as much as possible and restoring disturbed areas as soon as practical.	Short term negative

g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would be unlikely to endanger any species of animal, plant or other form of life. No threatened species are considered to have a moderate or high likelihood of occurring. Impacts to other fauna and flora would be negligible. Measures to reduce risks have been recommended in Section 6.2, primarily, confining the works areas and impacts as much as possible and restoring disturbed areas as soon as practical.	Short term negative
h. Any long-term effects on the environment? The proposal would enhance fright supply and support the national freight rail network. The proposal is unlikely to have any long-term effects on the environment.	Long term positive
i. Any degradation of the quality of the environment? The proposal would temporarily degrade small areas of the environment during construction, however, the potential impacts would be minimised with the implementation of the safeguards discussed in Section 6. In the long term the proposal would improve the efficiency and effectiveness of the existing Botany rail line by enhancing freight supply and supporting the national freight rail network.	Short term negative Long term positive
j. Any risk to the safety of the environment? The proposed works (construction and operation) are unlikely to pose a risk to the safety of the environment with the implementation of the proposed mitigation measures outlined in Section 6.	Nil
k. Any reduction in the range of beneficial uses of the environment? No likely reduction in the range of beneficial uses of the environment is predicted to occur as an impact from the proposal.	Nil
l. Any pollution of the environment? The proposed works could generate pollution risks for soils and water during construction works. These risks would be confined to the construction phase and are manageable with implementation of the safeguards outlined in Section 6.	Short term negative
m. Any environmental problems associated with the disposal of waste? Section 6.9 discusses the waste products associated with the proposal. Specific protocols are set out to manage waste and waste disposal. The proposal is unlikely to have any environmental problems associated with the disposal of waste, particularly with the reuse of excavated spoil within the construction site.	Nil
n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal does not require resources that are in short supply.	Nil
o. Any cumulative environmental effect with other existing or likely future activities? The cumulative impacts of the proposal are discussed in Section 7. The proposal may contribute to traffic and noise impacts during construction, however the effects of this would be minimal due to the temporary nature of the works.	Short term negative
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? No coastal processes or hazards would be impacted upon.	Nil

APPENDIX E MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Table E-1 Matters of National Environmental Significance

Factor	Impact
(a) Any impact on a World Heritage property? **The proposed works will not impact on any World Heritage property**	None
(b) Any impact on a National Heritage place? **The proposed works will not impact on a National Heritage place.**	None
(c) Any impact on a wetland of international importance (often called 'Ramsar' wetlands)? **The proposed works will not impact on any RAMSAR wetlands.**	None
(d) Any impact on nationally threatened species and ecological communities? **The proposed works will not impact on any nationally threatened species or ecological communities or migratory species.**	None
(e) Any impact on migratory species? **The proposed works will not impact on any migratory species.**	None
(f) Any impact on a Commonwealth marine area? **The proposed works will not impact on a Commonwealth marine area.**	None
(g) Any impact on the Great Barrier Reef Marine Park? **The proposed works will not impact on the Great Barrier Reef Marine Park**	None
(h) Does the proposal involve a nuclear action (including uranium mining)? **The proposed works do not involve any nuclear activities.**	None
(i) Any impact on a water resource in relation to coal seam gas development and large coal mining development? **The works will not impact on a water resource in relation to coal seam gas development and large coal mining development**	None

Additionally, any impact (direct or indirect) on the environment of Commonwealth land? **The proposed works will not impact (directly or indirectly) on the environment of Commonwealth land.**	None

BOTANY YARD
BI-DIRECTIONAL SIGNALLING

REVIEW OF ENVIRONMENTAL FACTORS