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Flora and Fauna Assessment Report

Kamay Botany Bay National Park

Report prepared by Narla Environmental

For

NSW National Parks and Wildlife Service

July 2023



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Glossary

Acronym/ Term	Definition
Activity	The use of land, the subdivision of land, the erection of a building, the carrying out of a work, the demolition of a building or work, any other act, matter or thing referred to in section 3.14 that is prescribed by the regulations for the purposes of this definition (Environmental Planning and Assessment Act 1979).
AS-4970	Australian Standard 4970 (2009) Protection of Trees on Development Sites
asl	above sea level
BAM	Biodiversity Assessment Methodology
BC Act	New South Wales Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
DAFF	Department of Agriculture, Fisheries and Forestry (formerly DAWE)
DAWE	Department of Agriculture, Water and the Environment (now DAFF)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation
DEE	Department of the Environment and Energy
DPE	Department of Planning and Environment (formerly DPIE and OEH)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (now DPE)
EEC	Endangered Ecological Community
EP&A Act	Environmental Planning & Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FFA	Flora and Fauna Assessment
ha	Hectares
KDF	Kurnell Dune Forest
km	Kilometres
LGA	Local Government Area
Locality	The area within a 5km radius of the Subject Site. The same meaning when describing a local population of a species or local occurrence of an ecological community.
m	metres
mm	millimetres

Acronym/ Term	Definition
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	Office of Environment and Heritage (now DPE)
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SRZ	Structural Root Zone
SSF	Swamp Sclerophyll Forest
Subject Site	All areas associated with the proposed activity at Kamay Botany Bay National Park
Threatened species, populations and ecological communities	Species, populations and ecological communities specified in Schedules 1 and 2 of the BC Act 2016
TPZ	Tree Protection Zone

1. Introduction

1.1 Project Background

Narla Environmental Pty Ltd (Narla) have been engaged by National Parks and Wildlife Services (NPWS) to prepare this Flora and Fauna Assessment to support a Review of Environmental Factors report (REF) for the implementation of activities identified in the Kamay Botany Bay National Park, Kurnell Master Plan (referred to as the Proposal).

The implementation of the Proposal would occur over three stages. These stages include:

- Stage 1: Pre-construction
- Stage 2: Construction
- Stage 3: Remediation / site demobilisation

All areas associated with the proposed activity are hereafter referred to as the 'Subject Site' (**Figure 1**) and:

- Construction of a new Visitors Centre building, located on the footprint of the existing visitor centre, and all service connections associated with the new building.
- Alteration to the existing Visitor Centre car park, including amendments to provide *Disability Discrimination Act (1992)* (DDA) compliant parking spaces, and provision for electric vehicle charging points.
- Construction of a new Cricket Pitch car park.
- Alterations to the existing Commemoration Flat car park.
- Construction of new visitor facilities including:
 - Picnic tables
 - Picnic shelters
 - BBQs
 - Bins
 - Bench seats
 - Outdoor showers and drinking fountains
 - Charcoal bins (area to safely dispose of charcoal waste associated with the BBQs) and associated slabs
 - Paths, bridges and boardwalks providing a DDA-compliant connection to the foreshore, including side paths to the whale sculptures.
- Construction of new kerb and gutters, road resurfacing, and stormwater connections to the Visitors Centre loop road.
- Construction of a new walking track connection between the new Cricket Pitch carpark and Cape Solander Drive.
- Construction of a new vehicular and path connections to Alpha House.
- Construction of performance circles within Commemoration Flat (a popular picnic destination within the Kamay Botany Bay National Park).
- Alterations to the existing Meeting Place stone structure to convert this structure into a new Collection Garden with associated paving, sandstone structures, planting, and side paths.
- Construction of new amenity buildings in the approximate location of the existing Commemoration Flat and Cricket Pitch amenity buildings, including installation of new underground services to these amenity buildings.

- Daylighting of the Freshwater Stream (the process of removing obstructions like concrete that cover the stream) and restoration of the creek bed where this is currently piped.
- Installation of Indigenous interpretation measures generally located throughout the works area.
- Transfer of existing overhead power cabling near the Cricket Pitch to be underground. This includes the associated underground cabling, installation of a new pad-mount substation (a ground mounted electrical power distribution transformer) and relocation of the existing main electrical board servicing the park.
- Upgrade works to the fire services within the National Park, including installation of a new hydrant booster valve assembly at the entry, new hydrant booster pump and pumphouse adjacent to the entry booth, and reticulation of new in-ground hydrant mains between the above, existing hydrant points, and the new Visitor Centre.
- Upgrade works to water supply and sewer services throughout the National Park, including new pump out sewer pits, rising mains, cold water lines and associated power cabling.
- Revegetation and planting works, and associated irrigation services.

In Addition:

- It is noted that construction of a new seawall/revetment wall to the Botany Bay foreshore between Commemoration Flat and the existing wharf structure, with associated stairs for foreshore access also form part of the Master Plan but is being assessed under a separate development application.
- The reconstruction of the ferry wharves at Kurnell and La Perouse also form part of the Master Plan. These approvals have been progressed under a separate development application by Transport for NSW.

Narla have produced this report in order to assess any potential impacts associated with the proposed activity on terrestrial ecology (biodiversity), particularly threatened species, populations and ecological communities listed under the Biodiversity Conservation Act 2016 (BC Act). The report will also recommend appropriate measures to mitigate any potential impacts in line with all relevant State Environmental Planning Policies (SEPP) as well the Biodiversity Conservation (BC) Act 2016 and the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.

1.2 Site Description and Location

These proposed works are located in the Kamay Botany Bay National Park, on the Kurnell side of Botany Bay (about 14 kilometres south of the Sydney Central Business District). The Subject Site contains large sections of intact remnant bushland, as well as areas of historically planted native and exotic canopy species above maintained lawns used as a recreational space for the public. The Subject Site also contains an existing visitor centre as well as other amenities such as carparks, pathways and public toilets.

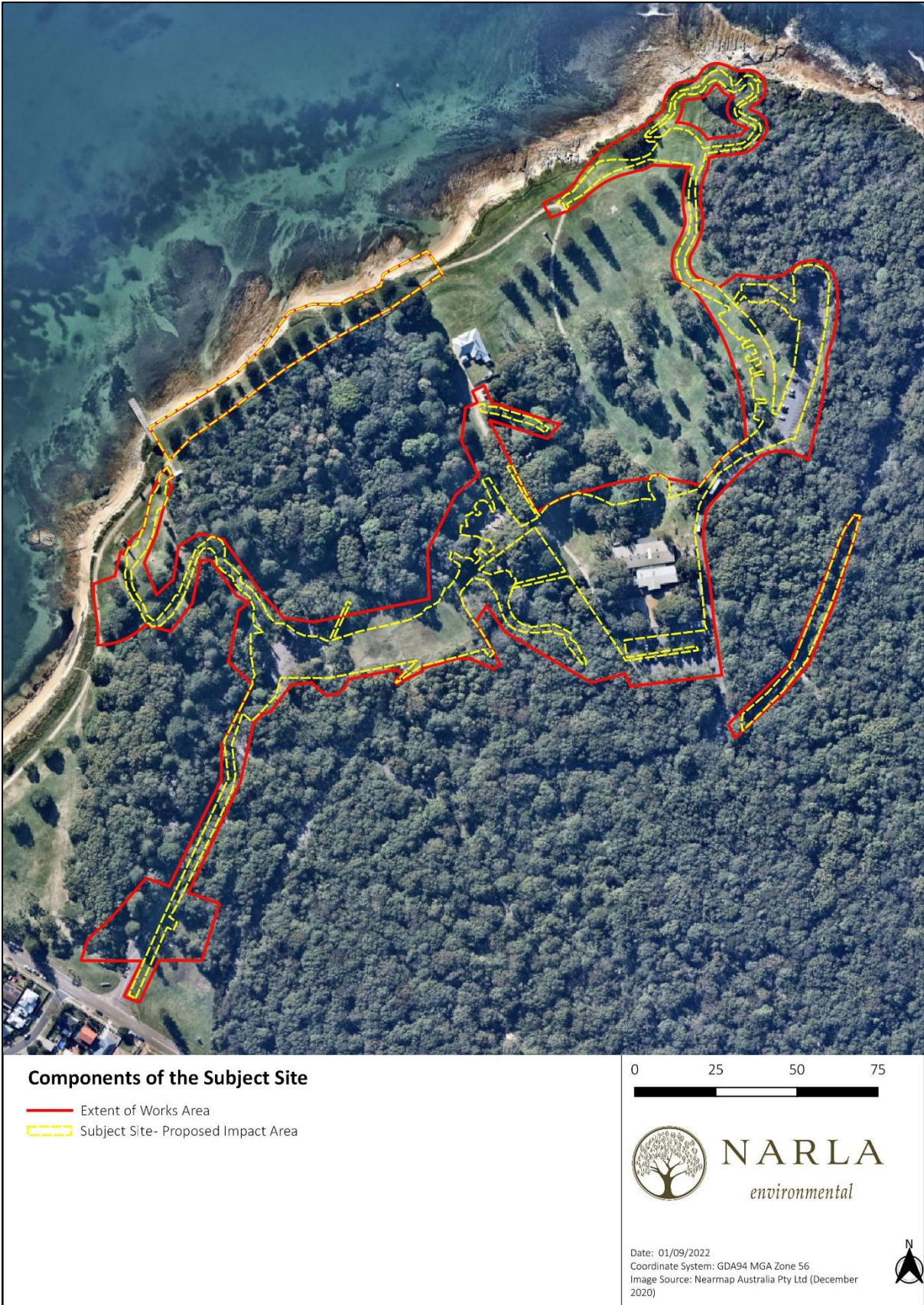


Figure 1. Components of the Subject Site.

1.3 Topography, Geology and Soil

The Subject Site occurs on a gentle slope that varies from approximately 2m above sea level (asl) to 20m asl. The Subject Site is situated on the 'Kurnell' soil landscapes as described in the Soil Landscapes of the Wollongong-Port Hacking 1:100,000 sheets (Hazelton and Tille 1990).

1.3.1 Kurnell Soil Landscape

This soil landscape is characterised by gently undulation to rolling coastal dune-fields and relict dunes. The geology is comprised of quaternary windblown, medium to fine grained well sorted marine quartz sand.

1.4 Hydrology

Three (3) first order watercourses have been mapped within or in close proximity to the Subject Site (**Figure 2**). The watercourse mapped in the south west of the Subject Site has been historically piped, which is proposed to be restored to its former natural state by the proposed activity. The centremost watercourse was not identifiable during the site assessment and may no longer be present.

1.5 Scope of Assessment

The objectives of this FFA were to:

- Establish the likelihood of occurrence of migratory species, threatened species, endangered populations and threatened ecological communities as listed under the BC Act and/or the EPBC Act;
- Assess any potential impacts to species and/or communities listed under the BC Act and EPBC Act;
- Identify and map the distribution of vegetation communities within the Subject Site;
- Record presence and the extent of any known or potential fauna habitat features such as nests, dreys, caves, crevices, culverts, pools, soaks, flowering trees, fruiting trees or hollow-bearing trees and provide recommendations for on-going management of these habitat features and any fauna present;
- Record presence and the extent of any Priority Weeds or weed infestations and provide recommendations for on-going management; and
- Recommend any controls or additional actions to be taken to protect or improve environmental outcomes of the proposed activity.

1.6 Study Limitations

This study was not intended to provide a complete inventory of all flora and fauna species with potential to occur within the Subject Site. The species list provided for the Subject Site within this report was restricted to what was observed during the site assessment by the Narla Ecologists. The timing of the surveys may not have coincided with emergence times of some species of flora and fauna, such as seasonally flowering herbs, seasonal migratory fauna or nocturnal fauna. To account for those species that could not be identified during the site assessment, detailed habitat assessments were combined with desktop research and local ecological knowledge to establish an accurate prediction of the potential for such species to occur on or adjacent the Subject Site.

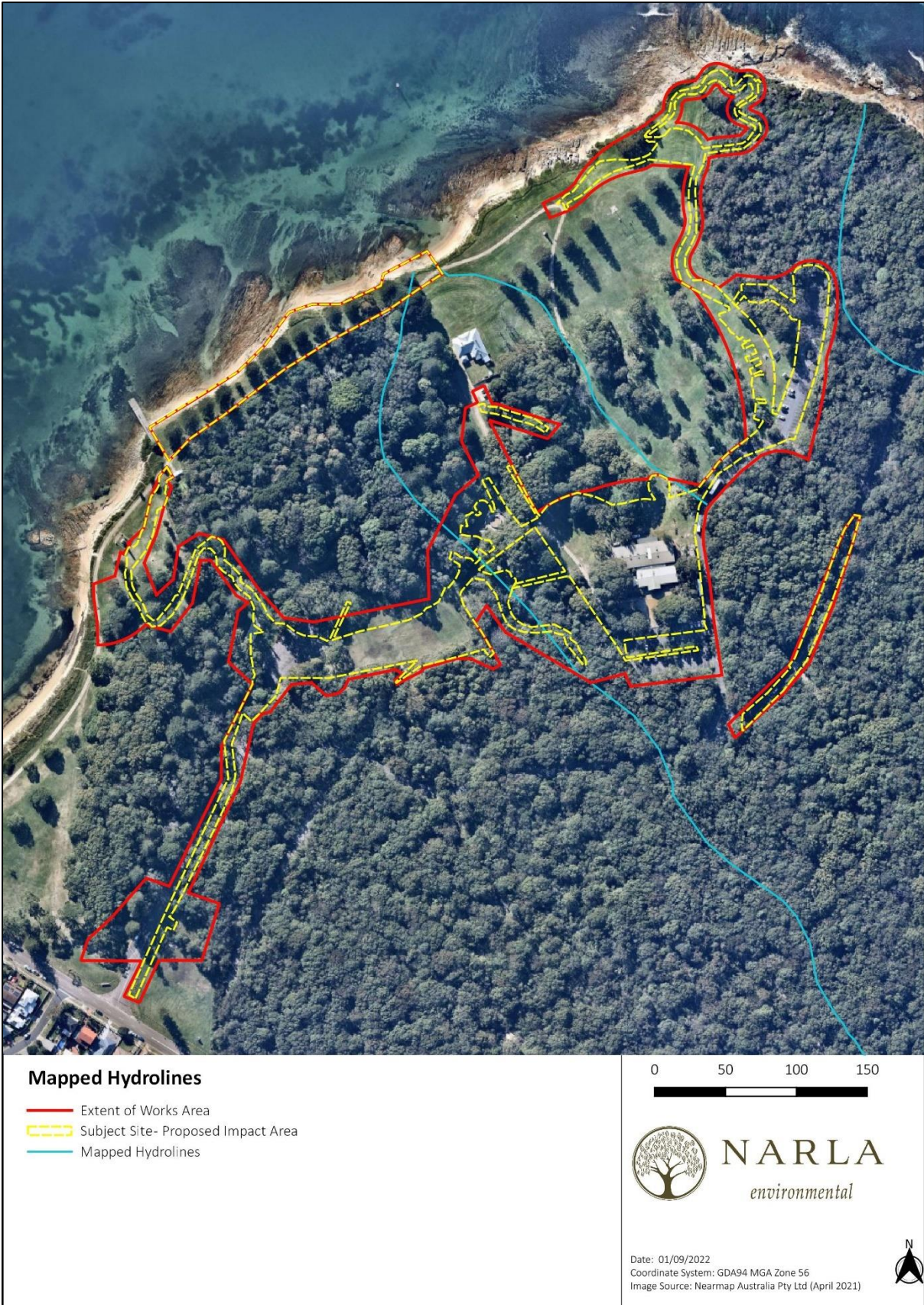


Figure 2. Mapped hydrolines within or in close proximity to the Subject Site.

1.7 Relevant Legislation and Policy

The legislation and policy that are addressed in this report are listed in **Table 1**.

Table 1. Relevant legislation and policy addressed

Legislation/Policy	Relevant Ecological Feature on Site	Triggered	Action Required
Environmental Planning and Assessment Act 1979 (EP&A Act)	All threatened species, populations and ecological communities and their habitat that occur or are likely to occur within the Subject Site during a part of their lifecycle.	Yes	This Flora and Fauna Assessment and all subsequent recommendations relevant to the planning process under Part 5 of the EP&A Act
Biodiversity Conservation Act (BC Act) (New South Wales)	<p>Two (2) BC Act listed Endangered Ecological Communities were identified within or neighbouring the Subject Site:</p> <ul style="list-style-type: none"> Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion; and Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale. <p>One (1) threatened fauna species listed under the BC Act was identified within close proximity to the Subject Site at the time of the site assessment:</p> <ul style="list-style-type: none"> White-bellied Sea Eagle (<i>Haliaeetus leucogaster</i>; Vulnerable) <p>Additional suitable habitat for various threatened fauna species was identified.</p>	Yes	<p>Tests of Significance (5-part Test) have been prepared within this report for both of the BC Act listed Endangered Ecological Communities. A Test of Significance (5-part Test) has also been included within this report for the White-bellied Sea Eagle which was recorded nesting in close proximity to the Subject Site (Appendix C).</p> <p>This FFA, particularly the likelihood tables for threatened fauna and flora species occurring or potentially occurring within the Subject Site, as well as severity of potential impacts.</p>
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Commonwealth)	<p>One EPBC Threatened Ecological Communities was identified within the Subject Site:</p> <ul style="list-style-type: none"> Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland. <p>No EPBC Act (Commonwealth) listed threatened species or populations were identified within the Subject Site during the site assessment. However, suitable habitat for various threatened fauna species was present.</p>	Yes	This FFA, particularly the likelihood tables for threatened fauna and flora species occurring or potentially occurring within the Subject Site. An Assessment of Significant Impact Criteria has been undertaken for the EPBC Act listed community (Appendix D).

Legislation/Policy		Relevant Ecological Feature on Site	Triggered	Action Required
Biosecurity Act 2015 (Bio Act)		Five (5) Priority Weeds for the Greater Sydney region were identified within the Subject Site: <ul style="list-style-type: none"> ▪ <i>Anredera cordifolia</i> (Madeira Vine); ▪ <i>Asparagus aethiopicus</i> (Ground Asparagus); ▪ <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i> (Bitou Bush); ▪ <i>Lantana camara</i> (Lantana); and ▪ <i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive). 	Yes	The listed Priority Weeds must be managed in accordance with the Biosecurity Act 2015.
State Environmental Planning Policy (Resilience and Hazards) 2021: Chapter 2 – Coastal Management		The Subject Site contains areas mapped as 'Coastal Environment Area' and 'Coastal Use Area'.	Yes	Works must be conducted in accordance with the relevant provisions of this SEPP (section 1.7.1).
State Environmental Planning Policy (Biodiversity and Conservation SEPP) 2021	Chapter 4 – Koala habitat protection 2021	This chapter of the SEPP does not apply to land reserved or dedicated under the National Parks and Wildlife Act 1974 and therefore does not apply.	No	None.
	Chapter 6— Bushland in Urban Areas	This chapter of the SEPP does not apply to land reserved or dedicated under the National Parks and Wildlife Act 1974 and therefore does not apply.	No	None.

1.7.1 State Environmental Planning Policy (Resilience and Hazards) 2021: Chapter 2 – Coastal Management

The Subject Site is mapped as containing lands within the 'Coastal Environment Area' and the 'Coastal Use Area' (**Figure 3**). It is not expected that the proposed works would significantly impact any aspects of the Coastal Environment or the use of the area. The proposed activity is to ensure the following provisions of SEPP are satisfied.

1.7.1.1 Development on land within the coastal environment area

- Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:
 - The integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment;
 - Coastal environmental values and natural coastal processes;
 - The water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,

- Marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms;
 - Existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability;
 - Aboriginal cultural heritage, practices and places;
 - The use of the surf zone.
- Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that—
 - The development is designed, sited and will be managed to avoid an adverse impact referred to in the above subclause, or
 - If that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
 - If that impact cannot be minimised—the development will be managed to mitigate that impact.
- This clause does not apply to land within the Foreshores and Waterways Area within the meaning of Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005.

1.7.1.2 Development on land within the coastal use area

- Development consent must not be granted to development on land that is within the coastal use area unless the consent authority:
 - Has considered whether the proposed development is likely to cause an adverse impact on the following:
 - Existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
 - Overshadowing, wind funnelling and the loss of views from public places to foreshores,
 - The visual amenity and scenic qualities of the coast, including coastal headlands,
 - Aboriginal cultural heritage, practices and places,
 - Cultural and built environment heritage, and
 - Is satisfied that:
 - The development is designed, sited and will be managed to avoid an adverse impact referred to above, or
 - If that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
 - If that impact cannot be minimised—the development will be managed to mitigate that impact, and
 - Has taken into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development.
- This clause does not apply to land within the Foreshores and Waterways Area within the meaning of Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005.

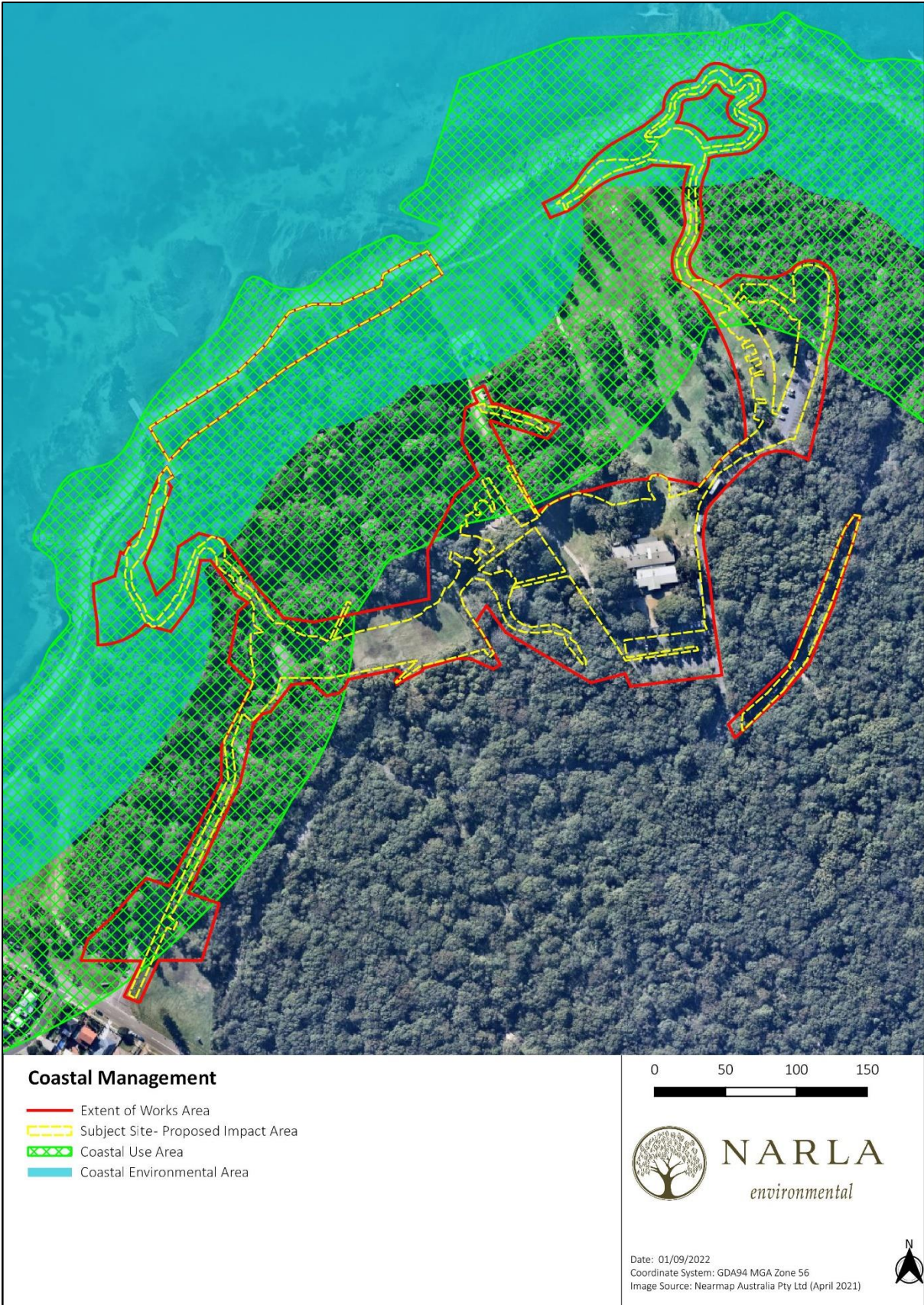


Figure 3. Areas listed under the Coastal Management SEPP located within the Subject Site.

2. Methodology

2.1 Desktop Assessment and Literature Review

A thorough literature review of local information relevant to the Kamay Botany Bay National Park and the Kurnell LGA was undertaken. Searches using NSW Wildlife Atlas (BioNet; DPE 2022b) and the Commonwealth Protected Matters Search Tool (DCCEEW 2022) were conducted to identify all current threatened flora and fauna, as well as migratory fauna records within a 10km x 10km cell search area centred on the Subject Site. These data were used to assist in establishing the presence or likelihood of any ecological values as occurring on or adjacent the Subject Site and helped inform our Ecologists on what to look for during the site assessments.

Soil landscape and geological mapping was examined to gain an understanding of the environment on the Subject Site and assist in determining whether any threatened flora or ecological communities may occur there (Hazelton and Tille 1990).

2.2 Ecological Site Assessment

2.2.1 General Survey

A site assessment was undertaken by experienced Narla Ecologists, Chris Moore, on Tuesday the 25th May 2021. During the site assessments, the following activities were undertaken:

- Identifying and recording the vegetation communities present within the Subject Site, with focus on identifying any threatened ecological communities;
- Recording a detailed list of flora species encountered within the Subject Site, with a focus on threatened species, species diagnostic of threatened ecological communities and Priority Weeds;
- Recording opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds of the Subject Site;
- Targeted surveys for threatened flora;
- Identifying and recording the locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats;
- Assessing the connectivity and quality of the vegetation within the Subject Site and surrounding area; and
- Targeting the habitat of any threatened and regionally significant fauna including:
 - Tree hollows (habitat for threatened large forest owls, parrots and arboreal mammals);
 - Caves and crevices (habitat for threatened reptiles, small mammals and microbats);
 - Termite mounds (habitat for threatened reptiles);
 - Soaks (habitat for threatened frogs);
 - Wetlands (habitat for threatened fish, frogs and water birds);
 - Drainage lines (habitat for threatened fish and frogs);
 - Fruiting trees (food for threatened frugivorous birds and mammals);
 - Flowering trees (food for threatened nectarivorous birds and mammals);
 - Trees and shrubs supporting nest structures (habitat for threatened birds and arboreal mammals); and
 - Any other habitat features that may support fauna (particularly threatened) species.

2.2.2 Weather Conditions for General Site Assessment

Weather conditions recorded at the nearest weather station (Sydney Airport, NSW) prior to and during the site assessments are provided in **Table 2** (BOM 2022). The data revealed a small amount of rainfall and cool temperatures leading up to the surveys. The cool conditions may not have been conducive to the emergence of annual herbs.

Table 2. Weather conditions recorded at Sydney Airport, NSW (station 066037) preceding and during the site assessments (site assessment dates in bold).

Survey date	Day	Minimum Temp. (°C)	Maximum Temp. (°C)	Rainfall (mm)
18/05/2021	Tuesday	8.7	20.7	0
19/05/2021	Wednesday	8.3	21.6	0
20/05/2021	Thursday	9.2	21.7	0
21/05/2021	Friday	9.6	17.7	0.6
22/05/2021	Saturday	8.5	18.9	2.2
23/05/2021	Sunday	10.7	19.4	0
24/05/2021	Monday	12.8	19.6	1.8
25/05/2021	Tuesday	12.5	22.3	0.8

2.2.3 Mapping and Analysis of Vegetation Communities

Narla examined local satellite imagery, geological mapping, soil landscape mapping and topographic mapping, in addition to existing vegetation mapping (Native Vegetation of the Sydney Metropolitan Area [OEH 2016]) in order to stratify the Subject Site and guide the site assessment survey efforts. The following resources were consulted prior to the site assessments to assist with the identification of vegetation communities present within the Subject Site:

- eSPADE v2.2 (DPE 2022d);
- Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Version 3.1
- Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0
- The Soil Landscapes of the Wollongong-Port Hacking 1:100,000 sheet (Hazelton and Tille 1990).

2.2.4 Targeted Amphibian Surveys

Targeted amphibian surveys were conducted by Eco Logical Australia Pty Ltd (ELA), to determine potential impacts to *Litoria aurea* (Green and Golden Bell Frog) and *Crinia tinnula* (Wallum Froglet). ELA identified any hydrolines mapped within the vicinity of the proposed works area, and focused the survey effort along these, keeping survey transect start points to less than 500 m apart. Visual spotlighting and call playback surveys were completed along the survey transects where edges of suitable breeding habitat were identified. Surveys sampled the available range of waterbodies within the study area including creek lines, sodden grassy areas, sedgeland and heathy melaleuca vegetation. The surveys were undertaken over two weeks between 16 – 30 March 2022 by two ecologists. Surveys started after sunset when it was deemed dark enough for frogs to become active and so more visible (ELA 2022; **Appendix F**).

2.2.5 Noise Monitoring

Noise monitoring was conducted by Pulse White Noise Acoustics (PWNA) to determine the background noise levels at nearby receivers, with long term unattended noise monitoring conducted at the base of a nesting tree

for the vulnerable BC Act listed *Haliaeetus leucogaster* (White-bellied Sea Eagle). The monitoring was conducted to determine whether there would be a significant increase in noise levels as a result of the proposed development which might disturb the breeding and nesting habitat for the species.

Instrumentation used for the noise survey comprised of a SVAN 971 (serial number 74365), and a Rion NL-42 type sound level meter (serial number 01000231) and a fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Charts presenting summaries of the measured daily noise data are attached in Appendix B. These charts, representing each 24-hour period, show the LA1, LA10, LAeq and LA90 noise levels measured over 15 minute time periods (PWNA 2022).

Logging was conducted from Monday May 23th 2022 to Thursday June 30th 2022. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Sydney Airport AMO, NSW. The measured background noise data of the logger was assessed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) Noise Policy for Industry (NPI). The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and the night. The measured noise levels are considered to be representative of the levels to be expected at the nearest and most affected residence to the proposed development (PWNA 2022; **Appendix E**).

2.2.6 Impact Assessment

An assessment of likely occurrence was carried out for locally recorded threatened species (**Table 10, Table 12**). Assessments of Significance (5-part Tests) were then carried out for the BC Act listed Endangered Ecological Communities, Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions and Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale, as well as the Vulnerable species, White-bellied Sea Eagle (*Haliaeetus leucogaster*; **Appendix C**).

An Assessment of Significant Impact Criteria was also undertaken for the EPBC Act listed Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland. community (**Appendix D**)

3. Native Vegetation

3.1 Vegetation Community

3.1.1 Historically Mapped Vegetation Communities

Historic vegetation mapping (OEH 2016b) identified five (5) vegetation communities within the Subject Site and broader survey area (**Figure 4**):

- Plant_n: Plantation (Native and/or exotic);
- S_DSF06: Coastal Sandstone Foreshores Forest;
- S_FoW04: Coastal Sand Swamp Mahogany Forest;
- S_FoW08: Estuarine Swamp Oak Forest;
- S_HL05: Coastal Foredune Wattle Scrub; and
- Urban_E/N: Urban Exotic/Native

3.1.2 Field-validated Vegetation Communities

The field survey conducted by the Narla Ecologist identified the vegetation within the Subject Site as best conforming to the following vegetation communities, as well areas of existing infrastructure and hardstand (**Figure 5**):

- Planted Vegetation;
- S_WSF03: Coastal Sand Littoral Forest (Kurnell Dune Forest EEC);
- S_FoW04: Coastal Sand Swamp Mahogany Forest (Swamp Sclerophyll Forest EEC)
- S_DSF03: Coastal Sand Apple – Bloodwood Forest;
- S_DSF06: Coastal Sandstone Foreshore Forest; and
- Exotic Grassland

The determination of these vegetation communities was based on soil profile, topography and the number of ‘positive diagnostic’ species identified throughout the Subject Site. The vegetation communities identified within the Subject Site are detailed in **Table 3** to **Table 7** and displayed in **Figure 5**.

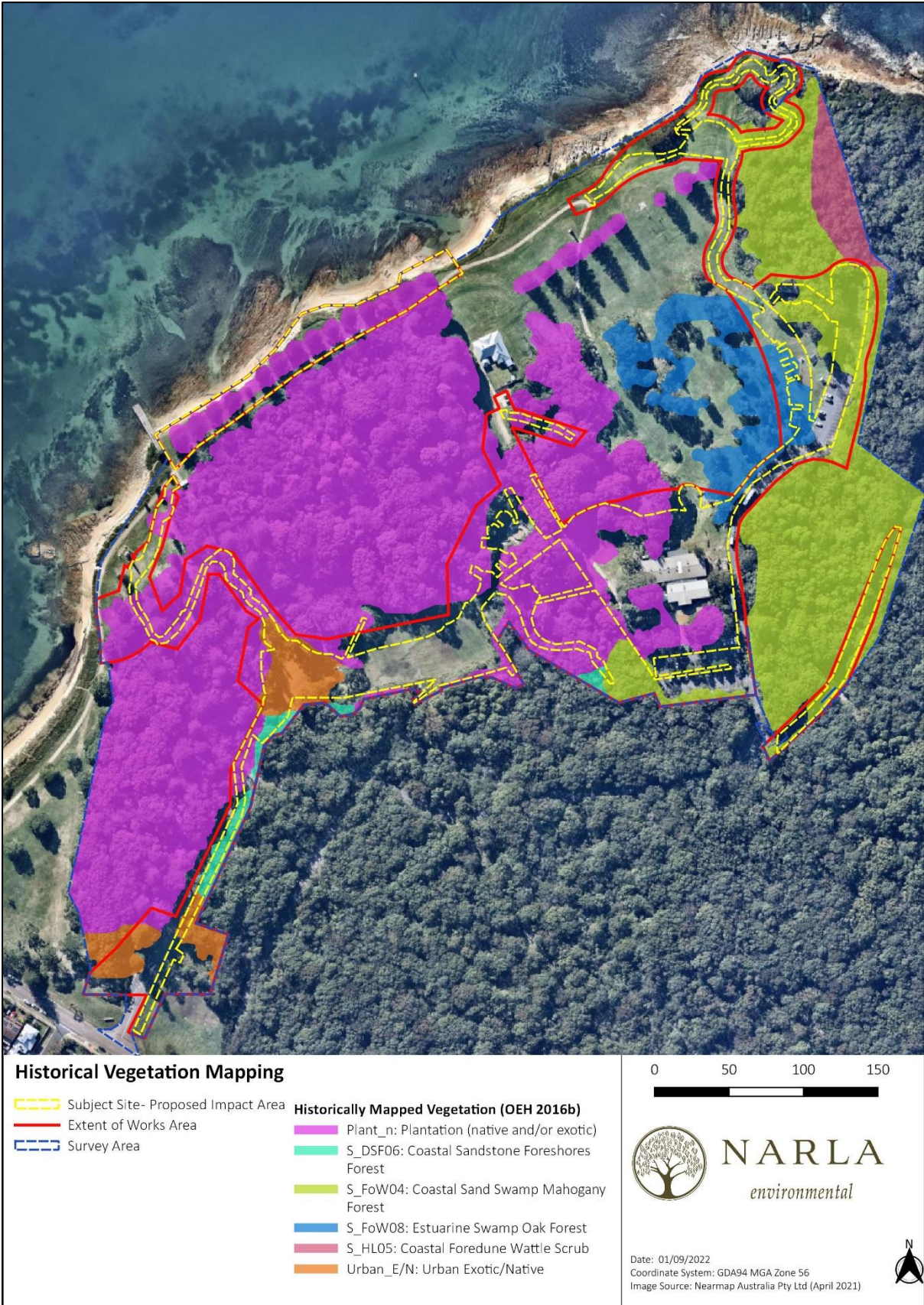


Figure 4. Historically mapped vegetation communities within and surrounding the Subject Site (OEH 2016).

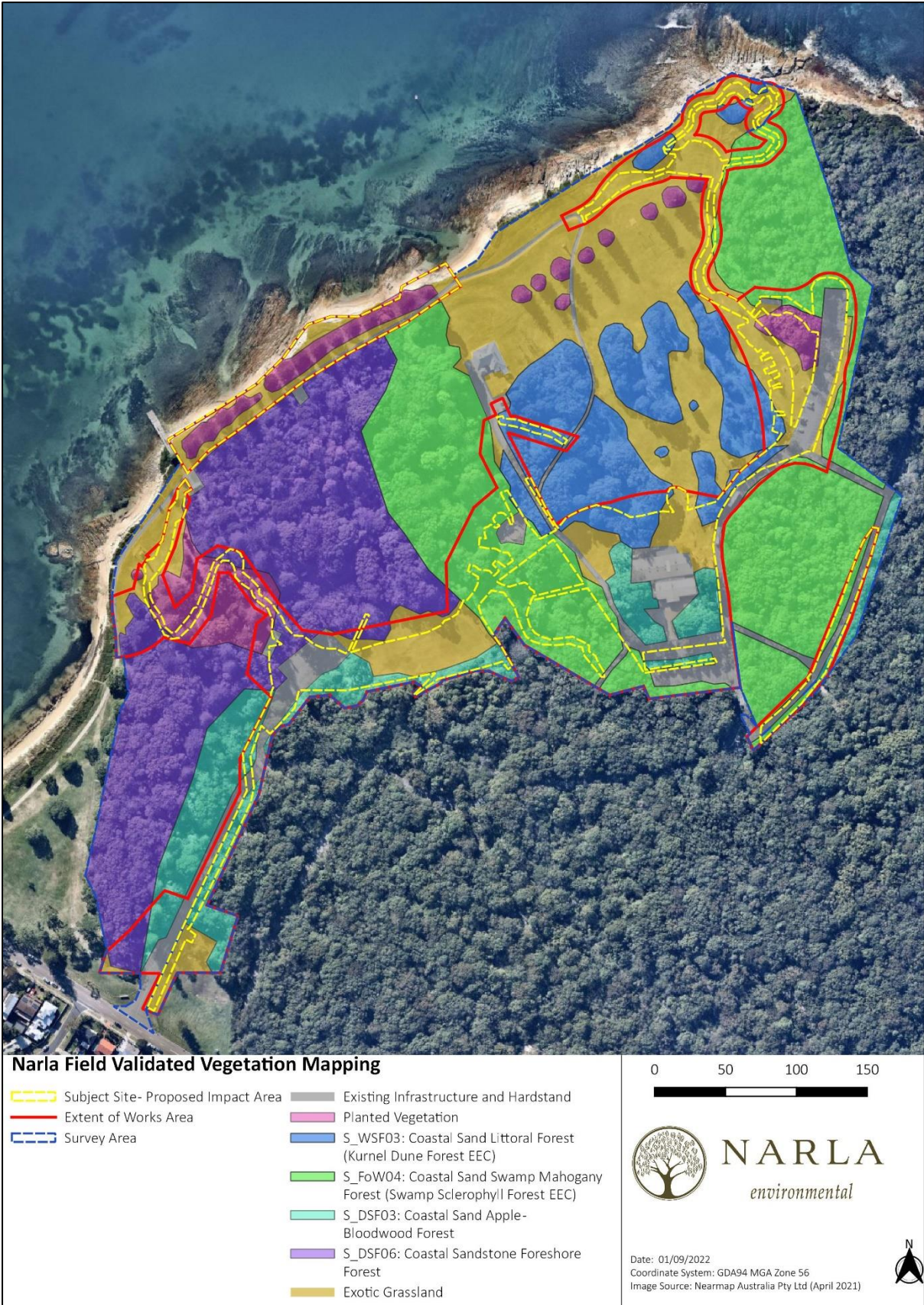



Figure 5. Field validated vegetation mapping.

Table 3. Description of Coastal Sand Littoral Forest identified within and surrounding the Subject Site.

S_WSF03: Coastal Sand Littoral Forest	
	
Vegetation Formation / Keith Class	North Coast Wet Sclerophyll Forests
Extent within Survey Area (approximate)	1.88ha
Extent within Subject Site (approximate)	0.21ha
Description of the Vegetation within the Subject Site	
<p>This community within the Subject Site was comprised of stands of native canopy species above a regularly maintained lawn. The canopy species included <i>Eucalyptus robusta</i> and <i>Casuarina glauca</i>, with sporadic occurrences of <i>Melaleuca</i> spp. and <i>Lomandra longifolia</i> making up the mid and ground layers, respectively.</p>	
Description (OEH 2016)	
<p>Coastal Sand Littoral Forest comprises a forest and woodland community with a prominent component of littoral rainforest species amongst the shrub and small tree layer. An open cover of tuckeroo (<i>Cupaniopsis anacardioides</i>) and other waxy-leaved species occur below a canopy of banksia, casuarina and/or eucalypt trees. A high diversity of vines are found across multiple layers of the vegetation. The woody vine cockspur thorn (<i>Maclura cochinchinensis</i>), identifiable by its long spikes, is a useful diagnostic species for the community. Habitat and</p>	

S_WSF03: Coastal Sand Littoral Forest

disturbance are both very influential in the structure and composition of the community at any given location. It is restricted to coastal sand deposits receiving greater than 1050 millimeters of mean annual rainfall. The most extensive areas remain on the older low-lying (c. 1.5-10 metres above sea level) transgressive barrier dunes along the northern side of the Kurnell Peninsula. On the drier siliceous sands, the forest forms a eucalypt-dominated forest comprising bangalay (*Eucalyptus botryoides*) and/or swamp mahogany (*Eucalyptus robusta*) with a grassy and ferny ground cover. On the humic podsols associated with poorly drained areas eucalypts are less prominent and instead tall coast banksia (*Banksia integrifolia*) and swamp oak (*Casuarina glauca*) dominate above a ground cover of sedges thriving amongst the waterlogged soils. Above 10 metres above sea level this community is increasingly restricted to sheltered situations. Eucalypts may once have consistently dominated, however today lower-growing banksia scrubs are more common. Similar forests occur on the sand deposits on the New South Wales Central Coast.

Justification of Vegetation Assignment	The determination of this community was based on the IBRA Bioregion, IBRA Sub-region, landscape attributes including soil landscapes and elevation, and the presence of diagnostic species.
BC Act Status	This community conforms to the BC Act listed Endangered Ecological Community (EEC), Kurnell Dune Forest in the Sutherland Shire and City of Rockdale (see section 3.2).
EPBC Act Status	Not listed.
References	Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Version 3.1 Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0

Table 4. Description of Coastal Sand Swamp Mahogany Forest identified within and surrounding the Subject Site.

S_FoW04: Coastal Sand Swamp Mahogany Forest



Vegetation Formation / Keith Class	Coastal Swamp Forests
Extent within the Survey Area (approximate)	4.60ha
Extent within Subject Site (approximate)	0.39ha

S_FoW04: Coastal Sand Swamp Mahogany Forest

Description of the Vegetation within the Subject Site

This vegetation community was dominated by *Eucalyptus robusta*, which was accompanied by stands of *Casuarina glauca* and *Melaleuca styphelioides*. The midstorey was comprised of *Pittosporum undulatum*, *Glochidion ferdinandi* and *Livistona australis*. The ground stratum consisted of a mixture of native grass and fern species such as *Entolasia marginata*, *Oplismenus aemulus* and *Pteridium esculentum*. With exotics such as *Hydrocotyle bonariensis* present in high numbers. The priority weeds *Lantana camara*, *Chrysanthemoides monilifera* subsp. *rotundata* and *Asparagus aethiopicus* were also present low densities within this community.

Description (OEH 2016)

Coastal Sand Swamp Mahogany Forest occurs on low-lying coastal sandy substrates found in or adjoining dune swales, lagoons and other alluvial infill. It is a low open eucalypt forest with a sparse dry shrub layer and a very distinctive ground cover of sedges, rushes and ferns. Swamp mahogany (*Eucalyptus robusta*) dominates the canopy above a low cover of paperbarks, tea-trees, banksias and wattles. These sites are underlain by an elevated water table that saturates the peaty sand year-round. This encourages a diverse and abundant layer of sedges and rushes. These include bare twig-rush (*Baumea juncea*) jointed twig-rush (*Baumea articulata*), tall saw-sedge (*Gahnia clarkei*) and zig-zag bog-rush (*Schoenus brevifolius*).

Few examples of this forest remain in the Sydney area, with Dee Why Lagoon and the Kurnell Peninsula retaining the largest areas. These landscapes are coastal barrier dunes that do not exceed 10 metres in elevation. In Sydney such swamps have been replaced by urban and industrial development. More extensive areas occur on the Central Coast (NPWS 2000c) and the NSW south coast to Jervis Bay (Tozer et al. 2010), although these too are now subject to development pressures.

Justification of Vegetation Assignment	The determination of this community was based on the IBRA Bioregion, IBRA Sub-region, landscape attributes including soil landscapes and elevation, and the presence of diagnostic species.
BC Act Status	This community conforms to the BC Act listed Endangered Ecological Community (EEC), Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (see section 3.2).
EPBC Act Status	This community conforms to the EPBC Act listed Endangered Ecological Community (EEC), Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (see section 3.3.1).
References	Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Version 3.1 Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0

Table 5. Description of Coastal Sand Apple-Bloodwood Forest identified within and surrounding the Subject Site.

S_DSF03: Coastal Sand Apple-Bloodwood Forest



Vegetation Formation / Keith Class

Coastal Dune Dry Sclerophyll Forests

Extent within the Survey Area (approximate)

0.49ha

Extent within Subject Site (approximate)

1.33ha

S_DSF03: Coastal Sand Apple-Bloodwood Forest

Description of the Vegetation within the Subject Site

This community was comprised of canopy species such as *Angophora costata*, *Eucalyptus haemastoma*, *Eucalyptus racemosa* and *Corymbia gummifera*. The midstorey consisted of species including *Breynia oblongifolia*, *Acacia falcata*, *Monotoca elliptica* and *Dodonaea triquetra*. The ground layer was sparse but consisted of the native species *Imperata cylindrica*, *Lomandra longifolia* and *Pomax umbellata*. The fringes of this community were inundated with the exotic grass *Stenotaphrum secundatum*.

Description (OEH 2016)

Coastal Sand Apple-Bloodwood Forest is one of several vegetation communities found on the large sand dunes associated with the prominent headlands of the Sydney coastline. The forest is of low to moderate height and is characterised by an open cover of dry shrub and heath plants. Typically, the canopy comprises smooth-barked apple (*Angophora costata*), old-man banksia (*Banksia serrata*) and red bloodwood (*Corymbia gummifera*), though may also include broad-leaved scribbly gum (*Eucalyptus haemastoma*) and less frequently bangalay (*Eucalyptus botryoides*). The surface soil is generally deeply podsolised, inferring that the dune systems upon which this forest grows have been stable for a long time. These impoverished soils, in combination with the exposed wind-blown situations, support a heath understorey of tea-trees, banksias, broom heath and grass trees above a ferny ground cover.

These forests are found on the larger headland systems at Jibbon Head near Bundeena, Kurnell and La Perouse. The massive dune systems that once covered the Botany-Randwick area would have once supported a network of these low-growing forests amongst the treeless sandplain heaths. Some examples are on thin sand mantles above sandstone rock plates. Beyond the Sydney metropolis, the community is found on low elevation dunes of the Central Coast (NPWS 2000c, Bell 2002).

Justification of Vegetation Assignment	The determination of this community was based on the IBRA Bioregion, IBRA Sub-region, landscape attributes including soil landscapes and elevation, and the presence of diagnostic species.
BC Act Status	Not listed.
EPBC Act Status	Not listed.
References	Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Version 3.1 Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0

Table 6. Description of Coastal Sandstone Foreshore Forest identified within and surrounding the Subject Site.

S_DSF06: Coastal Sandstone Foreshore Forest



Vegetation Formation / Keith Class	Sydney Coastal Dry Sclerophyll Forests
Extent within the Survey Area (approximate)	3.62ha
Extent within Subject Site (approximate)	0.08ha

S_DSF06: Coastal Sandstone Foreshore Forest

Description of the Vegetation within the Subject Site

This community was comprised of canopy species such as *Angophora costata*, *Eucalyptus botryoides*, *Syncarpia glomulifera* and *Eucalyptus microcorys*. The midstorey consisted of species including *Elaeocarpus reticulatus*, *Glochidion ferdinandi*, *Breynia oblongifolia* and *Pittosporum undulatum*. The ground layer was dominated in sections by the priority weed *Asparagus aethiopicus*. Native species consisted of *Lomandra longifolia* and *Dianella caerulea*.

Description (OEH 2016)

Coastal Sandstone Foreshores Forest is found on sheltered sandstone slopes along the foreshores of Sydney's major waterways and coastal escarpments. It is an open forest with a moist shrub layer and a ground cover of ferns, rushes and grasses. The flora of this community has a maritime influence given its exposure to prevailing sea breezes. The canopy can be dominated by pure stands of smooth-barked apple (*Angophora costata*), though more regularly this is found in combination with other tree species. Localised patches of bangalay (*Eucalyptus botryoides*) and coast banksia (*Banksia integrifolia*) occur closest to the coast, whereas Sydney peppermint (*Eucalyptus piperita*) and blackbutt (*Eucalyptus pilularis*) prefer more protected locations and in the case of the latter some minor shale enrichment in the soil. A prominent layer of hardy mesic small trees and shrubs is present. These include sweet pittosporum (*Pittosporum undulatum*), cheese tree (*Glochidion ferdinandi*) and blueberry ash (*Elaeocarpus reticulatus*). In the suburban environment the proliferation of these species in the understorey at long unburnt sites has generated considerable debate, particularly as there appears to be strong correlation between time since fire and their density (Rose and Fairweather 1997). It is also appears that these species are more common in these littoral zones than in other sheltered sandstone forests situated further away from the coast.

This forest is restricted to sandstone soils derived from either Hawkesbury or Narrabeen geology. The distribution is coastal and requires a combination of low elevation (between two and 45 metres above sea level) and mean annual rainfall that exceeds 1100 millimetres per annum. It is noticeable that most sites are exposed to salt-laden winds. Samples are situated up to 10 kilometres from the coastline, but still in close proximity to major waterways.

Justification of Vegetation Assignment	The determination of this community was based on the IBRA Bioregion, IBRA Sub-region, landscape attributes including soil landscapes and elevation, and the presence of diagnostic species.
BC Act Status	Not listed.
EPBC Act Status	Not listed.
References	Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Version 3.1 Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0

Table 7. Description of Planted Vegetation identified within and surrounding the Subject Site.

Planted Vegetation	
	
Extent within the Survey Area (approximate)	0.97ha
Extent within Subject Site (approximate)	0.35ha
Description of the Vegetation within the Subject Site	
<p>This vegetation was comprised of stands of historically planted native and exotic vegetation, including <i>Eucalyptus microcorys</i>, <i>Araucaria heterophylla</i>, <i>Araucaria cunninghamii</i> and <i>Cupaniopsis anacardioides</i> with a completely lacking shrub layer, and maintained lawn groundlayer.</p>	

Planted Vegetation	
Justification of Vegetation Assignment	As the vegetation within the zone consisted of native species that were historically planted out of their natural distribution, as well as exotic species, it was not considered to confirm to any locally occurring vegetation community.
BC Act 2016 Status	Not listed.
EPBC Act 1999 Status	Not listed.
References	N/A

Table 8. Description of Exotic Grassland identified within and surrounding the Subject Site.

Exotic Grassland	
	
Extent within the Survey Area (approximate)	4.05ha
Extent within Subject Site (approximate)	1.19ha
Description of the Vegetation within the Subject Site	
<p>This vegetation was comprised of regularly mowed and maintained grassland vegetation. No trees or shrubs were located within this zone and it was dominated by <i>Stenotaphrum secundatum</i>, <i>Cenchrus clandestinus</i> and <i>Cynodon dactylon</i>.</p>	

Exotic Grassland	
Justification of Vegetation Assignment	As the vegetation within the zone consisted of native species that were historically planted out of their natural distribution, as well as exotic species, it was not considered to confirm to any locally occurring vegetation community.
BC Act 2016 Status	Not listed.
EPBC Act 1999 Status	Not listed.
References	N/A

3.2 Biodiversity Conservation Act (BC Act) Listing

3.2.1 Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

3.2.1.1 Coastal Sand Swamp Mahogany Forest

Coastal Sand Swamp Mahogany Forest is associated with the BC Act listed EEC, Swamp sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (SSF). This vegetation within the Subject Site meets the BC Act listing for the EEC as it contains species indicative of this EEC and occurs within the associated geology and landscape position. Native species listed within the final determination (NSW Scientific Committee 2004) that occur within the Subject Site include *Breynia oblongifolia*, *Casuarina glauca*, *Dianella caerulea*, *Eucalyptus robusta*, *Glochidion ferdinandi*, *Hydrocotyle peduncularis*, *Livistona australis*, *Lomandra longifolia*, *Melaleuca quinquenervia*, *Oplismenus aemulus*, *Parsonsia straminea* and *Stephania japonica*. The Swamp Sclerophyll Forest within the Subject Site was in moderate to high condition, consisting of large remnant canopy and shrub species with an exotic dominant groundlayer.

3.2.2 Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale

3.2.2.1 Coastal Sand littoral Forest

Coastal Sand Littoral Forest is associated with the BC Act listed EEC, Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale (KDF). This community was in low condition, consisting of stands of native canopy trees above a sparse shrub layer and maintained lawn ground layer. Despite the historical disturbance this vegetation within the Subject Site consisted of *Eucalyptus robusta* on sandy soils within the suburb of Kurnell in the Sutherland Shire LGA, and therefore was considered to meet the BC Act listing in accordance with Final Determination (Scientific Committee 1999).

3.3 Environmental Protection and Biodiversity Conservation Act 1999

3.3.1 Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland Endangered Ecological Community

In order to be protected as a matter of national environmental significance areas of the ecological community must meet both:

- The key diagnostic characteristics listed in Section 2.1 of the approved conservation advice (DAWE 2021); AND
- Meet at least the minimum condition thresholds outlined in the approved conservation advice (DAWE 2021)

The vegetation within and surrounding the Subject Site mapped as Coastal Sand Swamp Mahogany Forests, meets the requirements for protection Under the EPBC Act to be listed as the Endangered Ecological Community Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland Endangered Ecological Community. The vegetation meets the Key Diagnostic criteria outlined in section 2.1 of the advice and when compared against the condition thresholds (**Table 9**) was found to meet criteria for listing as High Condition Class A.

Table 9. Condition thresholds - Approved Conservation Advice (DAWE 2021)

<p>Patch size thresholds →</p> <p>Biotic thresholds ↓</p>	<p>Large patch The patch is at least 5 ha. It may or may not be contiguous with other native vegetation.</p>	<p>Medium patch The patch is at least 2 ha and less than 5 ha. It may or may not be contiguous with other native vegetation.</p>	<p>Small contiguous patch The patch is at least 0.25 ha and less than 2 ha and is part of a larger area of native vegetation of at least 5 ha.</p>	<p>Small patch The patch is at least 0.5 ha and less than 2 ha which is isolated or part of a small native vegetation remnant less than 5 ha in total.</p>
<p>HIGH CONDITION Non-native species comprise < 20% of total ground layer vegetation cover*</p>	<p>CLASS A A <u>large patch</u> that meets key diagnostics AND has a <u>predominantly</u> native ground layer.</p>	<p>CLASS B1 A <u>medium patch</u> that meets key diagnostics AND has a <u>predominantly</u> native ground layer.</p>	<p>CLASS B2 A <u>small patch</u> that meets key diagnostics AND has a <u>predominantly</u> native ground layer AND is <u>contiguous**</u> with another <u>large</u> area of native vegetation.</p>	<p>CLASS C1 A <u>small patch</u> which meets key diagnostics AND has a <u>predominantly</u> native ground layer.</p>
<p>GOOD CONDITION Non-native species comprise 20% to 50% of total ground layer vegetation cover*</p>	<p>CLASS B1 A <u>large patch</u> that meets key diagnostics AND the ground layer is <u>mostly</u> native.</p>	<p>CLASS C1 A <u>medium patch</u> that meets key diagnostics AND the ground layer is <u>mostly</u> native.</p>	<p>CLASS C2 A <u>small patch</u> that meets key diagnostics AND has a <u>mostly</u> native ground layer AND is <u>contiguous**</u> with another large area of native vegetation.</p>	<p>CLASS C2 A <u>small patch</u> that meets key diagnostics AND has a <u>mostly</u> native ground layer.</p>
<p>MODERATE CONDITION Non-native species comprise 50% - 80% of total ground layer vegetation cover*</p>	<p>CLASS C1 A <u>large patch</u> which meets key diagnostics AND the ground layer has at least 20% native vegetation cover.</p>	<p>CLASS C2 A <u>medium patch</u> that meets key diagnostics AND the ground layer has at least 20% native vegetation cover.</p>	<p>Not protected</p>	<p>Not protected</p>
<p>LOW CONDITION Non-native species comprise more than 80% of total ground layer vegetation cover*</p>	<p>CLASS C2 A <u>large patch</u> which meets key diagnostics, but the ground layer has low native vegetation cover.</p>	<p>Not protected</p>	<p>Not protected</p>	<p>Not protected</p>
<p>*Refers to total perennial ground layer vegetation cover for the patch of the ecological community. Includes vascular plant species with a lifecycle of more than two growing seasons. It includes herbs (graminoids and forbs), grasses, shrubs, and juvenile plants of canopy species, but does not include annual plants, cryptogams, leaf litter or exposed soil.</p> <p>**Contiguous means the patch is connected or within 30 m of another area of native vegetation.</p> <p>See Appendix B for further information on non-native/invasive alien plants associated with the Coastal Swamp Sclerophyll Forest.</p>				

4. Threatened Species

4.1 Threatened Flora

Desktop analysis revealed a range of threatened flora as occurring or having the potential to occur on or within a 10km x 10km cell centred on the Subject Site. Thorough targeted surveys were undertaken throughout the Subject Site for potentially occurring threatened flora. No threatened flora were identified at the time of the site assessment in May 2021.

A comprehensive list of flora species identified during the site assessment is presented in **Appendix A**.

The following locally recorded threatened species were assessed for their potential to occur within the Subject Site (**Table 10**). It was determined that the proposed activity will have no significant impact on these species; therefore, no further assessment of impacts pursuant the BC Act (e.g. Biodiversity Development Assessment Report [BDAR]) and/or EPBC Act (Referral to Commonwealth) will be required.

Table 10. Assessment of likely occurrence of threatened flora species within the Subject Site.

Species	BC Act	EPBC Act	Likelihood of occurrence within the Subject Site	Further Impact Assessment Required?
<i>Acacia terminalis</i> subsp. Eastern Sydney (Sunshine Wattle)	Endangered	Endangered	Low to moderate. Whilst potential habitat (coastal scrub and dry sclerophyll woodland on sandy soil) does exist for this species within and surrounding the Subject Site, a targeted survey was conducted and no individuals were located.	No
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	Vulnerable	-	Low. Whilst potential habitat (dry sclerophyll forest on the coast and adjacent ranges) does exist for this species within and surrounding the Subject Site, a targeted survey was conducted and no individuals were located.	No
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	Vulnerable	-	Very low. This species is typically located in vegetation communities that have a strong shale soil influence. The Subject Site was located on sandy soils, not shale, and furthermore a targeted survey was conducted and no individuals of the <i>Epacris</i> genus were located.	No
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	Endangered	Endangered	Low. This species grows in dry sclerophyll forest and moss gardens over sandstone. The geology of the Subject Site consisted of marine quartz sands, not sandstone. Therefore, it is considered that the geology within the Subject Site would provide suboptimal habitat for this species, making it unlikely to occur.	No
<i>Pterostylis</i> sp. Botany Bay	Endangered	Endangered	Low. This species is known to occupy moist level sites on skeletal sandy soils. Associated	No

Species	BC Act	EPBC Act	Likelihood of occurrence within the Subject Site	Further Impact Assessment Required?
(Botany Bay Bearded Orchid)			vegetation is coastal heath dominated by <i>Melaleuca nodosa</i> and <i>Baeckea imbricata</i> . Whilst the Subject Site does occur on sandy soils, the vegetation present does not constitute a coastal heath and <i>Melaleuca nodosa</i> and <i>Baeckea imbricata</i> were not located. Therefore, the attributes within the Subject Site is deemed to provide suboptimal habitat for this species making it unlikely to occur.	
<i>Senecio spathulatus</i> (Coast Groundsel)	Endangered	-	Low to moderate. This species is known to occur on coastal dunes. A small area of coastal dunes exists within the Subject Site, however a targeted survey was conducted and this species was not located.	No
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	Endangered	Vulnerable	Very low. This species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest or on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. No such habitat was present within the Subject site.	No
<i>Thelymitra atronitida</i> (Black-hooded Sun Orchid)	Endangered	-	Moderate. A known population of this species is known to occur within the Kamay Botany Bay National Park. However, this population is recorded from shallow black peaty soils in coastal heath. The site assessment confirmed that the Subject Site occurs on sands, with no coastal heath present. It is therefore unlikely that this species would occupy the section of the National Park where the Subject Site is located.	No

4.2 Threatened Fauna

Details of the threatened fauna habitat recorded within the Subject Site are included in **Table 11**. The likelihood of occurrence of threatened fauna species within the Subject Site is presented in **Table 12**. One (1) threatened species was identified nesting during the site assessment:

- White-bellied Sea Eagle (*Haliaeetus leucogaster*; Vulnerable)

A 5-part Test of Significance was conducted for this species and it was concluded that the proposed activity will have no potential for significant impact upon this species.

A small suite of native fauna species were identified within and surrounding the Subject Site during the site assessments. All native fauna species encountered are listed as 'protected' under the BC Act. The list of fauna recorded during the site visit was produced opportunistically (**Appendix B**).

Table 11. Fauna habitat values identified within and surrounding the Subject Site.

Habitat component	Site values
Coarse woody debris	Present.
Rock outcrops and bush rock	Absent.
Caves, crevices and overhangs	Absent.
Culverts, bridges, mine shafts, or abandoned structures	Absent.
Nectar/lerp-bearing Trees	Native nectar-bearing tree species were identified within the Subject Site including Angophoras and Eucalypts. These trees may provide intermittent nectar sources for nectivores such as the Grey-headed Flying-fox.
Nectar-bearing shrubs	Native nectar-bearing shrub species were identified within the Subject Site including Melaleucas. These shrubs may provide intermittent nectar sources for similar nectivores.
Koala Feed Trees	Present.
Large stick nests	Present. A White-bellied Sea Eagle nest was identified within proximity to the Subject Site.
Sap and gum sources	Native sap and gum source trees were recorded within the Subject Site including Angophoras and Eucalypts. These trees may provide intermittent sap and/or lerp sources for various fauna species.
She-oak fruit (Glossy Black Cockatoo feed)	<i>Casuarina glauca</i> was identified within the Subject Site.
Seed-bearing trees and shrubs	Seed-bearing trees such as Eucalypts were identified within the Subject Site and may provide foraging habitat for various fauna species.
Soft-fruit-bearing trees	Pittosporum species were identified within the Subject Site and may provide foraging habitat for fructivores.
Dense shrubbery and leaf litter	Present.
Tree hollows	Numerous hollows were located in the areas surrounding the Subject Site, ranging in size from small to extra-large.
Decorticating bark	Absent.
Wetlands, soaks, and streams	Three (3) first order streams were mapped within the Survey Area however only the south wester most stream was evident within the Subject Site at the time of the site assessment.
Open water bodies	The subject Site is located on the Kurnell Peninsula which is on the shores of Botany Bay.
Estuarine, beach, mudflats, and rocky foreshores	Sandy and rocky foreshore are located just outside the Subject Site. No foreshore habitat will be impacted by the proposed activity.

4.2.1 Migratory Fauna Species

The following EPBC Act listed migratory fauna species were considered to occasionally use habitat within or around the Subject Site for foraging or passage:

- *Actitis hypoleucos* (Common sandpiper);
- *Anous stolidus* (Common Noddy);
- *Apus pacificus* (Fork-tailed Swift);
- *Ardenna carneipes* (Flesh-footed Shearwater);
- *Ardenna grisea* (Sooty Shearwater);
- *Ardenna pacifica* (Wedge-tailed Shearwater);
- *Ardenna tenuirostris* (Short-tailed Shearwater);
- *Arenaria interpres* (Ruddy Turnstone);
- *Calidris acuminata* (Sharp-tailed Sandpiper);
- *Calidris alba* (Sanderling);
- *Calidris canutus* (Red Knot);
- *Calidris ferruginea* (Curlew Sandpiper);
- *Calidris melanotos* (Pectoral Sandpiper);
- *Calidris ruficollis* (Red-necked Stint);
- *Calidris tenuirostris* (Great Knot);
- *Charadrius leschenaultii* (Greater Sandplover);
- *Charadrius mongolus* (Lesser Sandplover);
- *Chlidonias leucopterus* (White-winged Tern);
- *Fregata ariel* (Lesser Frigatebird);
- *Gallinago hardwickii* (Latham's Snipe);
- *Gelochelidon nilotica* (Gull-billed Tern);
- *Hirundapus caudacutus* (White-throated Needletail);
- *Hydroprogne caspia* (Caspian Tern);
- *Limicola falcinellus* (Broad-billed Sandpiper);
- *Limosa lapponica* Bar-tailed Godwit);
- *Limosa limosa* (Black-tailed Godwit);
- *Numenius madagascariensis* (Eastern Curlew);
- *Numenius phaeopus* (Whimbrel);
- *Oceanites oceanicus* (Wilson's Storm-petrel);
- *Phaethon lepturus* (White-tailed Tropicbird);
- *Philomachus pugnax* (Ruff);
- *Pluvialis fulva* (Pacific Golden Plover)
- *Pluvialis squatarola* (Grey Plover);
- *Stercorarius parasiticus* (Arctic Jaeger)
- *Sterna hirundo* (Common Tern);
- *Sternula albifrons* (Little Tern);
- *Sula leucogaster* (Brown Booby);
- *Thalasseus bergii* (Crested Tern);
- *Tringa brevipes* (Grey-tailed Tattler);
- *Tringa clareola* (Wood Sandpiper);
- *Tringa incana* (Wandering Tattler);
- *Tringa nebularia* (Common Greenshank);
- and
- *Xenus cinereus* (Terek Sandpiper).

The proposed activity will have low impacts to potential foraging habitat and negligible impacts to potential breeding habitat for these species given their migratory nature. In the event that these species forage within the Subject Site, the proposed removal of vegetation will have low impacts to foraging habitat given the large areas of suitable foraging habitat in the surrounding area and in their migratory range. No anticipated net loss of breeding habitat is expected. As such, the proposed activity is unlikely to a significant impact on these species; therefore, a Referral to Commonwealth pursuant to the EPBC Act should not be required.

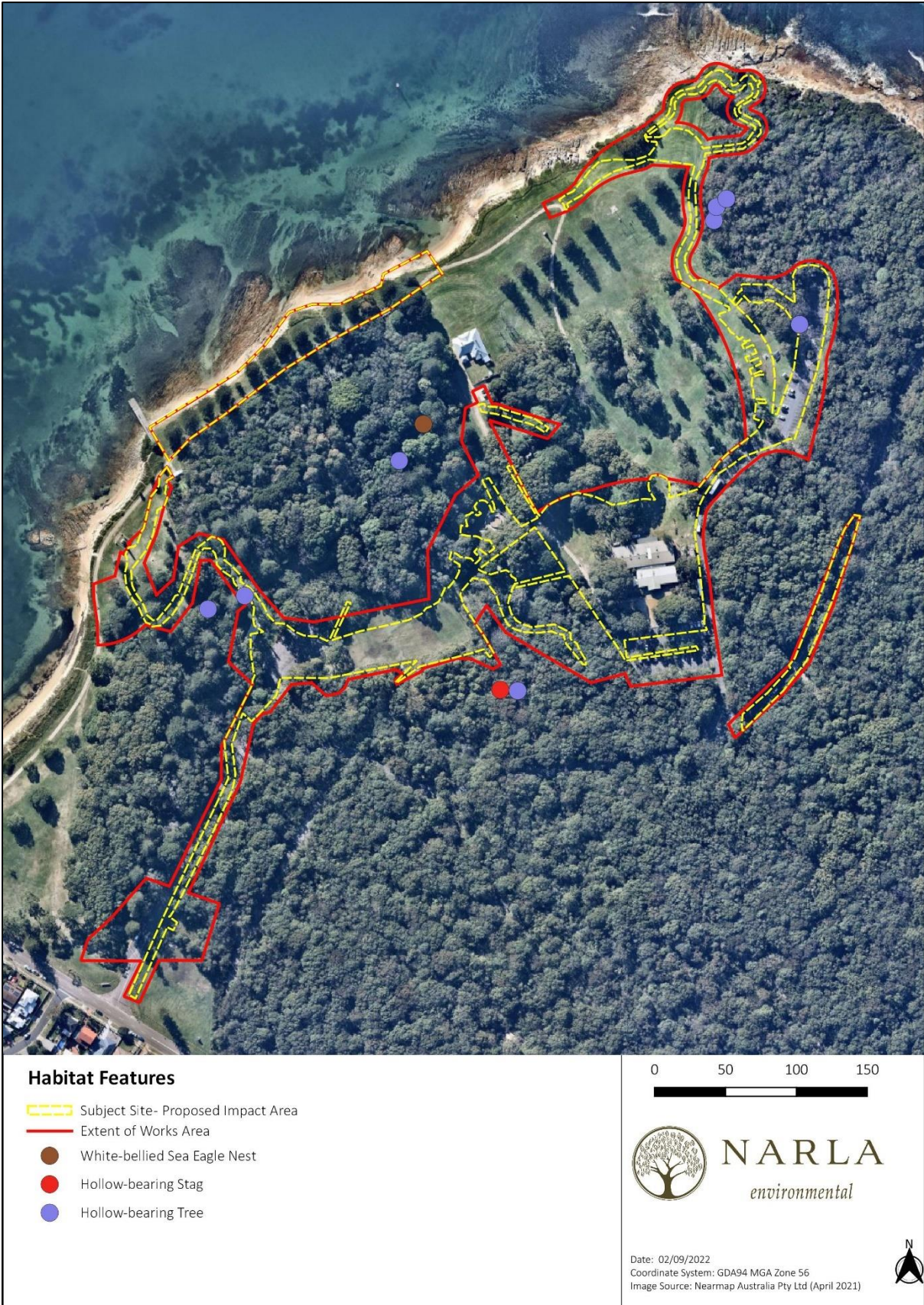


Figure 6. Habitat features recorded within and surrounding the Subject Site.

Table 12. Assessment of likely occurrence of threatened fauna species within the Subject Site.

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Anthochaera phrygia</i> (Regent Honeyeater)	Endangered	Critically Endangered	Low	The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Nectar and fruit from the mistletoes <i>Amyema miquelii</i> , <i>A. pendula</i> and <i>A. cambagei</i> are also utilised. When nectar, is scarce lerp and honeydew can comprise a large proportion of the diet. Potential foraging habitat was identified within the Subject Site.	This species breeds in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. No such habitat was identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat. Site assessment in May 2021 did not detect this species and the Subject Site is not identified on the Important Areas Map for this species.	No
<i>Ardenna carneipes</i> (Flesh-footed Shearwater)	Vulnerable	Migratory	Very low	This species forages over the ocean.	Nests 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.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Artamus cyanopterus cyanopterus</i> (Dusky Woodswallow)	Vulnerable	-	Medium	Often inhabit dry, open eucalypt forests and woodlands with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and	Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches,	Low impact to potential foraging and breeding habitat. However, the species is highly mobile and extensive areas of suitable habitat exist in the surrounding area. Site	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				ground-cover of grasses or sedges and fallen woody debris. Primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. Potential foraging habitat was identified within the Subject Site.	spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Potential breeding habitat was identified within the Subject Site.	assessment in May 2021 did not detect this species.	
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	Endangered	Endangered	Low	This species feeds on frogs, fish, yabbies, spiders, insects and snails within reeds near deep waterbodies. No such habitat was identified within the Subject Site.	This species builds nests in secluded places in densely-vegetated wetlands on a platform of reeds. No such habitat was identified within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Calidris alba</i> (Sanderling)	Vulnerable	Migratory	Very low	Often found in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons; individuals are rarely recorded in near-coastal wetlands. Such habitat does not exist within the Subject Site.	This species breeds in the northern hemisphere.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Calidris canutus</i> (Red Knot)	Vulnerable	Endangered; Migratory	Very low	In NSW the Red Knot mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours	This species breeds in the northern hemisphere.	Negligible, no anticipated impact to foraging or breeding habitat.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps. Such habitat does not exist within the Subject Site.			
<i>Calidris ferruginea</i> (Curlew Sandpiper)	Endangered	Critically Endangered; Migratory	Very low	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. Such habitat does not exist within the Subject Site.	The species breeds in Siberia.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Calidris tenuirostris</i> (Great Knot)	Vulnerable	Critically Endangered; Migratory	Very low	Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Such habitat does not exist within the Subject Site.	The species breeds in Siberia.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Collocephalon fimbriatum</i> (Gang-gang Cockatoo)	Vulnerable	-	Low	In autumn and winter, the species often moves to drier more open eucalypt forests and woodlands, or	This species favours Eucalypt tree species with hollows greater than 9cm diameter.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				in dry forest in coastal areas and often found in urban areas. Potential feed trees occur within the Subject Site.	Suitable hollows were located within proximity to the Subject Site however none will be removed by the proposed activity.	the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	
<i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo)	Vulnerable	-	Low to medium	This species feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species). Potential foraging habitat was identified within the Subject Site.	This species is dependent on large hollow-bearing Eucalypts for nest sites. Suitable hollows were located within the proximity to the Subject Site however none will be removed by the proposed activity.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	No
<i>Charadrius leschenaultii</i> (Greater Sand-plover)	Vulnerable	Vulnerable; Migratory	Very low	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. Such habitat was not present within the Subject Site	This species breeds in central Asia.	Negligible, no anticipated impact to foraging or breeding habitat.	No
<i>Charadrius mongolus</i> (Less Sand-plover)	Vulnerable	Endangered; Migratory	Very low	Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats;	This species breeds in central and north eastern Asia.	Negligible, no anticipated impact to foraging or breeding habitat.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				occasionally occurs on sandy beaches, coral reefs and rock platforms. Such habitat was not present within the Subject Site.			
<i>Crinia tinnula</i> (Wallum Froglet)	Vulnerable	-	Medium	They typically occur in sedgeland and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. Such habitat exists within the Subject Site.	The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Potential breeding habitat may exist within the Subject Site.	Low potential impact to foraging and breeding habitat given the proposed works to restore the previously piped creek. Extensive suitable habitat exists within the surrounding area. Targeted surveys were conducted for this species (ELA 2022) and no individuals were located.	5- Part Test of Significance conducted by ELA 2022 (Appendix F)
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	Vulnerable	-	Medium	Inhabits Eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee, and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Potential foraging habitat was identified within the Subject Site.	Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. No nests were identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Dasyornis brachypterus</i> (Eastern Bristlebird)	Endangered	Endangered	Low	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Habitat within the Subject Site is deemed suboptimal for this species as no heath or heathy understorey was present.	Nests are elliptical domes constructed on or near the ground amongst dense vegetation. No such nests were identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	
<i>Epthianura albifrons</i> (White-fronted Chat)	Vulnerable	-	Low	This species is usually found foraging on bare or grassy ground in wetland areas. No wetland habitat was identified within the Subject Site.	Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation near wetlands. No such habitat was identified within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Epthianura albifrons</i> (White-fronted Chat) Sydney Population	Endangered Population	-	Low	This species is usually found foraging on bare or grassy ground in wetland areas. No wetland habitat was identified within the Subject Site.	Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation near wetlands. No such habitat was identified within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Gygis alba</i> (White Tern)	Vulnerable	-	Very low	This species forages over marine environments. No such habitat was present within the Subject Site.	This species nests in the high branches of trees. On Lord Howe Island it nests in the introduced Norfolk Island Pine as	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
					well as native Sallywood, Blackbutt, Greybark, Banyan and Pandanus. No suitable nests were identified within the Subject Site.		
<i>Haematopus fuliginosus</i> (Sooty Oyster Catcher)	Vulnerable	-	Very low	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. No such habitat was present within the Subject Site.	Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. No such habitat was present within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Haematopus longirostris</i> (Pied Oyster Catcher)	Endangered	-	Very low	Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. No such habitat was present within the Subject Site.	Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. No nests were located within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Haliaeetus leucogaster</i> (White-bellied Sea-eagle)	Vulnerable	-	Located nesting in proximity to the Subject Site.	This species feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Prey items may occur within the Subject Site.	This species builds large stick nests in large emergent eucalypts. This species was identified nesting in proximity to the Subject Site.	Nesting/breeding behaviour have the potential to be impacted by the proposed works.	Yes (5-part Test of Significance)
<i>Halobaena caerulea</i> (Blue Petrel)	-	Vulnerable	Very low	It forages in Antarctic and subantarctic waters mainly on pelagic crustaceans, fish, cephalopods and	This species breeds close to the Antarctic Convergence Zone.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				insects. No such habitat exists within the Subject Site.			
<i>Lathamus discolor</i> (Swift Parrot)	Endangered	Critically Endangered	Medium	Favoured feed trees include winter flowering species such as <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> , <i>C. gummifera</i> , <i>E. tereticornis</i> , <i>E. sideroxylon</i> and <i>E. albens</i> . Commonly used lerp infested trees include <i>E. microcarpa</i> , <i>E. moluccana</i> , <i>E. pilularis</i> , and <i>E. melliodora</i> . Potential feed trees were identified within the Subject Site.	This species breeds in Tasmania.	Low impact to potential foraging habitat. This species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat. Site assessment in May 2021 did not detect this species and the Subject Site is not identified on the Important Areas Map for this species.	No
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	Vulnerable	Migratory	Very low	Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayment's, lagoons, saltmarshes and reefs as feeding and roosting habitat. No such habitat was present within the Subject Site.	The species breeds in Siberia.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Limosa limosa</i> (Black-tailed Godwit)	Vulnerable	Migratory	Very low	Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. No such habitat was	This species breeds in Mongolia.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				present within the Subject Site.			
<i>Litoria aurea</i> (Green and Golden Bell Frog)	Endangered	Vulnerable	Low	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha spp.</i>) or spikerushes (<i>Eleocharis spp.</i>). No such habitat was present within the Subject Site.	Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Such habitat was not present within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Targeted surveys were conducted for this species (ELA 2022) and no individuals were located.	5- Part Test of Significance conducted by ELA 2022 (Appendix F)
<i>Lophoictinia isura</i> (Square-tailed Kite)	Vulnerable	-	Low	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Potential foraging habitat was present within the Subject Site.	Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. No nests were located within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Macronectes giganteus</i> (Southern Giant Petrel)	Endangered	Endangered	Very low	This species forages at sea.	The species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Macronectes halli</i> (Northern Giant Petrel)	Vulnerable	Vulnerable	Very low	This species forages at sea.	Breeding in Australian territory is limited to Macquarie Island.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Miniopterus australis</i> (Little Bent-winged Bat)	Vulnerable	-	Medium	This species occupies moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. At night forage for small insects beneath the canopy of densely vegetated habitats. Potential foraging habitat was identified within the Subject Site.	This species only breeds in caves. No such habitat was identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat.	No
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	Vulnerable	-	Medium	Hunt in forested areas, catching moths and other flying insects above the tree tops. Potential prey items may occur within the Subject Site.	This species only breeds in caves. No such habitat was identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area.	No
<i>Myotis macropus</i> (Southern Myotis)	Vulnerable	-	Medium	Forage over streams and pools catching insects and small fish by raking their feet across the water surface. Suitable foraging habitat was present within the Subject Site.	Generally, this species roosts 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.	Low potential impact to foraging and breeding habitat given the proposed works to restore the previously piped creek. No hollows are proposed for removal and extensive suitable habitat exists within the surrounding area.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
					Suitable habitat was present within the Subject Site.		
<i>Neochmia ruficauda</i> (Star Finch)	Endangered	Endangered	Low	The Star Finch forages on the ground, where it picks up fallen seed, and in vegetation (including grasses and shrubs), it takes seeds from seed-heads and Casuarina cones and insects from grasses and other foliage. Potential foraging habitat was identified within the Subject Site.	The Star Finch occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. No such habitat was present within the Subject Site.	Minimal impact to potential foraging habitat given the mobility of the species and the extensive areas of suitable foraging habitat in the surrounding area. No anticipated net loss of potential breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	No
<i>Neophema chrysogaster</i> (Orange-bellied Parrot)	Critically Endangered	Critically Endangered	Low	Birds forage in low samphire herb land or taller coastal shrubland. Potential foraging habitat was identified within the Subject Site.	The Orange-bellied Parrot breeds in the south-west of Tasmania	Minimal impact to potential foraging habitat given the mobility of the species and the extensive areas of suitable foraging habitat in the surrounding area. No anticipated net loss of potential breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	No
<i>Ninox strenua</i> (Powerful Owl)	Vulnerable	-	Medium	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The main prey items are medium-sized	Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts. Suitable hollows were located within the proximity to the Subject	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable habitat exist in the surrounding area. No anticipated net loss of breeding habitat as	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Potential prey items may occur within the Subject Site.	Site however none will be removed by the proposed activity.	hollow-bearing trees will be retained.	
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	Critically Endangered; Migratory	Very low	This species is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. No such habitat was present within the Subject Site.	This species breeds in Russia and north-eastern China.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Onychoprion fuscata</i> (Sooty Tern)	Vulnerable	-	Very low	This species forages over marine habitats.	In NSW only known to breed at Lord Howe Island.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Oxyura australis</i> (Blue-billed Dick)	Vulnerable	-	Very low	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. No such habitat was present within the Subject Site.	Blue-billed Ducks usually nest solitarily in Cumbungi over deep water. No suitable breeding habitat was present within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Pandion cristatus</i> (Eastern Osprey)	Vulnerable	-		Feed on fish over clear, open water. No suitable foraging habitat was present within the Subject Site.	Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. No Osprey nests were located within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Petroica boodang</i> (Scarlet Robin)	Vulnerable	-	Low	This species forages from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. They inhabit dry eucalypt forests and woodlands that contains abundant logs and fallen timber. Potential foraging habitat was identified within the Subject Site.	The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions. No nests were located within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable habitat exist in the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Pezoporus wallicus wallicus</i> (Eastern Ground Parrot)	Vulnerable	-	Very low	The Ground Parrot occurs in high rainfall coastal and near coastal low heathlands and sedgeland, generally below one metre in height and very dense (up to 90% projected foliage cover). No such habitat was present within the Subject Site.	Eggs are laid in a shallow bowl of fine sticks and grass, well hidden under overhanging tall, coarse grass, sedge or low, heathy shrubs. No such nests were located within the Subject Site at the time of the site assessment.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Polytelis swainsonii</i> (Superb Parrot)	Vulnerable	Vulnerable	Very low	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. No such habitat was present within the Subject Site.	In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. No such habitat was present within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Procelsterna cerulea</i> (Grey Ternlet)	Vulnerable	-	Very low	This species forages over marine habitats.	Breeds on Lord Howe Island on seacliffs of northern hills and southern mountains, and also on offshore islands including Admiralty Islets, Muttonbird Island and Ball's Pyramid.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Pterodroma nigripennis</i> (Black-winged Petrel)	Vulnerable	-	Very Low	This species forages over marine habitats.	Nests at numerous sites on Lord Howe Island: North Head, New Gulch, Dawson's Ridge, Malabar, Ned's Beach, Jim's Point, Transit Hill, adjacent to Muttonbird Point, Red Point and Ball's Pyramid	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
<i>Pterodroma solandri</i> (Providence Petrel)	Vulnerable	-	Very low	This species forages over marine habitats.	Breeds on Lord Howe Island on seacliffs of northern hills and southern mountains, and also on offshore islands including Admiralty Islets, Muttonbird Island and Ball's Pyramid.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	Vulnerable	Vulnerable	Medium	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Potential foraging habitat was identified with the Subject Site.	No breeding camps were identified within or surrounding the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat.	No
<i>Ptilinopus superbus</i> (Superb Fruit Dove)	Vulnerable	-	Low	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of	he nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Potential foraging habitat was present within the Subject Site.	appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species. No such preferred breeding habitat was present within the Subject Site.	the surrounding area. No anticipated net loss of breeding habitat.	
<i>Puffinus assimilis</i> (Little Shearwater)	Vulnerable	-		This species forages over marine habitats.	Breeding sites at Lord Howe Island include Roach Island, Muttonbird Island, Blackburn Island and on the main Island at Muttonbird Point and Transit Hill.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Saccolaimus flaviventris</i> (Yellow-bellied Shearwater)	Vulnerable	-	Medium	This species forages in most habitats across its very wide range, with and without trees. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Potential prey items may occur within the Subject Site.	This species requires tree hollows or buildings for roosting/breeding. Hollows were identified within the Subject Site.	Low impact to potential foraging habitat. However, the species is highly mobile and extensive areas of suitable foraging habitat exist in the surrounding area. No anticipated net loss of breeding habitat as hollow-bearing trees will be retained.	No
<i>Stagonopleura guttata</i> (Diamond Firetail)	Vulnerable	-	Low	This species is found in grassy eucalypt woodlands, including Box-Gum	Nests are globular structures built either in the shrubby	Low impact to potential foraging and breeding habitat. However, the species is highly mobile and	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. 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). Potential foraging habitat was identified within the Subject Site.	understorey, or higher up, especially under hawk's or raven's nests. Potential breeding habitat was identified within the Subject Site; however, no nests were identified.	extensive areas of suitable habitat exist in the surrounding area. Site assessment in May 2021 did not detect this species.	
<i>Sternula albifrons</i> (Little Tern)	Endangered	Migratory	Very low	This species forages over marine habitats.	Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. No suitable nesting habitat was located within the Subject Site.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No
<i>Thinornis cucullatus</i> (Eastern Hooded Dotterel)	Critically Endangered	Vulnerable	Very low	This species prefers sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. No	In eastern Australia, this species usually breeds from August to March on sandy ocean beaches strewn with beachcast seaweed, in a narrow strip between the high-water mark and the base of the	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

Species	BC Act	EPBC Act	Likelihood of Occurrence	Foraging Habitat Present Within the Subject Site	Breeding Habitat Present Within the Subject Site	Anticipated Impact	Further Impact Assessment Required?
				such habitat was located within the Subject Site.	fore-dunes. No suitable habitat was identified within the Subject Site.		
<i>Tyto longimembris</i> (Eastern Grass Owl)	Vulnerable	-	Low	Found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. Potential foraging habitat was present within the Subject Site.	Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation. No suitable nesting habitat was present within the Subject Site.	Low impact to potential foraging and breeding habitat. However, the species is highly mobile and extensive areas of suitable habitat exist in the surrounding area.	No
<i>Xenus cinereus</i> (Terek Sandpiper)	Vulnerable	Migratory	Very low	In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. No such habitat was present within the Subject Site.	This species breeds in the northern forests and Arctic tundra.	Negligible, no anticipated impact to foraging or breeding habitat. Site assessment in May 2021 did not detect this species.	No

5. Impact Summary

5.1 Vegetation

The proposed activity is situated predominately on areas of cleared, exotic grassland. However, sections do impact other vegetation communities including: Planted Vegetation, Coastal Sand Littoral Forest, Coastal Sand Swamp Mahogany Forest, Coastal Sand Apple-Bloodwood Forest and Coastal Sandstone Foreshore Forest.

The vegetation community Coastal Sand Littoral Forest identified within the Subject Site conforms to the BC Act listed EEC, Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale; however, it was in low condition, owing to it lacking other strata layers other than canopy.

The vegetation community, Coastal Sand Swamp Mahogany Forest identified within the Subject Site conforms to the BC Act listed EEC, Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. This community was in a moderate-to high condition, consisting of characteristic vegetation in all strata levels.

Assessments of Significance (5-part Test) were carried out for both EECs (**Appendix C**). The overall vegetation impacts are summarised in **Table 13**.

Table 13. Approximate areas of vegetation impacted by the proposed activity.

Vegetation Community	Approximate Area Cleared/Modified	Associated TEC
Planted Vegetation	0.35ha	-
Coastal Sand Littoral Forest	0.21ha	Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale (EEC)
Coastal Sand Mahogany Forest	0.39	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)
Coastal Sand Apple-Bloodwood Forest	0.49ha	-
Coastal Sandstone Foreshore Forest	0.08m ²	-
Exotic Grassland	1.19	-
Total Vegetation Impacted	2.71ha	
Total EEC Impacted	0.60ha	

5.1.1 Local Occurrence

5.1.1.1 Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale (EEC)

The local occurrence of the BC Act listed EEC, Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale was calculated using the Sydney Metropolitan (OEH 2016) historic vegetation mapping. This was combined with Narla field-validated vegetation mapping to determine the impact of the proposed activity on this EEC within the locality (**Figure 7**). The local occurrence of the EEC was calculated to be 21.84ha. The proposed clearing/modification of 0.21ha of this EEC accounts for only 0.96% of the local occurrence.

5.1.1.2 Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)

The local occurrence of the BC Act listed EEC, Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions was calculated using Sydney Metropolitan (OEH 2016) historic vegetation mapping which was combined with Narla field-validated vegetation mapping to determine the impact of the proposed activity on this EEC within the locality (**Figure 8**). The local occurrence of the EEC was calculated to be 15.22ha. The proposed clearing of 0.39ha of this EEC accounts for only 2.56% of the local occurrence.

5.2 Threatened Fauna

5.2.1 White-bellied Sea Eagle

A BC Act listed Vulnerable species, the White-bellied Sea Eagle (*Haliaeetus leucogaster*), was identified nesting in vegetation approximately 100m from the closest section of the proposed works (**Photo Plate 1**). An acoustic survey followed by an assessment of available information from raptor expert Stephen Debus (2022; **Appendix E**) concluded:

“The acoustic report, and site photographs, reveal that most redevelopment activities (demolition and reconstruction of the Visitor Centre, works on the seawall) will generate noise levels of less than 60 dB (mostly 50–55 dB) at the eagle’s nest, are visually screened from most angles, and are mostly at least 100 m from the nest. Accordingly, it is considered that the proposed Master plan works will not create any disturbance to the subject Sea-Eagles greater than the activities to which they are currently habituated, and the works may proceed within the identified noise and proximity parameters while the Sea-Eagles are nesting.”

An Assessment of Significance (5-part Test) was also carried out for this species (**Appendix C**) and it was determined that the proposed activity was not likely to result in a significant impact.

5.2.2 Threatened Amphibians

Targeted surveys for Green and Golden Bell Frogs (GGBF; *Litoria aurea*) and Wallum Froglet (*Crinia tinnula*) conducted by ELA in March 2022 identified no individuals within areas considered to be potential habitat. Test of Significance prepared by ELA concluded that no significant impacts were likely to occur to GGBF or Wallum Froglet as a result of the proposed masterplan (**Appendix F**)



Photo Plate 1. White-bellied Sea Eagle nest (in yellow), located within proximity of the Subject Site.

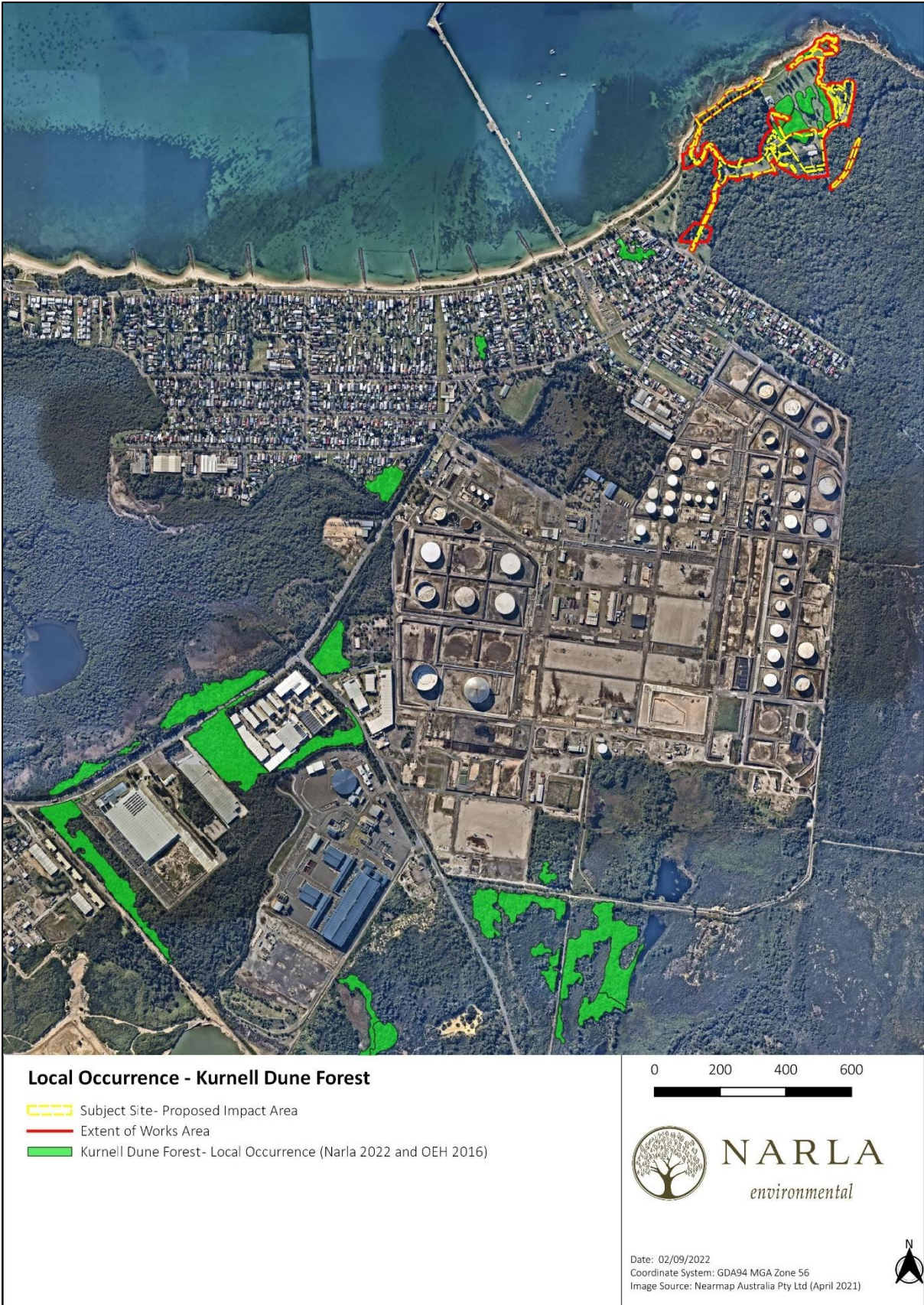


Figure 7. Local occurrence of S_WSF03: Coastal Sand Mahogany Forest (Kurnell Dune Forest EEC).



Figure 8. Local occurrence of S_FoW04: Coastal Sand Swamp Mahogany Forest (Swamp Sclerophyll Forest EEC)

5.3 Matters of National Environment Significance

The Matters of National Environment Significance (MNES) protected by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) identified in a Protected Matters search,, including a buffer of 10km around the Subject Site, are presented in **Table 14**.

Table 14. Matters of National Environment Significance relevant to the Proposal.

Matters of National Environment Significance (MNES)	Results	Comment
World Heritage Properties	-	-
National Heritage Places	4	Refer to heritage consultant report.
Wetlands of International Importance	1	N/A. The Subject Site is not in proximity to the Towra Point Nature Reserve which is a listed Ramsar site. No impacts to this area will result from the proposed master plan.
Great Barrier Reef Marine Park	-	-
Commonwealth Marine Areas	1	N/A the proposed works will not impact any Commonwealth Marine Areas
Threatened Ecological Communities	13	One EPBC Threatened Ecological Communities was identified within the Subject Site: <ul style="list-style-type: none"> ▪ Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland. An Assessment of Significant Impact Criteria has been undertaken for this community (Appendix D)
Threatened Species	100	No EPBC Act listed threatened species were observed within the Subject Site during the site assessment however potential habitat was present for several species. Threatened species with potential to occur within the Subject Site have been assessed for potential impacts in Table 12 .
Listed Migratory Species	83	The proposed activity will have low impacts to potential foraging habitat and negligible impacts to potential breeding habitat for these species given their migratory nature. In the event that these species forage within the Subject Site, the proposed removal of vegetation will have low impacts to foraging habitat given the large areas of suitable foraging habitat in the surrounding area and in their migratory range. No anticipated net loss of breeding habitat is expected. As such, the proposed activity is unlikely to a significant impact on these species; therefore, a Referral to Commonwealth pursuant to the EPBC Act should not be required

6. Recommendations

6.1 Impact Mitigation and Minimisation Recommendations

This section of the report details recommended efforts to avoid and minimise impacts on biodiversity values associated with the proposed activity. Measures to be implemented before, during, and post construction are detailed in **Table 15**.

Table 15. Measures to be implemented before, during, and after construction to avoid and minimise the impacts of the proposed activity.

Action	Outcome	Timing	Responsibility
Project Location, Design and Planning	<p>The proposed activity will involve the clearing/modification of exotic grassland, planted vegetation along with the native vegetation communities Coastal Sand Littoral Forest, Coastal Sand Swamp Mahogany Forest, Coastal Sand Apple-Bloodwood Forest and Coastal Sandstone Foreshore Forest.</p> <p>The location of the proposed activity has been strategically placed to avoid the removal of trees where possible. The works proposed for the creek remediation is the only location where some tree removal is unavoidable, however these works will restore the currently piped creek, to its original free flowing state, which will ultimately improve the state of the vegetation community and local fauna that rely on it.</p>	Pre-construction phase	Proponent
Assigning a Project Ecologist	<p>Prior to the implementation of the activity, the proponent should commission the services of a qualified and experienced Ecologist with a minimum tertiary degree in Science, Conservation, Biology, Ecology, Natural Resource Management, Environmental Science, or Environmental Management. The Ecologist should be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act.</p> <p>The Ecologist should be commissioned to:</p> <ul style="list-style-type: none"> Undertake an extensive pre-clearing survey, delineating habitat-bearing trees and shrubs to be retained/removed; and 	Pre-construction phase	Proponent

Action	Outcome	Timing	Responsibility
	<ul style="list-style-type: none"> Supervise the clearance of trees and shrubs (native and exotic) in order to capture, treat and/or relocate any displaced fauna. 		
Tree Protections	<p>Australian Standard 4970 (2009) Protection of Trees on Development Sites (AS-4970) outlines that a Tree Protection Zone (TPZ) is the principal means of protecting trees on construction sites. It is an area isolated from construction disturbance so that the tree remains viable. Ideally, activity should be avoided within the TPZ.</p> <p>A Minor Encroachment is less than 10% of the TPZ and is outside the structural root zone (SRZ). A Minor Encroachment is considered acceptable by AS-4970 when it is compensated for elsewhere and contiguous within the TPZ.</p> <p>A Major Encroachment is greater than 10% of the TPZ or inside the SRZ. Major Encroachments generally require root investigations undertaken by non-destructive methods or the use of tree sensitive construction methods.</p>	Pre-construction phase	Proponent Arborist
Protection of remaining vegetation	Prior to any works commencing, exclusion fencing or flagging is to be installed around all vegetation not proposed for removal by the proposed activity to avoid any incidental removal or impacts.	Construction phase	Proponent
Relocation of woody debris	All woody debris and fallen trees should be relocated within the retained vegetation adjacent the Subject Site to maintain habitat features in the area.	Construction phase	Project Ecologist Construction Contractor
Hollow-bearing tree replacement	<p>All hollow-bearing trees (including dead trees) should be retained where possible. In the event a hollow-bearing tree is required to be removed, a qualified ecologist should be on site to oversee the removal and to safely relocate any fauna that may be inside.</p> <p>All removed hollows are required to be replaced by nest boxes at a 1:1 ratio within the retained vegetation adjacent the Subject Site. Nest boxes are a good way of improving the biodiversity values of an area and, as such, the installation of a range of nest boxes in the area should be considered.</p>	Construction phase	Project Ecologist Proponent
Tree Replacement	Any trees proposed to be removed are to be replaced by locally indigenous native tree species representative of either the Kurnell Dune Forest or Swamp Sclerophyll Forest EECs. Trees are to be replaced at a minimum 1:1 ratio.	Construction phase	Project Ecologist Proponent

Action	Outcome	Timing	Responsibility
White-bellied Sea Eagle Impact Avoidance	Noise monitoring is to be conducted during construction to ensure works do not exceed the levels outlined in Noise Monitoring Report (PWNA 2022). If works are expected to exceed this noise limit, then monitoring should be conducted by a suitably qualified person to ensure such works are not adversely impacting the breeding pair.	Construction phase	Project Ecologist Proponent
Threatened Amphibians	The ELA assessment of GGBF and Wallum Froglet (2022) has recommended the following controls to minimise potential impacts to these species: <ul style="list-style-type: none"> • Erosion and sediment control, water quality management. • Identifying measures to protect areas of significant habitat value from construction activities and vehicle access. • Protection of vegetation outside the immediate works area. • Pollution control and protection. • Zero waste policy and safe disposal of all wastes off site. • Containment and management of spills (oil, fuel, or other products). • Methods of contamination and removing spilt material from any vehicles including fuels and spills. • Wash down procedures against introduction of chytrid, phytophthora and weed species to/from site in accordance with Saving Our Species Hygiene Protocols (DPIE 2020). • Site environmental control on vehicle and materials storage. 	Construction phase	Proponent Construction Contractor
Erosion and Sedimentation	Appropriate erosion and sediment control should be erected and maintained at all times during construction in order to avoid the potential of incurring indirect impacts on biodiversity values. As a minimum, such measures should comply with the relevant industry guidelines such as 'the Blue Book' (Landcom 2004).	Construction phase	Proponent Construction Contractor
Storage and Stockpiling (Soil and Materials)	Allocate all materials within the designated stockpile locations away from any vegetation that is planned to be retained. Avoid importing any soil from outside the site in order to avoid the potential of incurring indirect impacts on biodiversity values as this can introduce weeds and pathogens to the site.	Construction phase	Construction Contractors

7. Conclusion

This assessment indicates that the relevant provisions of the Environmental Planning and Assessment Act 1979, Biodiversity Conservation Act 2016, and the Environmental Protection and Biodiversity Act 1999 have been satisfied. No threatened ecological communities, fauna or flora species, or populations are expected to be significantly impacted as a result of the proposed Activity if appropriate recommendations in this report are followed.

In summary, the proposed Activity will require the clearing/modification of:

- Approximately 0.35ha of Planted Vegetation
- Approximately 0.21ha of S_WSF03: Coastal Sand Littoral Forest (Kurnell Dune Forest EEC);
- Approximately 0.39ha of S_FoW04: Coastal Sand Swamp Mahogany Forest (Swamp Sclerophyll Forest EEC);
- Approximately 0.48ha of S_DSF03: Coastal Sand Apple-Bloodwood Forest;
- Approximately 0.08ha of S_DSF06: Coastal Sandstone Foreshore Forest; and
- Approximately 1.19ha of Exotic Grassland.

8. References

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Pulse White Noise Acoustics Pty Ltd (PWNA) (2022) Kamay Sea Eagle Nesting Site – Acoustic Assessment

Stephen Debus (2022) White-bellied Sea Eagle at Kamay Botany Bay National Park: Potential Impacts of Redevelopment.

Taylor, Cullity, Lethlean (2022), Kamay Master Plan Stage 1 – Draft Tender Issue.

9. Appendices

Appendix A. Flora species identified within and surrounding the Subject Site

Appendix B. Fauna species identified within and surrounding the Subject Site

Appendix C. Biodiversity Conservation Act 2016 – Assessments of Significance (5-part Test).

Appendix D EPBC Act Assessment of Significant Impact Criteria.

Appendix E. White-bellied Sea Eagle at Kamay Botany Bay National Park: Potential Impacts of Redevelopment (Stephen Debus 2022).

Appendix F. Kamay Botany Bay Park Amphibian Test of Significance (ELA 2022).

Appendix A. Flora species identified within and surrounding the Subject Site.

Scientific Name	Canopy	Midstorey	Understorey	Status
<i>Acacia falcata</i>		x		
<i>Acacia suaveolens</i>		x		
<i>Acacia ulicifolia</i>		x		
<i>Acetosa sagittata*</i>			x	
<i>Acmena smithii</i>		x		
<i>Andropogon virginicus*</i>			x	
<i>Angophora costata</i>	x			
<i>Anredera cordifolia*</i>			x	Priority Weed
<i>Araucaria cunninghamii</i>	x			
<i>Araucaria heterophylla</i>	x			
<i>Asparagus aethiopicus*</i>			x	Priority Weed
<i>Avena sativa*</i>			x	
<i>Banksia ericifolia</i>		x		
<i>Banksia integrifolia</i>		x		
<i>Banksia serrata</i>		x		
<i>Bidens pilosa*</i>			x	
<i>Brachychiton acerifolius</i>		x		
<i>Breynia oblongifolia</i>		x		
<i>Bromus catharticus*</i>			x	
<i>Callistemon</i> spp.		x		
<i>Carpobrotus glaucescens</i>			x	
<i>Casuarina glauca</i>	x			
<i>Cayratia clematidea</i>			x	
<i>Cenchrus clandestinus*</i>			x	
<i>Chloris gayana*</i>			x	
<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata*</i>			x	Priority Weed
<i>Clerodendrum tomentosum</i>		x		
<i>Commelina cyanea</i>			x	
<i>Corymbia gummifera</i>	x			
<i>Cupaniopsis anacardioides</i>		x		
<i>Cynodon dactylon</i>			x	
<i>Dianella caerulea</i>			x	
<i>Dichondra repens</i>			x	
<i>Dodonaea triquetra</i>		x		
<i>Doryanthes excelsa</i>			x	
<i>Echinochloa crus-galli*</i>			x	
<i>Echinopogon caespitosus</i>			x	
<i>Ehrharta erecta*</i>			x	
<i>Elaeocarpus reticulatus</i>		x		
<i>Entolasia marginata</i>			x	
<i>Eucalyptus botryoides</i>	x			
<i>Eucalyptus haemastoma</i>	x			
<i>Eucalyptus microcorys</i>	x			

Scientific Name	Canopy	Midstorey	Understorey	Status
<i>Eucalyptus racemosa</i>	x			
<i>Eucalyptus robusta</i>	x			
<i>Eustrephus latifolius</i>			x	
<i>Ficus macrophylla</i>		x		
<i>Gahnia spp.</i>			x	
<i>Geitonoplesium formosum</i>			x	
<i>Geranium homeanum</i>			x	
<i>Gleichenia dicarpa</i>			x	
<i>Glochidion ferdinandi</i>		x		
<i>Glycine clandestinus</i>			x	
<i>Hardenbergia violacea</i>			x	
<i>Hibbertia scandens</i>			x	
<i>Homalanthus populifolius</i>		x		
<i>Hydrocotyle bonariensis*</i>			x	
<i>Hydrocotyle peduncularis</i>			x	
<i>Hypochaeris radicata*</i>			x	
<i>Imperata cylindrica</i>			x	
<i>Indigofera australis</i>		x		
<i>Kennedia rubicunda</i>			x	
<i>Kunzea ambigua</i>		x		
<i>Lantana camara*</i>			x	Priority Weed
<i>Livistona australis</i>		x		
<i>Lobelia purpurascens</i>			x	
<i>Lomandra longifolia</i>			x	
<i>Lophostemon confertus</i>	x			
<i>Macrozamia communis</i>			x	
<i>Melaleuca quinquenervia</i>	x			
<i>Modiola caroliniana*</i>			x	
<i>Monotoca elliptica</i>		x		
<i>Nephrolepis cordifolia</i>			x	
<i>Notelaea longifolia</i>		x		
<i>Ochna serrulata*</i>			x	
<i>Olea europaea</i> subsp. <i>cuspidata*</i>		x		Priority Weed
<i>Oplismenus aemulus</i>			x	
<i>Parsonsia straminea</i>			x	
<i>Paspalum dilatatum*</i>			x	
<i>Persoonia lanceolata</i>		x		
<i>Phoenix canariensis*</i>		x		
<i>Pimelea linifolia</i>		x		
<i>Pittosporum multiflorum</i>		x		
<i>Pittosporum revolutum</i>		x		
<i>Pittosporum undulatum</i>		x		
<i>Plantago lanceolata*</i>			x	
<i>Poa affinis*</i>			x	
<i>Pomax umbellata</i>			x	

Scientific Name	Canopy	Midstorey	Understorey	Status
<i>Pteridium esculentum</i>			X	
<i>Schoenoplectus validus</i>			X	
<i>Senna pendula</i> *			X	
<i>Setaria parviflora</i> *			X	
<i>Smilax glycyphylla</i>			X	
<i>Solanum nigrum</i> *			X	
<i>Sonchus oleraceus</i> *			X	
<i>Sporobolus africanus</i> *			X	
<i>Stellaria media</i> *			X	
<i>Stenotaphrum secundatum</i> *			X	
<i>Stephania japonica</i>			X	
<i>Syncarpia glomulifera</i>	X			
<i>Tetragonia tetragonioides</i>			X	
<i>Trifolium repens</i> *			X	
<i>Typha orientalis</i>			X	
<i>Viola hederacea</i>			X	

* Denotes exotic species

Appendix B. Fauna species identified within and surrounding the Subject Site

Class	Scientific Name	Common Name	Status
Aves	<i>Anthochaera chrysoptera</i>	Little Wattlebird	Protected
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	Protected
	<i>Corvus coronoides</i>	Australian Raven	Protected
	<i>Cracticus tibicen</i>	Australian Magpie	Protected
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Protected
	<i>Grallina cyanoleuca</i>	Magpie Lark	Protected
	<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	Vulnerable (BC Act)
	<i>Manorina melanocephala</i>	Noisy Miner	Protected
	<i>Ocyphaps lophotes</i>	Crested Pigeon	Protected
	<i>Strepera graculina</i>	Pied Currawong	Protected
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Protected
	<i>Vanellus miles</i>	Masked Lapwing	Protected

Appendix C. Biodiversity Conservation Act 2016 – Assessments of Significance (5-part Test).

Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test) for Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale (KDF)		
BC Act Status: Endangered Ecological Community		
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	Not Applicable.	
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	The proposed Activity is not likely to have an effect on the extent of KDF such that its local occurrence is likely to be placed at risk of extinction. The proposed activity will involve the clearing/modification of approximately 0.21ha of low quality KDF. This area accounts for 0.96% of the locally occurring KDF. The vegetation that has been identified for removal from the EEC has been heavily modified with no shrub or ground layers present. Extensive areas of KDF will remain unimpacted across the greater landscape.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	The proposed activity is not likely to substantially and adversely modify the composition of KDF such that its local occurrence is likely to be placed at risk of extinction. The proposed development will involve the clearing/modification of approximately 0.21ha of low quality KDF. The community will continue to exist in the surrounding landscape, with the amount being removed/impacted considered minor in comparison to what is occurring within the local distribution of this EEC.
(c) in relation to the habitat of a threatened species, population or ecological community:	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposed activity will involve the clearing/modification of 0.21ha of low quality KDF. This area accounts for only 0.96% of the locally occurring KDF.

**Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test)
for
Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale (KDF)**

BC Act Status: Endangered Ecological Community

	<p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p>	<p>This area of KDF will not become fragmented or isolated from other areas of KDF as a result of the proposed activity. The minimal vegetation to be impacted is located on the fringe of this heavily modified community, with connectivity continuing to exist as it currently does.</p>
	<p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,</p>	<p>All areas of KDF is considered important. The proposed activity will involve the clearing/modification of 0.21ha of KDF. This area accounts for 0.96ha of the locally occurring KDF. Large areas of KDF will remain within the surrounding landscape.</p>
<p>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),</p>	<p>The proposed activity is not likely to have an adverse effect on any declared area of outstanding biodiversity value, directly or indirectly.</p>	
<p>(e) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the effect of, a key threatening process.</p>	<p>The proposed activity will result in the following Key Threatening Processes (KTPs) listed under Schedule 4 of the BC Act:</p> <ul style="list-style-type: none"> ▪ Clearing of native vegetation; and ▪ Removal of dead wood and dead trees. 	
<p>References: Department of Planning, Industry and Environment (DPIE) (2021f) Kurnell Dune Forest in the Sutherland Shire and City of Rockdale – profile. https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10448</p>		

<p style="text-align: center;">Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test) for Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SSF)</p>		
<p style="text-align: center;">BC Act Status: Endangered Ecological Community</p>		
<p>(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,</p>	<p>Not Applicable.</p>	
<p>(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p>	<p>(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p>	<p>The proposed activity is not likely to have an effect on the extent of SSF such that its local occurrence is likely to be placed at risk of extinction. The proposed activity will involve the clearing/modification of approximately 0.39ha of SSF. This area accounts for 2.56% of the locally occurring SSF. Extensive areas of SSF will remain unimpacted across the greater landscape.</p>
	<p>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,</p>	<p>The proposed activity is not likely to substantially and adversely modify the composition of SSF such that its local occurrence is likely to be placed at risk of extinction. The proposed development will involve the clearing/modification of approximately 0.39ha of SSF. The community will continue to exist in the surrounding landscape, with the amount being removed/impacted considered minor in comparison to what is occurring within the local distribution of this EEC.</p>
<p>(c) in relation to the habitat of a threatened species, population or ecological community:</p>	<p>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p>	<p>The proposed activity will involve the clearing/modification of 0.39 of moderate to high quality SSF This area accounts for only 2.56% of the locally occurring SSF.</p>
	<p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p>	<p>This area of SSF will not become fragmented or isolated from other areas of SSF as a result of the proposed activity. The small amount of vegetation to be removed/impacted is located on the fringes of this community, with connectivity continuing to exist as it currently does.</p>

<p align="center">Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test) for Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SSF)</p>		
<p align="center">BC Act Status: Endangered Ecological Community</p>		
	<p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,</p>	<p>All area of SSF is considered important. The proposed activity will involve the clearing/modification of 0.39ha of SSF. This area accounts for 2.56% of the locally occurring SSF. Large areas of SSF will remain within the surrounding landscape. Furthermore, the proposed creek remediation works will provide better suited habitat for this community in the long-term, by improving hydrological processes in the area.</p>
<p>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),</p>	<p>The proposed Activity is not likely to have an adverse effect on any declared area of outstanding biodiversity value, directly or indirectly.</p>	
<p>(e) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the effect of, a key threatening process.</p>	<p>The proposed activity will result in the following Key Threatening Processes (KTPs) listed under Schedule 4 of the BC Act:</p> <ul style="list-style-type: none"> ▪ Clearing of native vegetation; and ▪ Removal of dead wood and dead trees. 	
<p>References: Department of Planning, Industry and Environment (DPIE) (2021e) Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions– profile. https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10786</p>		

**Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test)
for
White-bellied Sea Eagle (*Haliaeetus leucogaster*)**

BC Act Status: Vulnerable

Species Ecology	The habitat of this species is characterised by the presence of large areas of open water includes larger rivers, swamps, lakes and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as ‘guard roosts’. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion.	
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	<p>The proposed activity is not likely to have an adverse effect on the life cycle of this species such that a local population is placed at risk of extinction.</p> <p>One individual was observed nesting approximately 100m from the closest point of the proposed Activity. The proposed works are not expected to result in an increased in noise greater than what these individuals will be experienced to in their current location (Stephen Debus 2022)</p> <p>No works will be conducted in the vicinity of the nesting trees. The proposed works may temporarily impact foraging habitat for this species, however extensive suitable habitat will still remain in the broader area.</p>	
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	Not Applicable
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	Not Applicable
(c) in relation to the habitat of a threatened species, population or ecological community:	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposed activity is located approximately 100m from the recorded nesting tree. The proposed works may temporarily impact foraging habitat for this species, however extensive suitable habitat will still remain in the broader area.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The habitat available for this species will not become fragmented from other areas as a result of the proposed activity. As this species is highly mobile, minor loss of select vegetation from within the Subject Site is not considered likely to significantly affect the species. Habitat connectivity will continue to occur in the adjoining section of the Kamay Botany Bay National Park

**Biodiversity Conservation Act 2016– Assessment of Significance (5-part Test)
for
White-bellied Sea Eagle (*Haliaeetus leucogaster*)**

BC Act Status: Vulnerable

	<p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,</p>	<p>The habitat to be removed/impacted is not considered important to the long-term survival of this species. The vegetation proposed for removal/modification within the Subject Site, may provide foraging habitat for this species however, extensive suitable habitat will remain in the broader area. The recorded nesting tree, and others that provide similar habitat will remain unimpacted.</p>
<p>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),</p>	<p>The development proposed is not likely to have an adverse effect on any declared area of outstanding biodiversity value, directly or indirectly.</p>	
<p>(e) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the effect of, a key threatening process.</p>	<p>The proposed activity will result in the following Key Threatening Processes (KTPs) listed under Schedule 4 of the BC Act:</p> <ul style="list-style-type: none"> ▪ Clearing of native vegetation; and ▪ Removal of dead wood and dead trees. 	
<p>References: Department of Planning, Industry and Environment (DPIE) (2021g) White-bellied Sea Eagle– profile. https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20322</p>		

Appendix D EPBC Act Assessment of Significant Impact Criteria.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Assessment of Significant Impact Criteria for the Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (SSF)	
EPBC Act Status: Endangered Ecological Community	
<p>Significant impact criteria An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</p>	
<ul style="list-style-type: none"> • reduce the extent of an ecological community 	<p>The proposed development will result in the clearing of 0.39ha of SSF.</p>
<ul style="list-style-type: none"> • fragment of increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines 	<p>The area of habitat it not likely to become fragmented or isolated from other areas of habitat as a result of the proposed activity. 0.39Ha of SSF is proposed for removal with all impacts restricted to the fringes of this community. The community will remain intact in areas surrounding the Subject Site, within the broader Subject Property.</p>
<ul style="list-style-type: none"> • adversely affect habitat critical to the survival of an ecological community 	<p>The proposed activity will not adversely affect habitat critical to the survival of this ecological community. 0.39ha of SSF will be impacted as a result of the proposed works. The local occurrence of SSF was mapped as approximately 15.22ha resulting in an impact are of approximately than 2.56%. Areas of this community will continue to exist and be protected immediately surrounding the Subject Site.</p>
<ul style="list-style-type: none"> • modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns 	<p>It is not expected that the proposed activity will modify or destroy abiotic factors (such as water, nutrients or soil) that is necessary for the survival of SSF especially given the small impact area of the proposed development. Furthermore part of the works involve creek rehabilitation works which will help improve the flow of water in this area, improving the overall health of the community outside of the Subject Site.</p>
<ul style="list-style-type: none"> • cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting 	<p>The proposed Activity will not cause a substantial change in the species composition of the occurrence of the ecological community. 0.39ha of SSF will be impacted as a result of the proposed works. The local occurrence of SSF was mapped as approximately 15.22ha resulting in an impact are of approximately than 2.56%. Areas of this community will continue to exist and be protected immediately surrounding the Subject Site.</p>
<ul style="list-style-type: none"> • cause a substantial reduction in the quality or integrity of an occurrence of an ecological community including but not limited to: <ul style="list-style-type: none"> - assisting invasive species that are harmful to the listed ecological community, to become established or - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or 	<p>The proposed development will not cause a substantial reduction in the quality or integrity of the occurrence of this EEC.</p> <ul style="list-style-type: none"> (i) Weed management will be undertaken throughout the proposed activity area, including the removal of Priority weeds. (ii) The use of pesticides harmful to the species within the patch of EEC should be minimised
<ul style="list-style-type: none"> • interfere with the recovery of the species 	<p>It is not expected that the removal of 0.39ha will interfere with the recovery of this ecological community given the implementation of the impact mitigation measures as outlined in this report.</p>

Commonwealth Environment Protection and Biodiversity Conservation Act 1999
Assessment of Significant Impact Criteria
for the
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (SSF)

EPBC Act Status: Endangered Ecological Community

References:

Department of Agriculture, Water and the Environment (DAWE) (2021) Conservation Advice for Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

Appendix E. White-bellied Sea Eagle at Kamay Botany Bay National Park: Potential Impacts of Redevelopment (Stephen Debus 2022).

STEPHEN DEBUS BA, Dip Natural Resources (Wildlife), Dip Ed, MSc (Zoology), PhD (Zool.)

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**WHITE-BELLIED SEA-EAGLE AT KAMAY BOTANY BAY NATIONAL
PARK: POTENTIAL IMPACTS OF REDEVELOPMENT**

REPORT TO NSW NATIONAL PARKS & WILDLIFE SERVICE

Stephen Debus

A handwritten signature in black ink, appearing to read 'S Debus', written in a cursive style.

29 July 2022

A pair of White-bellied Sea-Eagles *Haliaeetus leucogaster* is known to nest in Kamay Botany Bay National Park, in an identified nest tree in the Visitor Centre precinct. The species is listed as Vulnerable in NSW under the *Biodiversity Conservation Act* 2016. A concern for NPWS is whether the proposed Kamay Master Plan project works, comprising redevelopment of the Visitor Centre, carparks and other visitor infrastructure, with associated demolition and construction activity and noise levels, might affect the eagle pair's breeding success or continued use of the current nest.

I have reviewed all pertinent information supplied by NPWS, including the acoustic report by Pulse White Noise Acoustics (2022), photographs showing line of sight (or lack of) to the nest from various points on the site, and mapped 50-m contour intervals from the nest. Given that the nest is located near park facilities including the existing Visitor Centre, picnic area and site office (Alpha House), it is likely that the eagles are habituated to the existing level of human usage, noise and pedestrian traffic. It is known that regular mowing of grass on the Visitor Centre/picnic area grounds occurs immediately below the nest tree, generating a noise level of 70 dB, to which the eagles are habituated. The subject eagles thus present a similar situation to that at Sydney Olympic Park, where a pair of Sea-Eagles regularly nests successfully adjacent to the BirdLife Australia Discovery Centre, with its high level of human usage and a nest camera placed at the nest.

The acoustic report, and site photographs, reveal that most redevelopment activities (demolition and reconstruction of the Visitor Centre, works on the seawall) will generate noise levels of less than 60 dB (mostly 50–55 dB) at the eagle's nest, are visually screened from most angles, and are mostly at least 100 m from the nest. Accordingly, it is considered that the proposed Master plan works will not create any disturbance to the subject Sea-Eagles greater than the activities to which they are currently habituated, and the works may proceed within the identified noise and proximity parameters while the Sea-Eagles are nesting.

The only activity of concern with respect to noise and proximity is excavating and concreting of a path from Alpha House to the Visitor Centre, and resurfacing of the existing driveway to Alpha House. A worst-case scenario, of constructing the path directly below the nest tree, will generate a noise level of 71 dB at the nest. Any potential impacts on the eagles, their breeding success or continued use of the nest could be mitigated by conducting the path construction outside the eagles' breeding season (suggested construction window January to April), and routing the path as far as practicable from the nest, within the constraints of its required end points.

Finally, there is a proposal to install a nest camera, with feed to a screen in the Visitor Centre. This camera should have no adverse effect on the eagles, or their breeding success or continued use of the site, if a camera is installed in an adjacent tree outside the breeding season and visitors are passively discouraged (by site management, e.g. location of picnic facilities) from approaching the nest tree.



Kamay Sea Eagle Nesting Site – Acoustic Assessment

NSW National Parks & Wildlife Service

Report number: 220255 - Kamay Sea Eagle Nesting Site – Acoustic Assessment – R1

Date: 21 July 2022

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This report has been prepared by Pulse White Noise Acoustics Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with 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.

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1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has prepared the following report to provide an acoustic assessment of the anticipated demolition and construction works of Kurnell Visitor Centre, and the surrounding areas.

In terms of an operational noise assessment, proposed activities will be assessed against the Noise Policy for Industry (NPI). A 3D noise model will be created in the 3D noise modelling software iNoise (2022.01) to assess typical construction scenarios.

This document provides high level acoustic advice for the proposed facility, including an assessment of noise emissions to an identified, White-Bellied Sea Eagle nesting location in the vicinity of the site.

1.1 Site and Receiver Location

The site is located at the Kurnell Visitor Centre at 21 Cape Solander Dr, Kurnell NSW where the majority of demolition and construction works are expected. It is understood that there will also be additional smaller works in the surrounding areas (construction of new footpaths etc.).

The primary receiver of concern is the nest of White-Bellied Sea Eagles located approximately 150m to the South-West of the visitor centre. Figure 1 below highlights the visitor centre site location, the location of the Sea-Eagle nest, and the larger encompassing area around which footpaths are to be constructed (specific locations of these works have not yet been finalised).

The loudest existing noise sources on the site primarily include equipment such as ride-on lawnmowers and chainsaws.

Figure 1 Site Location





1.2 Proposed Development

The proposed facility is to be developed at the Kurnell Visitor Centre at 21 Cape Solander Dr, Kurnell NSW. There are also plans to construct additional footpaths at various locations within the site.

Primary noise generating sources from the site are expected to include truck movements, operational machinery and equipment associated with the demolition and construction of a new visitor centre.

Noise is expected to be generated during the construction phase, and as such construction noise criteria will be derived.



2 EXISTING ACOUSTIC ENVIRONMENT

2.1 Noise Descriptors and Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically, environmental noise is measured over 15-minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g., adding two sound sources of equal values result in an increase of 3 dB (i.e., 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the LAeq, LA1, LA10 and LA90 noise levels. The LAeq noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The LA1, LA10 and LA90 levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

2.2 Unattended Noise Monitoring

2.2.1 Monitoring Details

As mentioned, to determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at the base of the nesting tree.

2.2.2 Monitoring Instrumentation

Instrumentation used for the noise survey comprised of a SVAN 971 (serial number 74365), and a Rion NL-42 type sound level meter (serial number 01000231) and a fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. These charts, representing each 24-hour period, show the LA1, LA10, LAeq and LA90 noise levels measured over 15 minute time periods.

Logging was conducted from Monday May 23rd 2022 to Thursday June 30th 2022. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Sydney Airport AMO, NSW. Detailed noise logging results are shown in Appendix B.

The measured background noise data of the logger was assessed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (NPI).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and the night. The RBL LA90 (15minute) and LAeq noise levels are presented in Table 2-1 for the unattended logging. The measured noise levels are considered to be representative of the levels to be expected at the nearest and most affected residence to the proposed development.

Figure 2 Long term noise monitor at base of nesting tree



Table 2-1 Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime ¹ 7:00 am to 6:00 pm		Evening ¹ 6:00 pm to 10:00 pm		Night-time ¹ 10:00 pm to 7:00 am	
	LA90 ²	LAeq ³	LA90 ²	LAeq ³	LA90 ²	LAeq ³
Base of nesting tree	38	48	38	47	38	47

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

2.3 Existing Noise Assessment

It is understood that currently, existing noise sources within the vicinity of the Sea Eagle nest include overhead plane fly-bys from the nearby Sydney Airport, and periodic pedestrian foot traffic etc.

The loudest noise source to the nest is believed to be the ride-on lawn mower (Model: Toro Groundmaster 3200) which regularly operates around the base of the nesting tree.

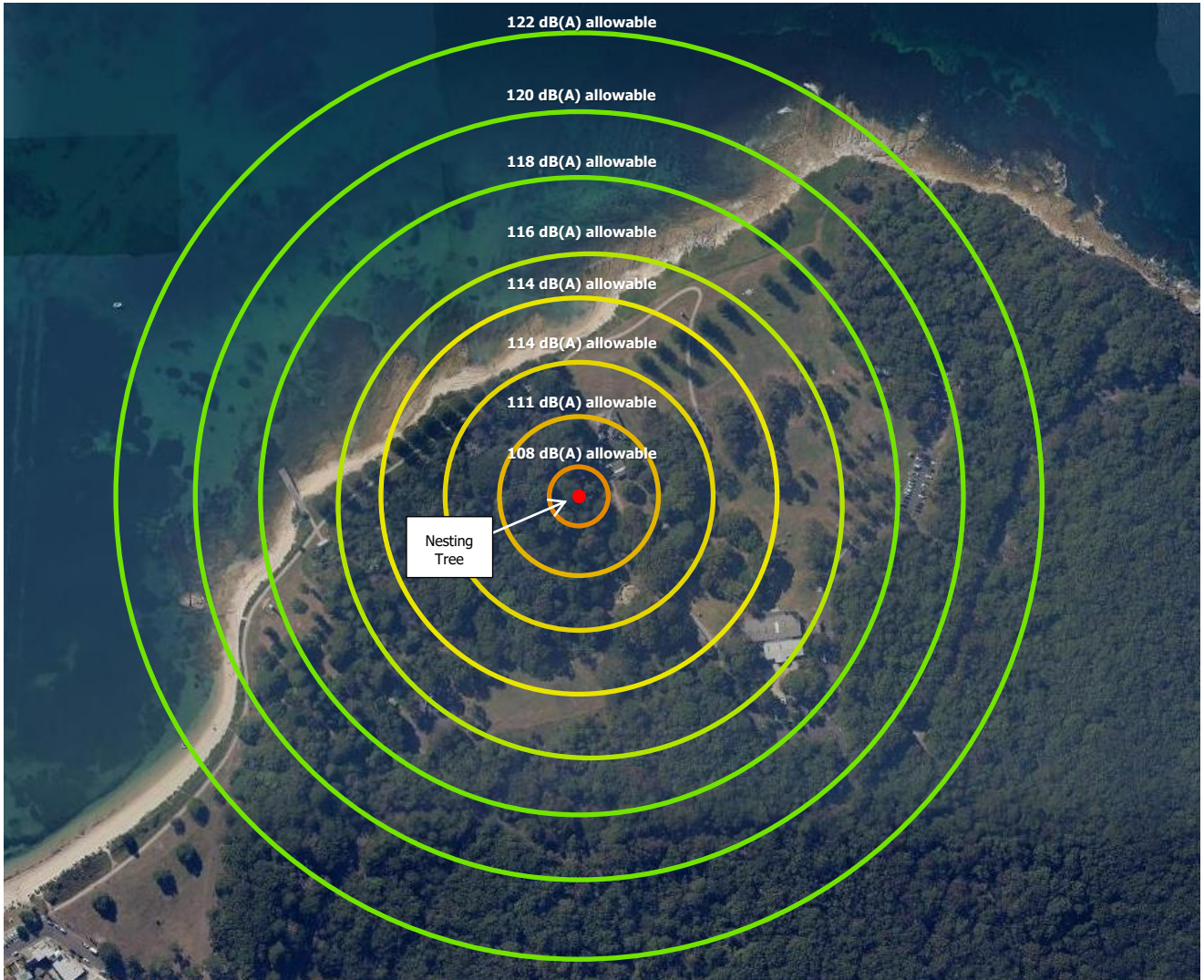
According to manufacturer specifications for the Toro Groundmaster 3200:

*"This unit has a sound power level of: **105 dB(A)** 1 pW, based on measurements of identical machines per Directive 2000/14/EC and amendments."*

The nest has been measured to be approximately 23m above ground level. Based on a mower sound power level of 105 dB(A) at the base of the tree, propagation loss from the ground to the nest results in a 35 dB(A) reduction. Hence, **the Sea Eagles are currently subject to a sound power level of approximately 70 dB(A)** when mowing is taking place at the base of the nesting tree.

Based on long term monitoring conducted at the base of the nesting tree, 70 dB(A) was also found to be representative of the loudest noise events surrounding the nest from all activities including chain sawing of surrounding trees.

Based on distance attenuation, a sound pressure level of 70 dB(A) at the height of the nest would be equivalent to the following sound power levels in the surrounding area (at ground level). Note that each circle is approximately 20m apart from the previous (the first circle is 20m from the base of the nesting tree).





3 OPERATIONAL ACOUSTIC ASSESSMENT

Predictive noise modelling was carried out using the ISO 9613 algorithm within iNoise 2022.01. The iNoise software package allows a 3D computational model of the site and surrounding area to be created. Inputs into the noise model included terrain, ground absorption, the noise location and various noise sources based on various typical construction/demolition scenarios.

3.1 Noise Generating Scenarios (Noise Inventory)

Table 2 lists the scenarios and associated machinery selections that are assumed to be used for demolition and construction of the new visitor centre.

Table 2 Summary of noise generating scenarios and utilised sound power levels

Tasks	Equipment	Sound Power Levels Excluding 5dB Penalties (dBA re 1pW)	Operational Time per 15-minute period
1. Demolition works	Excavator 25T	109	15 minutes
	Power hand tools	100	15 minutes
	Truck	106	5 minutes
2. Concreting works	Concrete truck	106	15 minutes
	Concrete pump	106	15 minutes
	Truck	106	5 minutes
3. Construction	Franna	106	15 minutes
	Truck	106	5 minutes
	Power hand tools	100	5 minutes

3.2 Predicted Operational Acoustic Assessment Summary

The predicted $L_{Aeq, 15 \text{ min}}$ results of the operational scenario are presented below in Table 3-3. Noise contours of the modelled $L_{Aeq, 15 \text{ min}}$ operational scenario are shown in the below figure.

Table 3-3 Predicted Noise Levels, Worst-Case Operational Scenario, L_{Aeq} (15 minute)

Noise Source	Location of works	Predicted Noise Level Scenarios (dB(A))		
		Calculated Noise Level from Ride of Lawn Mower		
Ride on Lawn Mower	Grassed Area below the tree	70		
Construction Activity		Excavation/Demolition	Concreting	General Construction
	Visitor Centre	52	52	50
	Meeting Place	58	58	56
	Footpath	71	71	-
	North-West Foreshore	-	59	56
Cricket Pitch Carpark	53	53	50	

It is understood that the predicted noise levels presented are to be further assessed and evaluated based on advice from a qualified ecologist.

3.2.1 Visitor Centre Works

When these three scenarios are to take place at the visitor Centre, the following figures illustrate predicted noise levels from such activities. The location of the sea-eagle nest is shown as a green dot.

Figure 3 Noise Contours of demolition conducted at visitor centre

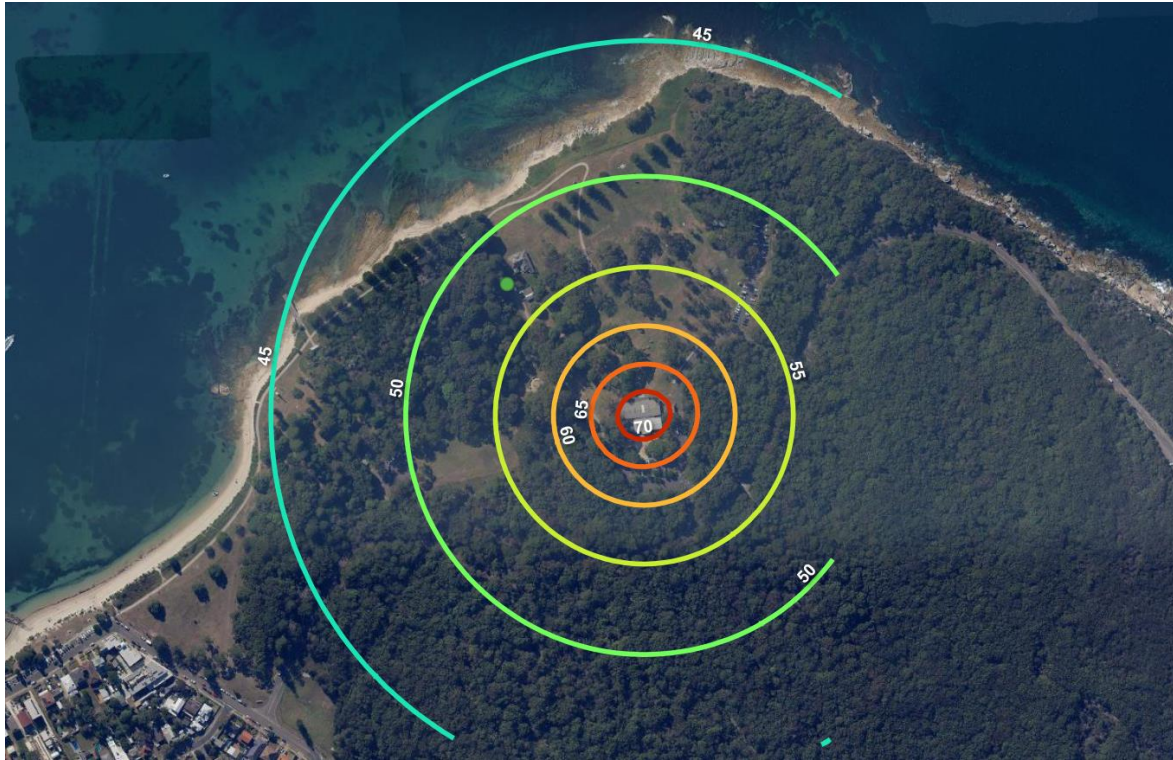


Figure 4 Noise contours of concreting conducted at visitor centre

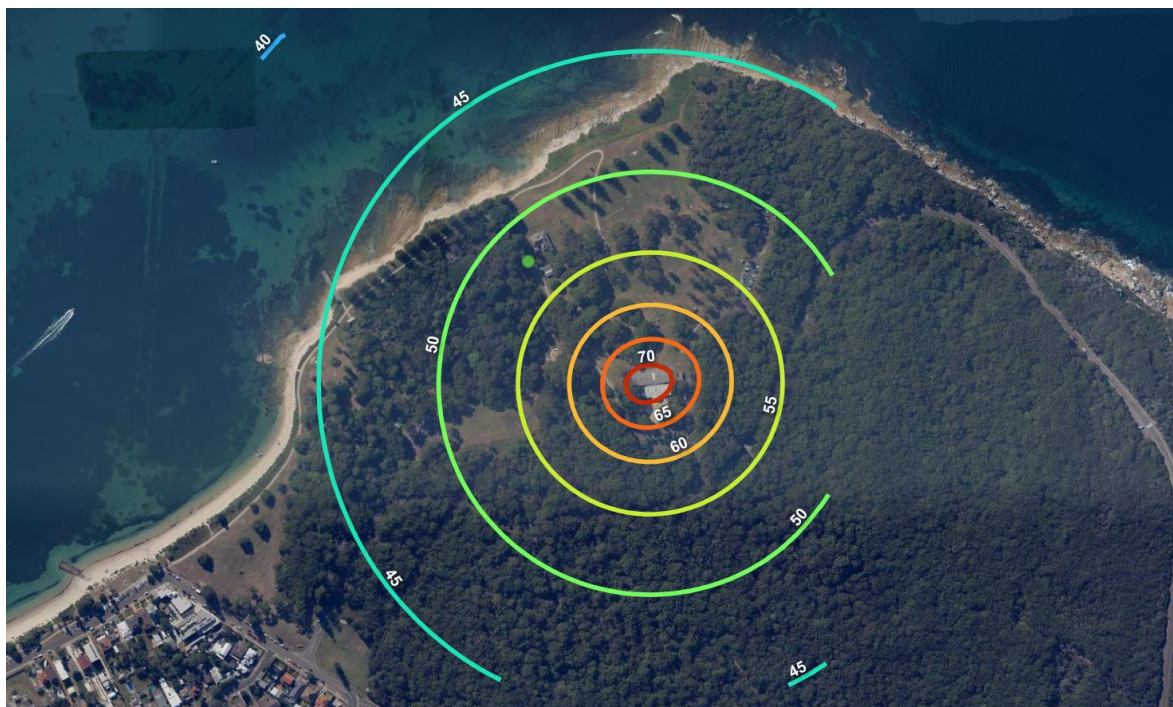
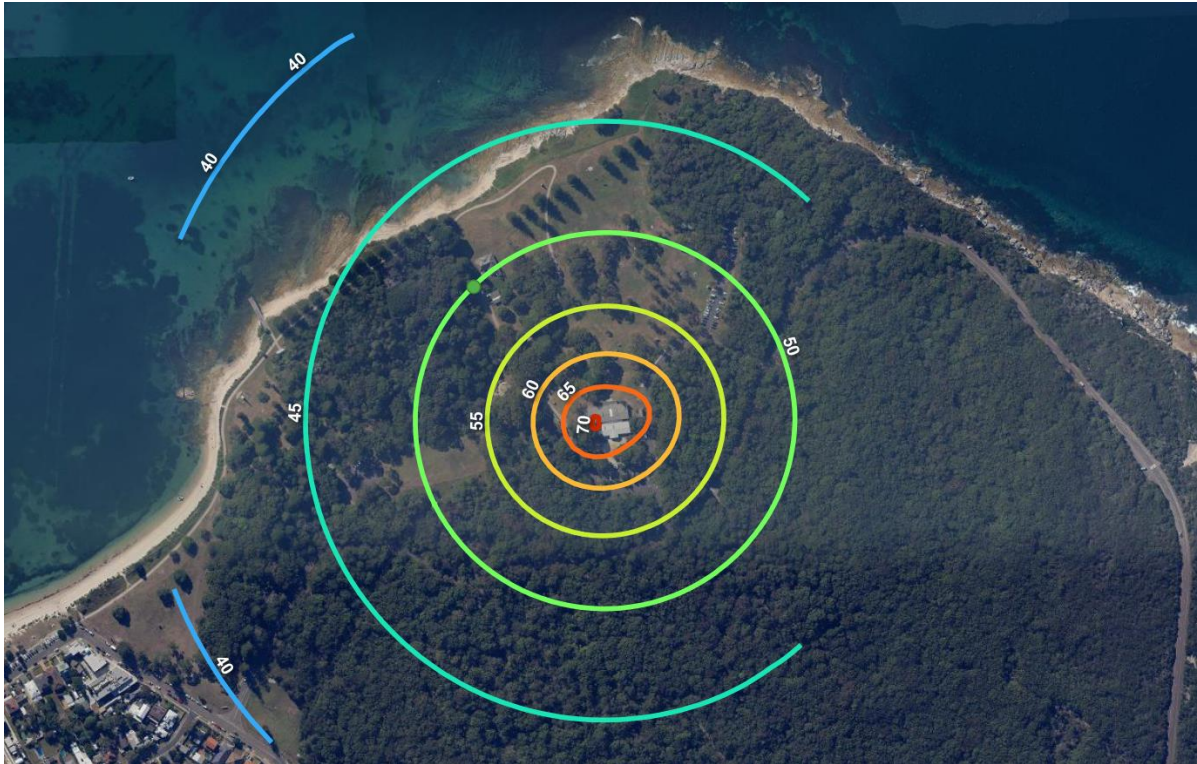


Figure 5 Noise contours of general construction conducted at visitor centre



3.2.2 Meeting Place Works

Additional works are anticipated to be conducted in locations other than the visitor centre, Figure 6 to Figure 8 depict the noise contribution contours from site work conducted at the meeting place.

Figure 6 Noise contours of excavation conducted at meeting place

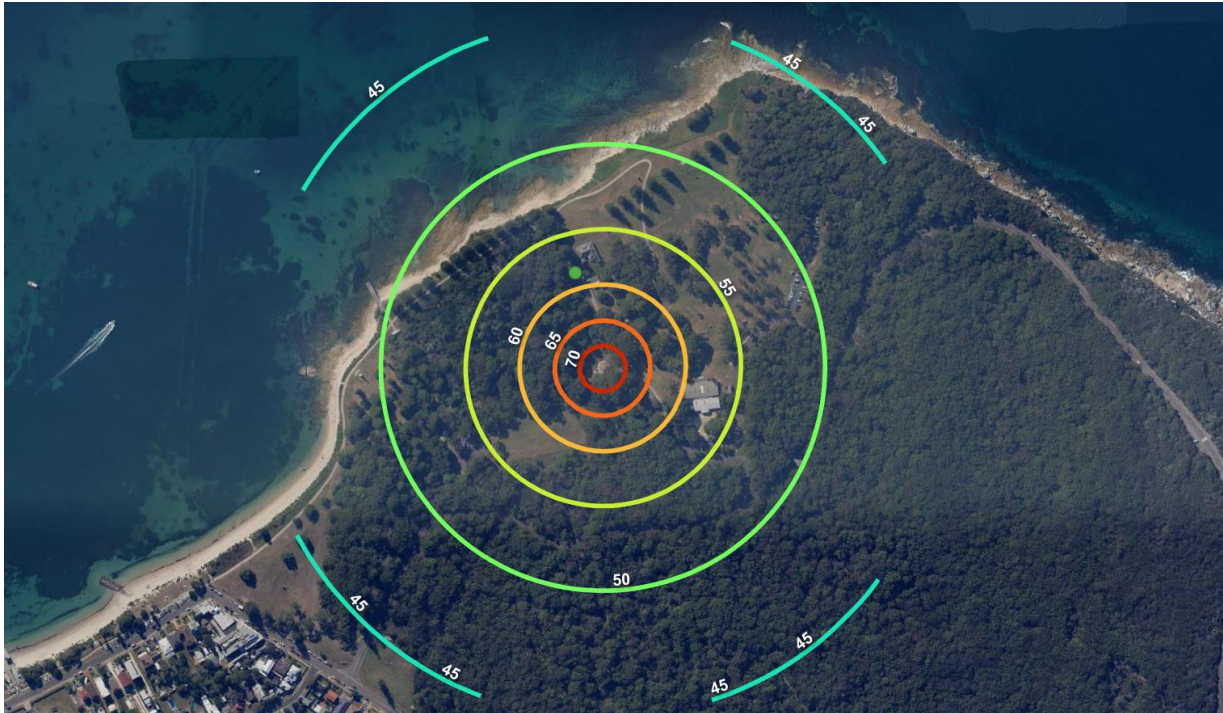


Figure 7 Noise contours of concreting conducted at meeting place

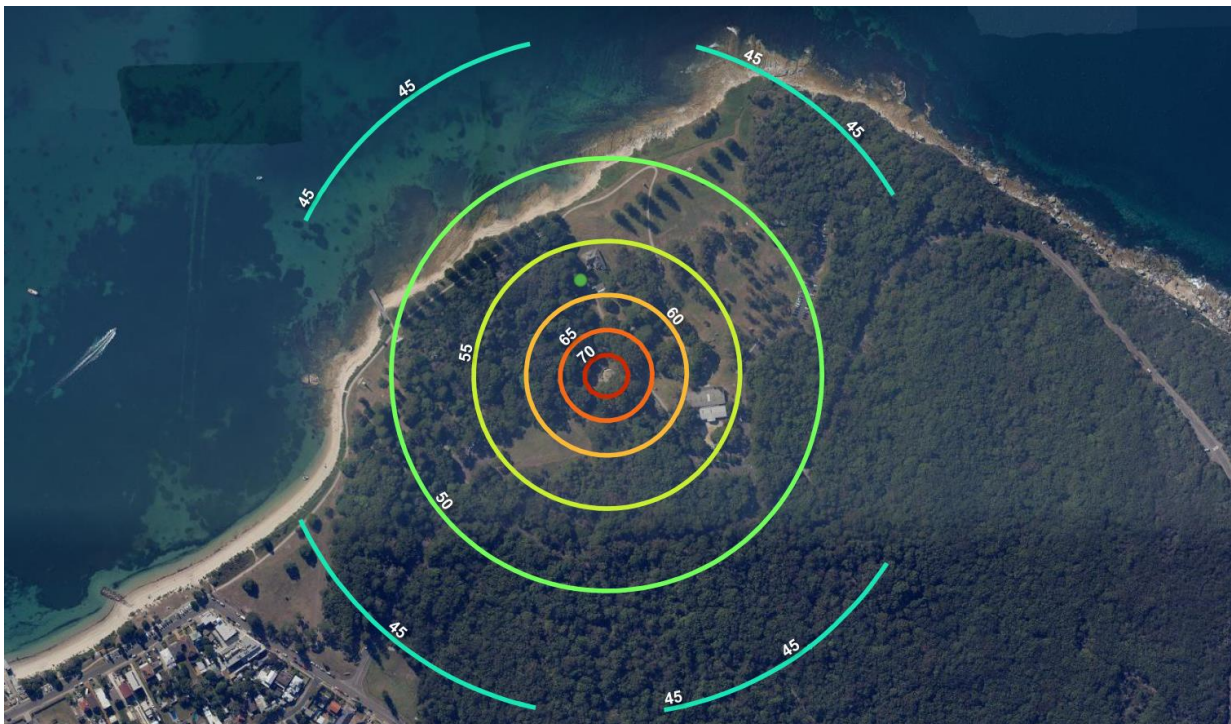
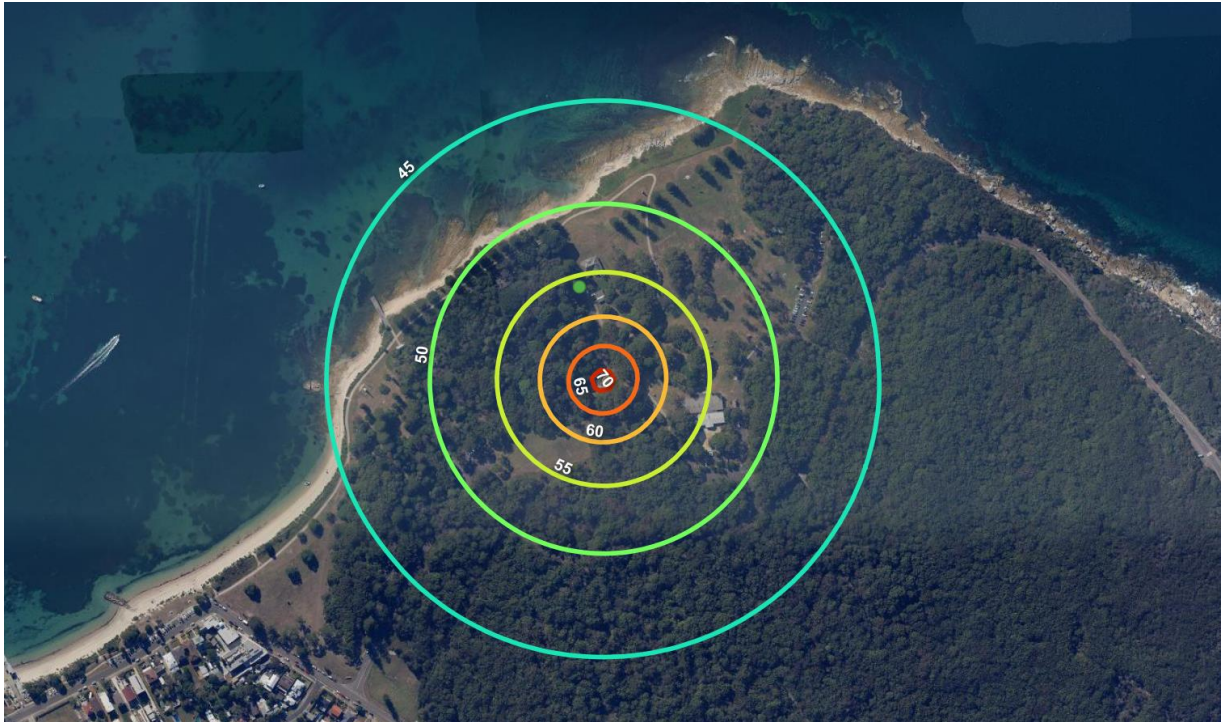


Figure 8 Noise contours of construction at meeting place



3.2.3 Footpath Works

There are plans to construct additional concreted footpath around a large extend of the overall site. While the locations of these footpaths are not yet finalised, a worst-case scenario assessment has been done assuming a footpath is to be constructed directly between the nesting tree and Alpha House. At this location, excavation and concreting noise scenarios have been predicted to be approximately 71 dB(A) at the sea-eagle nest.

Figure 9 Noise contours of excavation conducted at nearby footpath

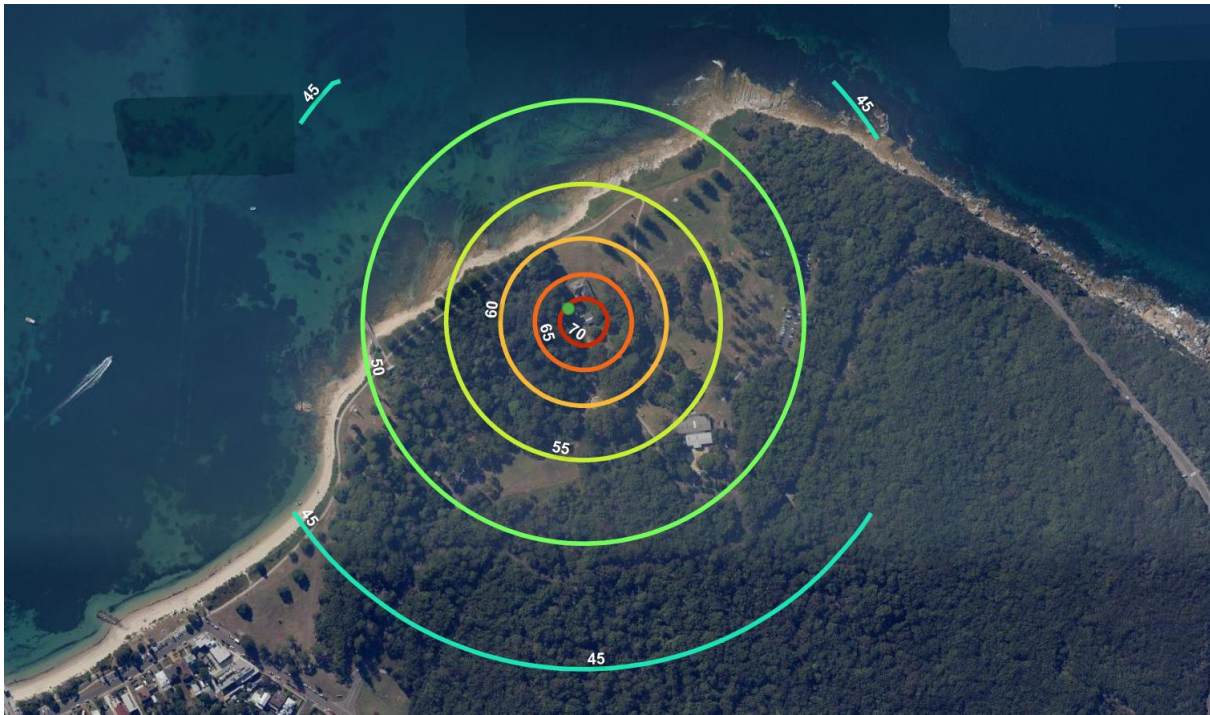
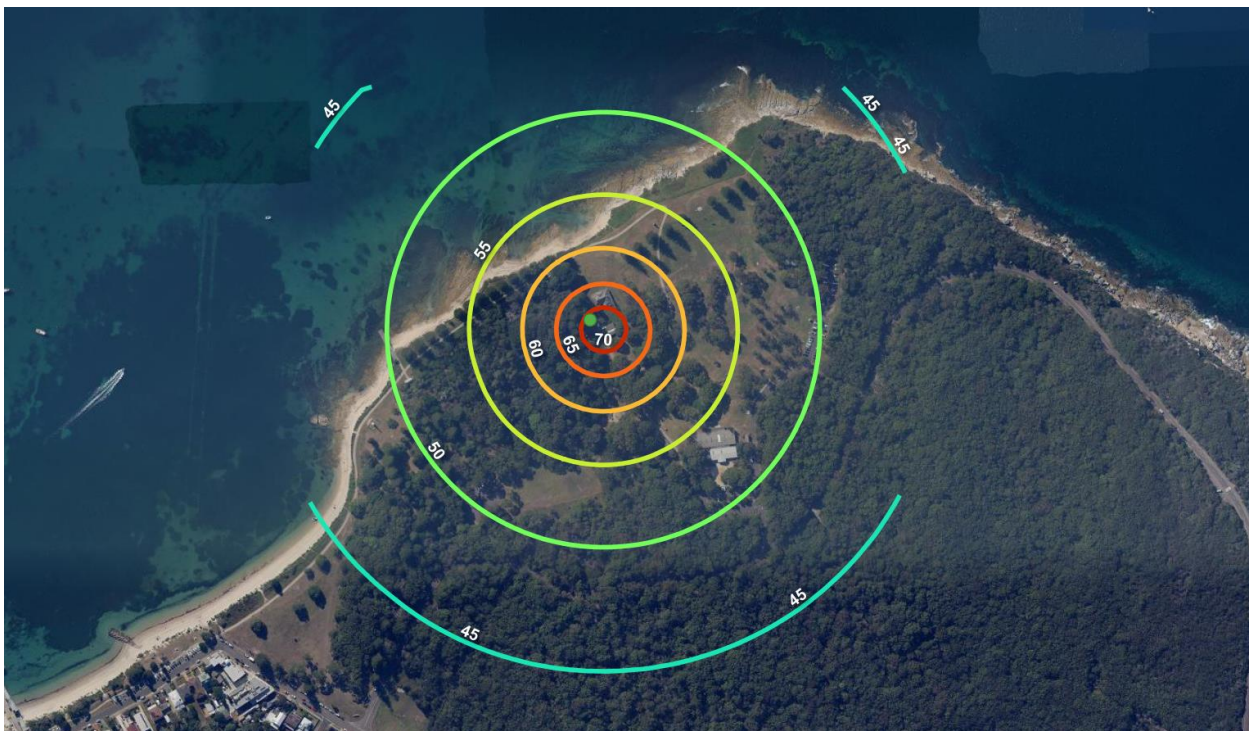


Figure 10 Noise contours of concreting conducted at nearby footpath



3.2.4 North-West Foreshore Works

The sea wall works along the North-West foreshore has also been included in this acoustic assessment. Though no excavation is envisioned in this area, concreting and general construction works are expected. Results below reflect these scenarios.

Figure 11 Noise contours of concreting conducted along the North-West foreshore



Figure 12 Noise contours of general construction conducted along the North-West foreshore



3.2.5 Cricket Pitch Carpark Works

Finally, the cricket pitch carpark is expected to see significant works, including demolition of the existing carpark, and construction of a new one, as well as additional concrete amenities. Primary concerns at this location include the noise generated by construction equipment. Noise contours of excavation, concreting, and general construction scenarios are provided below based on machinery (and associated noise levels) outlined in Table 2.

Figure 13 Noise Contours of excavation conducted at the cricket pitch carpark

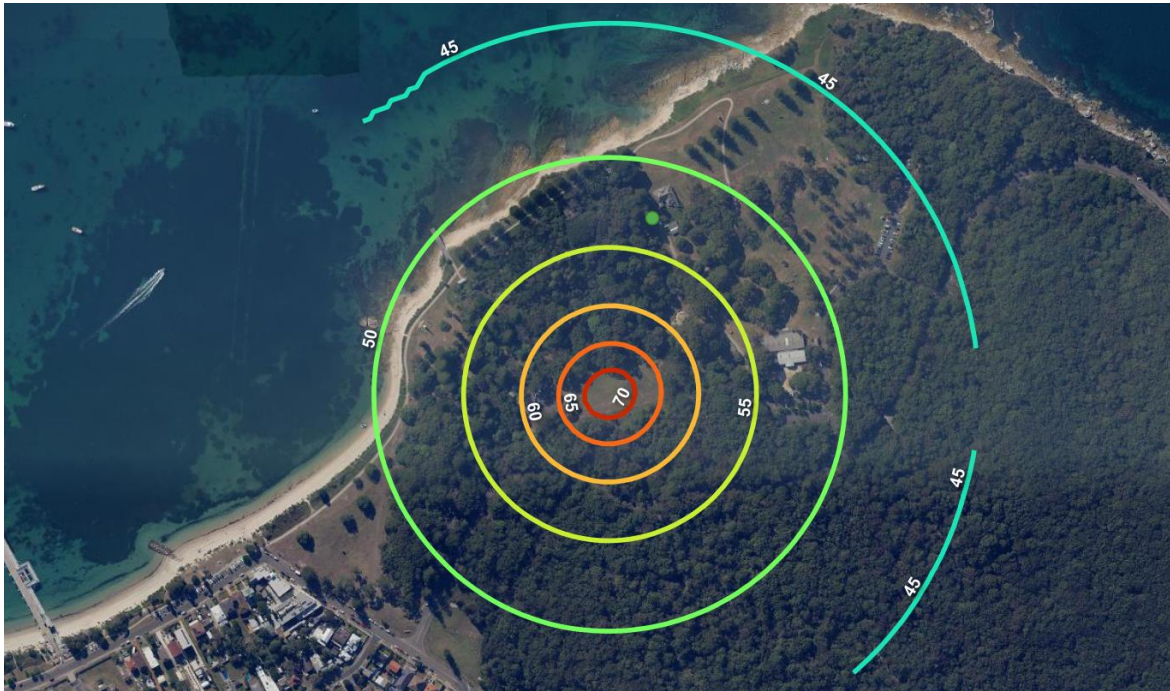


Figure 14 Noise contours of concreting conducted at the cricket pitch carpark

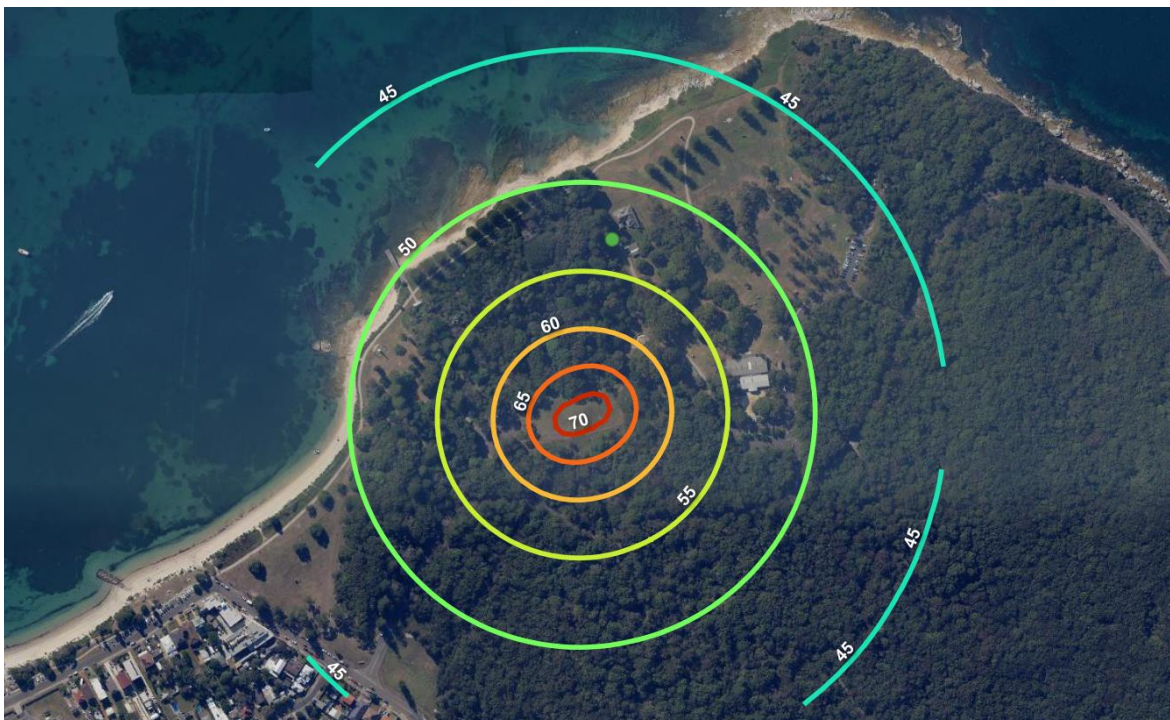
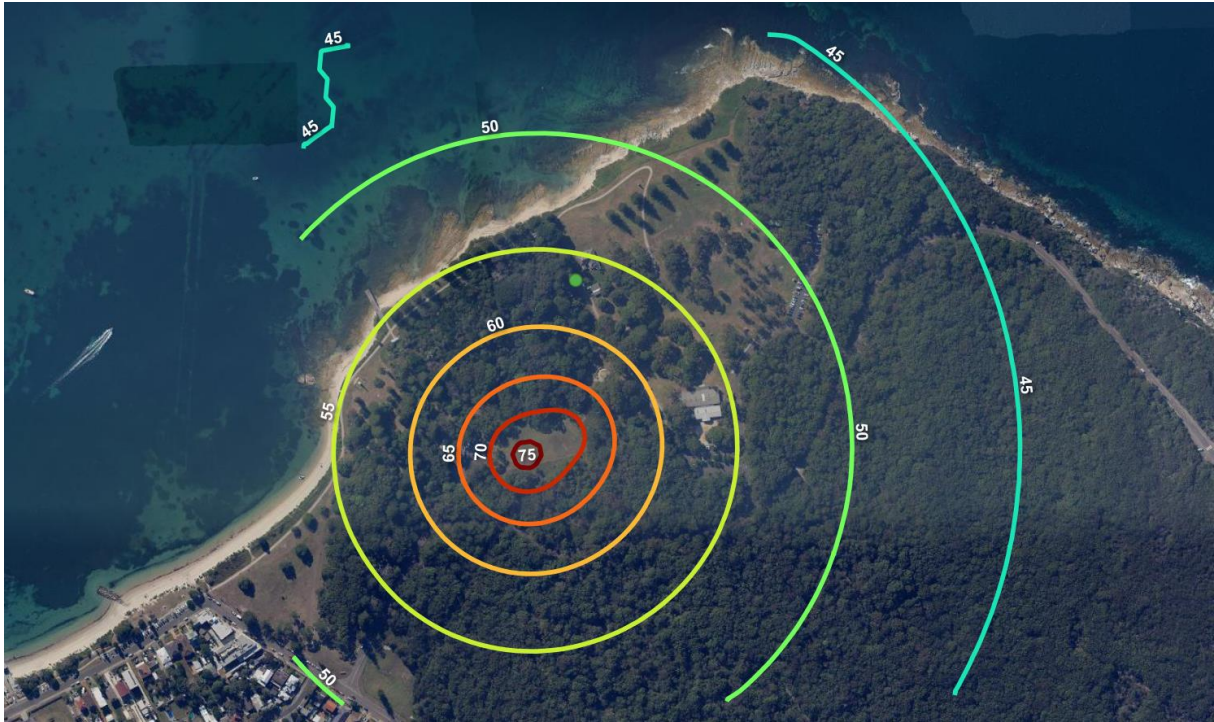


Figure 15 Noise contours of general construction conducted at cricket pitch carpark



4 CONCLUSIONS

A noise impact assessment of the Kurnell Visitor Centre reconstruction project, and surrounding foot path constructions has been conducted.

Existing noise levels of the environment have been evaluated using client provided information, and long-term noise monitoring of the area was conducted. From this, a sound power level of 70 dB(A) was found to be at the upper end of noise levels which the nest was exposed to on a regular basis. Distance attenuation calculations were then conducted to provide a map of allowable noise levels in the area surrounding the nesting tree.

Further, a 3D noise model has been created in the 3D noise modelling software iNoise to assess typical construction scenarios, and the consequent noise levels at the Sea Eagle nest have been calculated.

It is understood that the predicted noise levels provided in this memorandum are to be further assessed and evaluated based on advice from a qualified ecologist. We trust this information is of assistance. If you have any further questions, please do not hesitate to contact the undersigned.

Regards

A handwritten signature in black ink, appearing to read 'Brendan Ngo'.

Brendan Ngo

Acoustic Engineer

PULSE WHITE NOISE ACOUSTICS PTY LTD



APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

<i>Sound power level</i>	The total sound emitted by a source																						
<i>Sound pressure level</i>	The amount of sound at a specified point																						
<i>Decibel [dB]</i>	The measurement unit of sound																						
<i>A Weighted decibels [dB(A)]</i>	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
<i>Decibel scale</i>	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: <table> <tr> <td>0dB(A)</td> <td>Threshold of human hearing</td> </tr> <tr> <td>30dB(A)</td> <td>A quiet country park</td> </tr> <tr> <td>40dB(A)</td> <td>Whisper in a library</td> </tr> <tr> <td>50dB(A)</td> <td>Open office space</td> </tr> <tr> <td>70dB(A)</td> <td>Inside a car on a freeway</td> </tr> <tr> <td>80dB(A)</td> <td>Outboard motor</td> </tr> <tr> <td>90dB(A)</td> <td>Heavy truck pass-by</td> </tr> <tr> <td>100dB(A)</td> <td>Jackhammer/Subway train</td> </tr> <tr> <td>110 dB(A)</td> <td>Rock Concert</td> </tr> <tr> <td>115dB(A)</td> <td>Limit of sound permitted in industry</td> </tr> <tr> <td>120dB(A)</td> <td>747 take off at 250 metres</td> </tr> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/Subway train	110 dB(A)	Rock Concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 take off at 250 metres
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90dB(A)	Heavy truck pass-by																						
100dB(A)	Jackhammer/Subway train																						
110 dB(A)	Rock Concert																						
115dB(A)	Limit of sound permitted in industry																						
120dB(A)	747 take off at 250 metres																						
<i>Frequency [f]</i>	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
<i>Ambient sound</i>	The all-encompassing sound at a point composed of sound from all sources near and far.																						
<i>Equivalent continuous sound level [L_{eq}]</i>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
<i>Reverberation</i>	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)																						
<i>Air-borne sound</i>	The sound emitted directly from a source into the surrounding air, such as speech, television or music																						
<i>Impact sound</i>	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.																						
<i>Air-borne sound isolation</i>	The reduction of airborne sound between two rooms.																						
<i>Sound Reduction Index [R] (Sound Transmission Loss)</i>	The ratio the sound incident on a partition to the sound transmitted by the partition.																						
<i>Weighted sound reduction index [R_w]</i>	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.																						
<i>Level difference [D]</i>	The difference in sound pressure level between two rooms.																						

<i>Normalised level difference</i> [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
<i>Standardised level difference</i> [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
<i>Weighted standardised level difference</i> [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
<i>Impact sound isolation</i>	The resistance of a floor or wall to transmit impact sound.
<i>Impact sound pressure level</i> [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
<i>Normalised impact sound pressure level</i> [$L_{i,n}$]	The impact sound pressure level normalised for the absorption area of the receiving room.
<i>Weighted normalised impact sound pressure level</i> [$L_{i,n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
<i>Weighted standardised impact sound pressure level</i> [$L'_{i,nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_i	A value added to an $L_{i,nw}$ or $L'_{i,nT,w}$ value to account for variations in the spectrum.
<i>Energy Equivalent Sound Pressure Level</i> [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
<i>Percentile Sound Pressure Level</i> [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 "Acoustics – Glossary of terms and related symbols"



APPENDIX B: UNATTENDED NOISE LOGGING

Weather Station: SYDNEY AIRPORT AMO, NSW

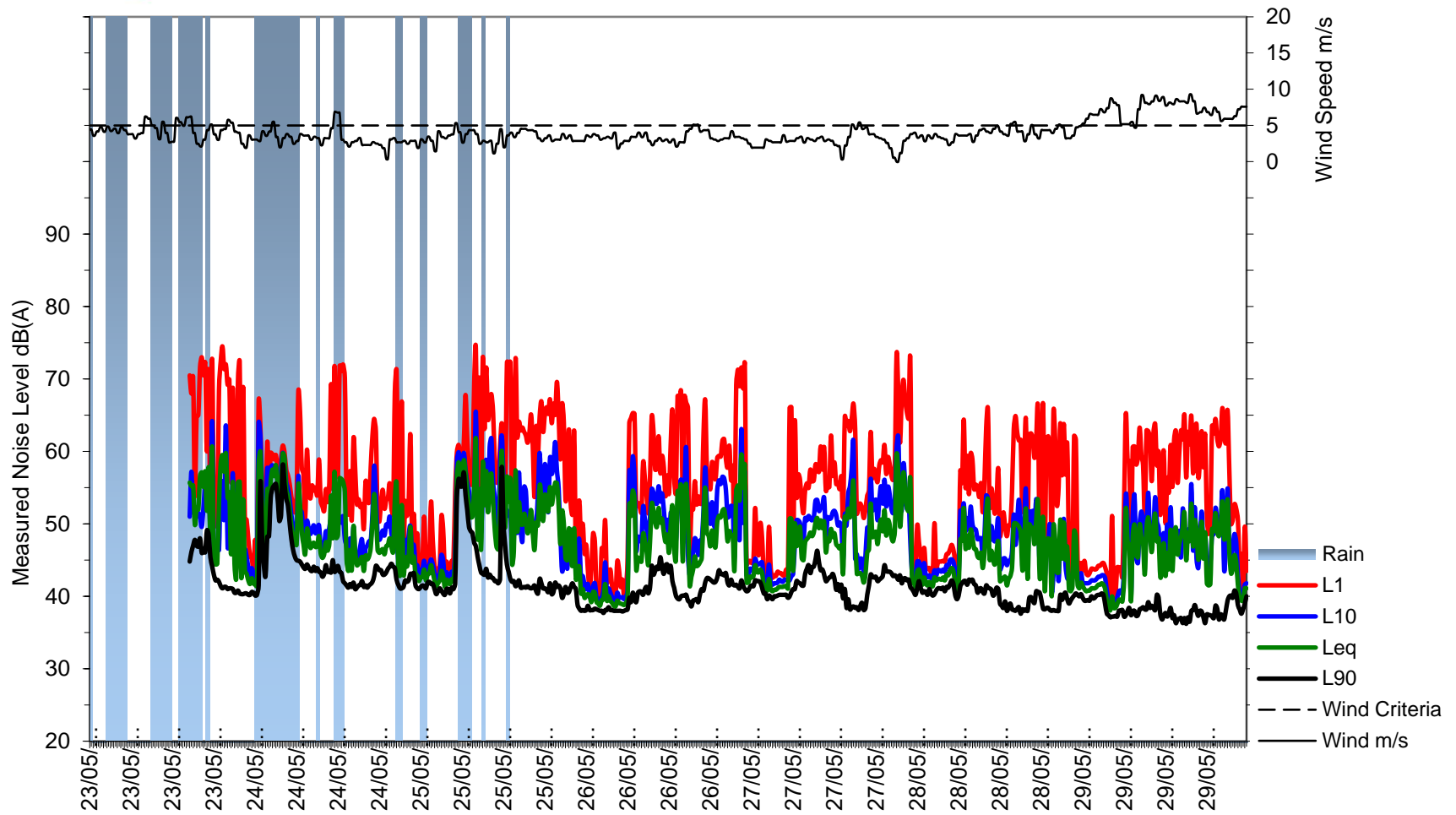
Weather Station ID: SITE 66037

Coordinates: -33.9465°S 151.1731°E 6m



Kamay Sea Eagle Nest

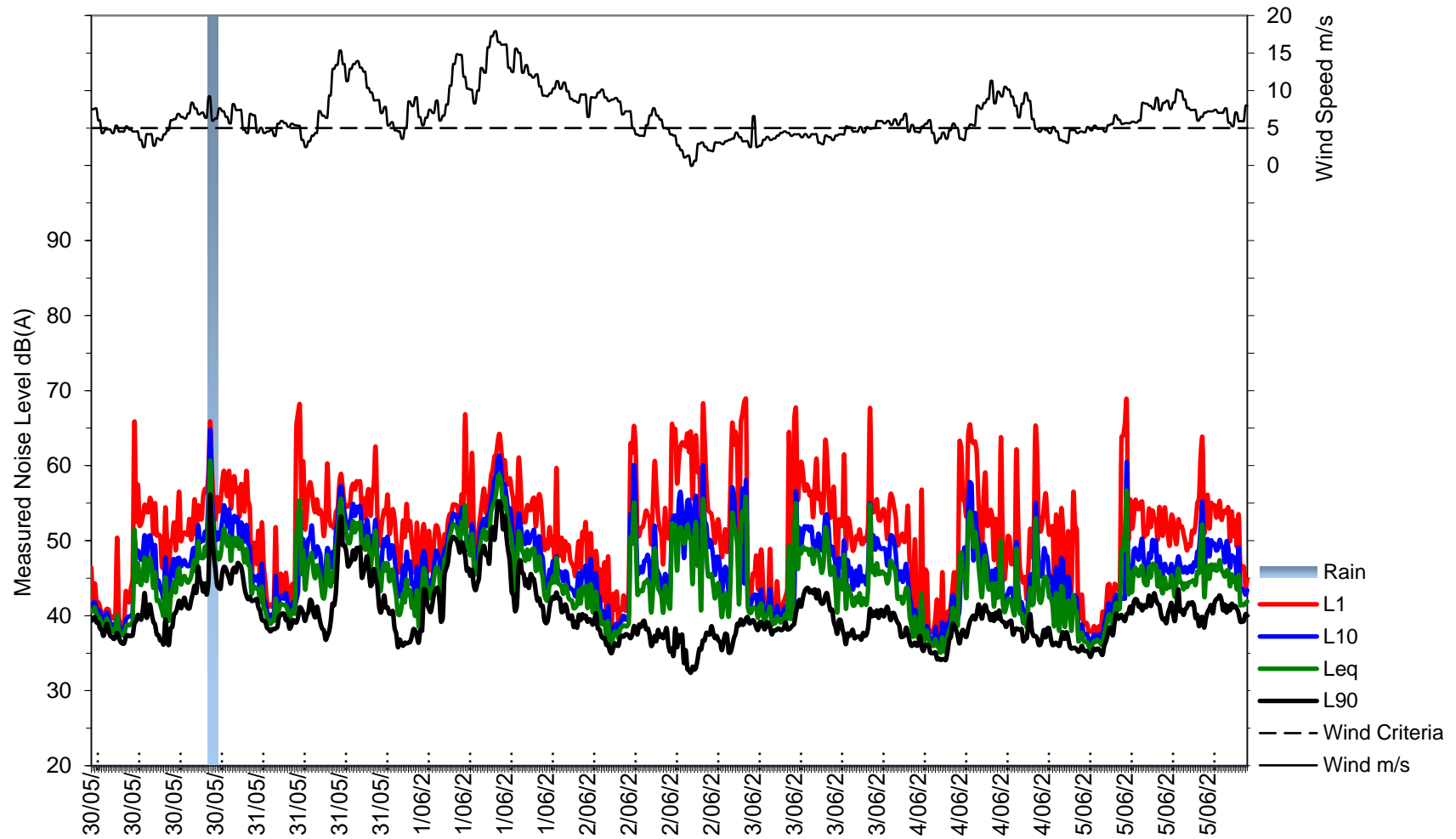
Monday 23 May 2022 to Sunday 29 May 2022





Kamay Sea Eagle Nest

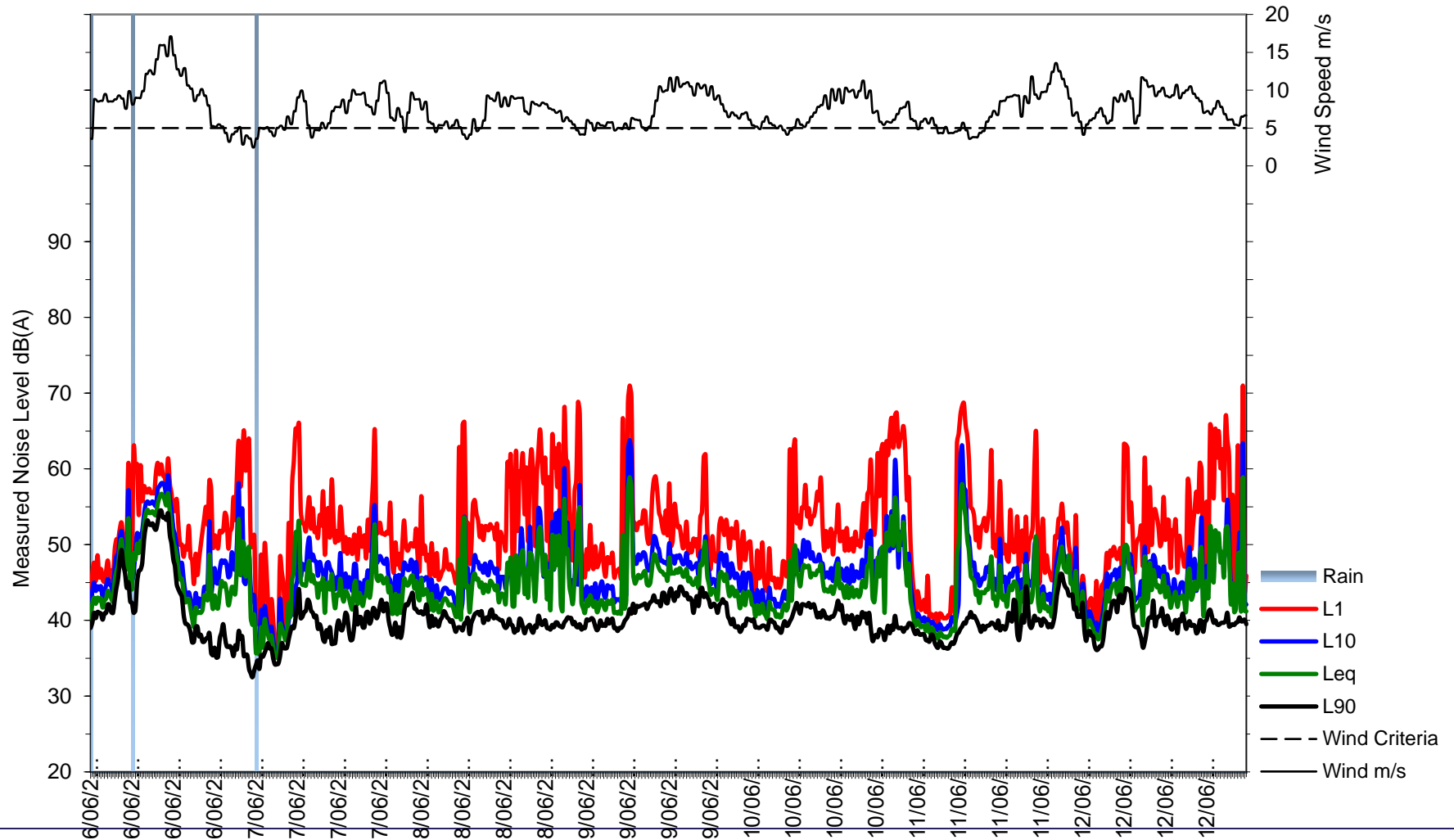
Monday 30 May 2022 to Sunday 05 June 2022





Kamay Sea Eagle Nest

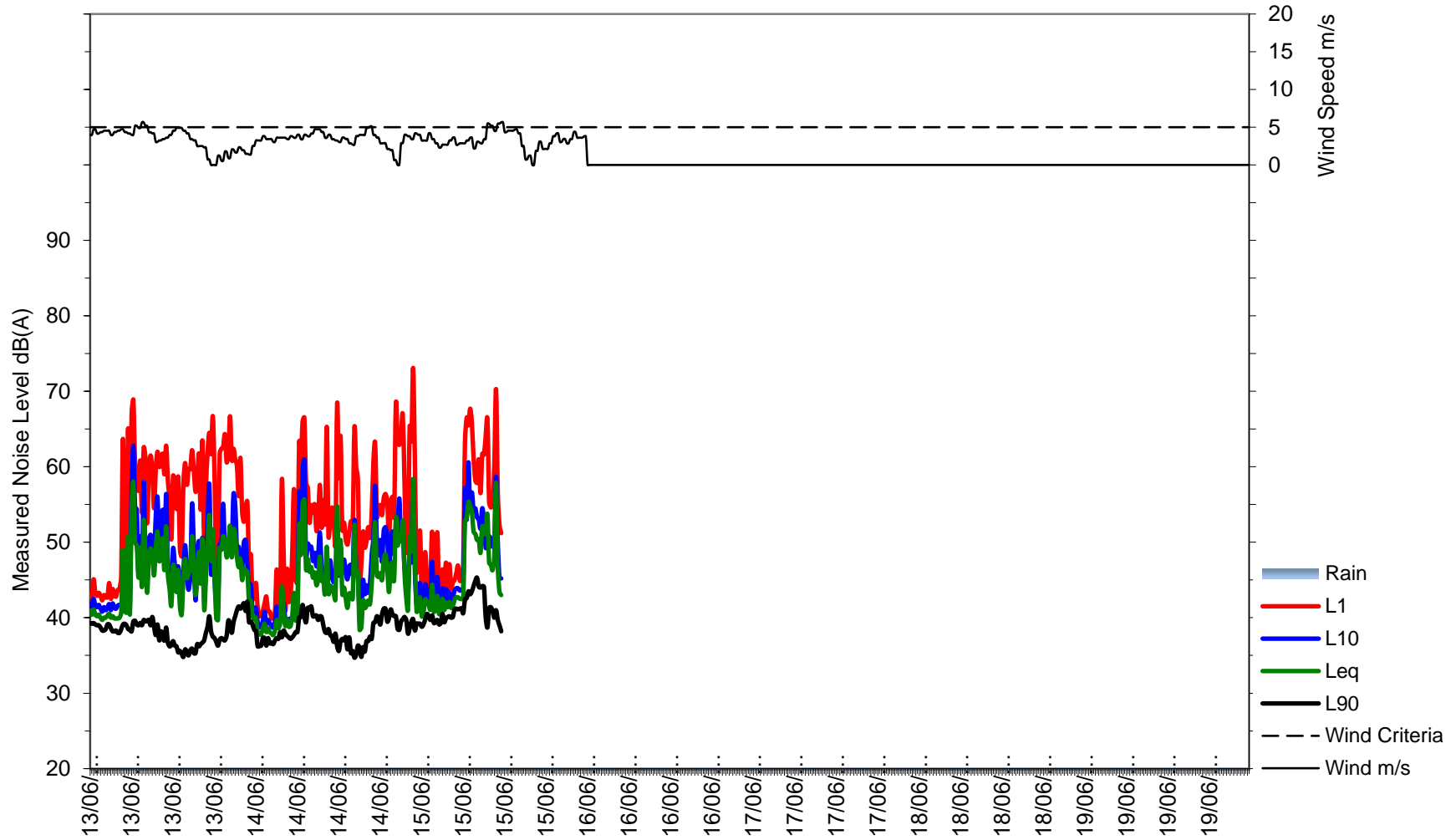
Monday 06 June 2022 to Sunday 12 June 2022





Kamay Sea Eagle Nest

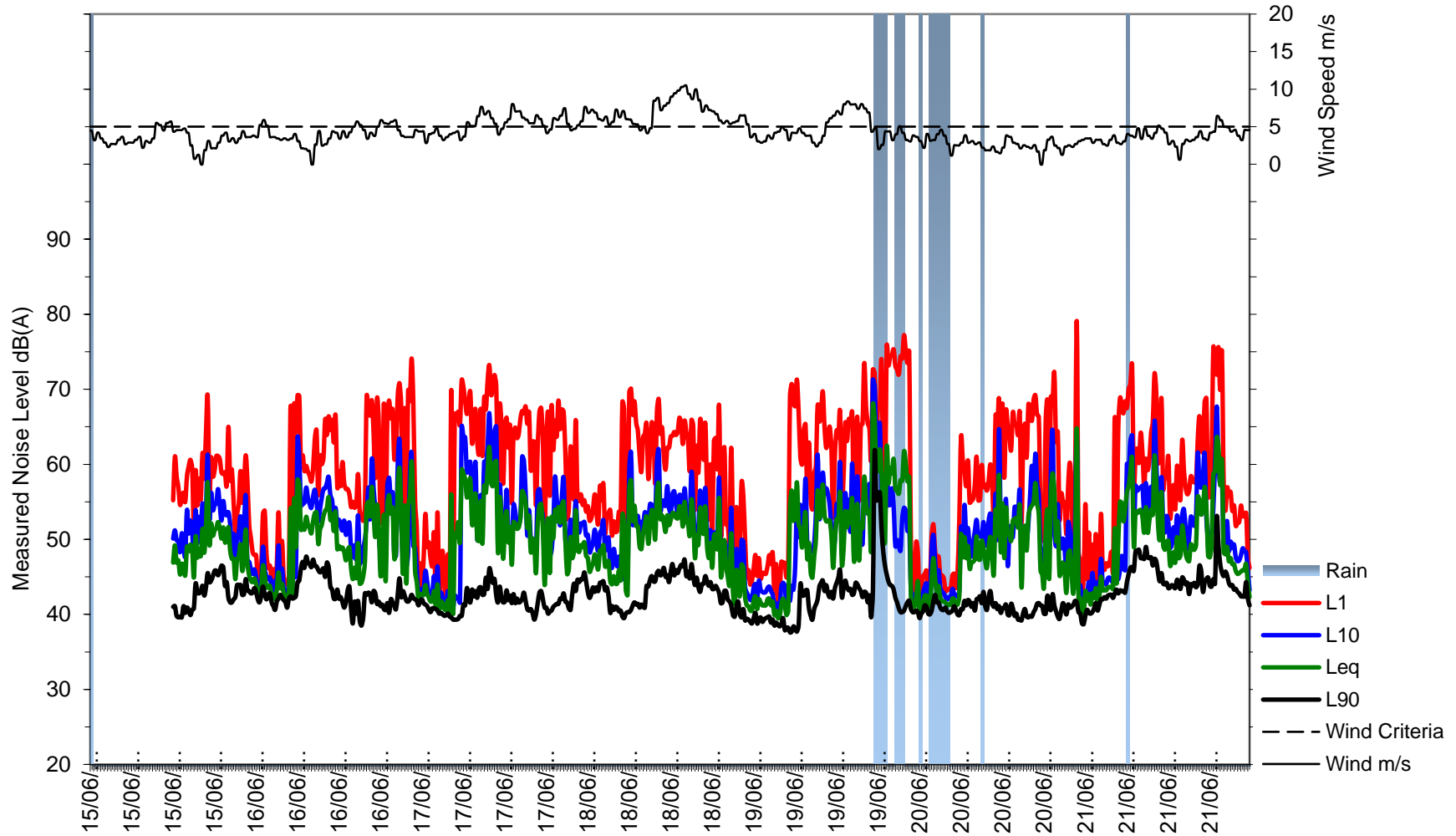
Monday 13 June 2022 to Wednesday 15 June 2022





Kamay Sea Eagle Nest

Wednesday 15 June 2022 to Tuesday 21 June 2022





Kamay Sea Eagle Nest

Wednesday 22 June 2022 to Tuesday 28 June 2022

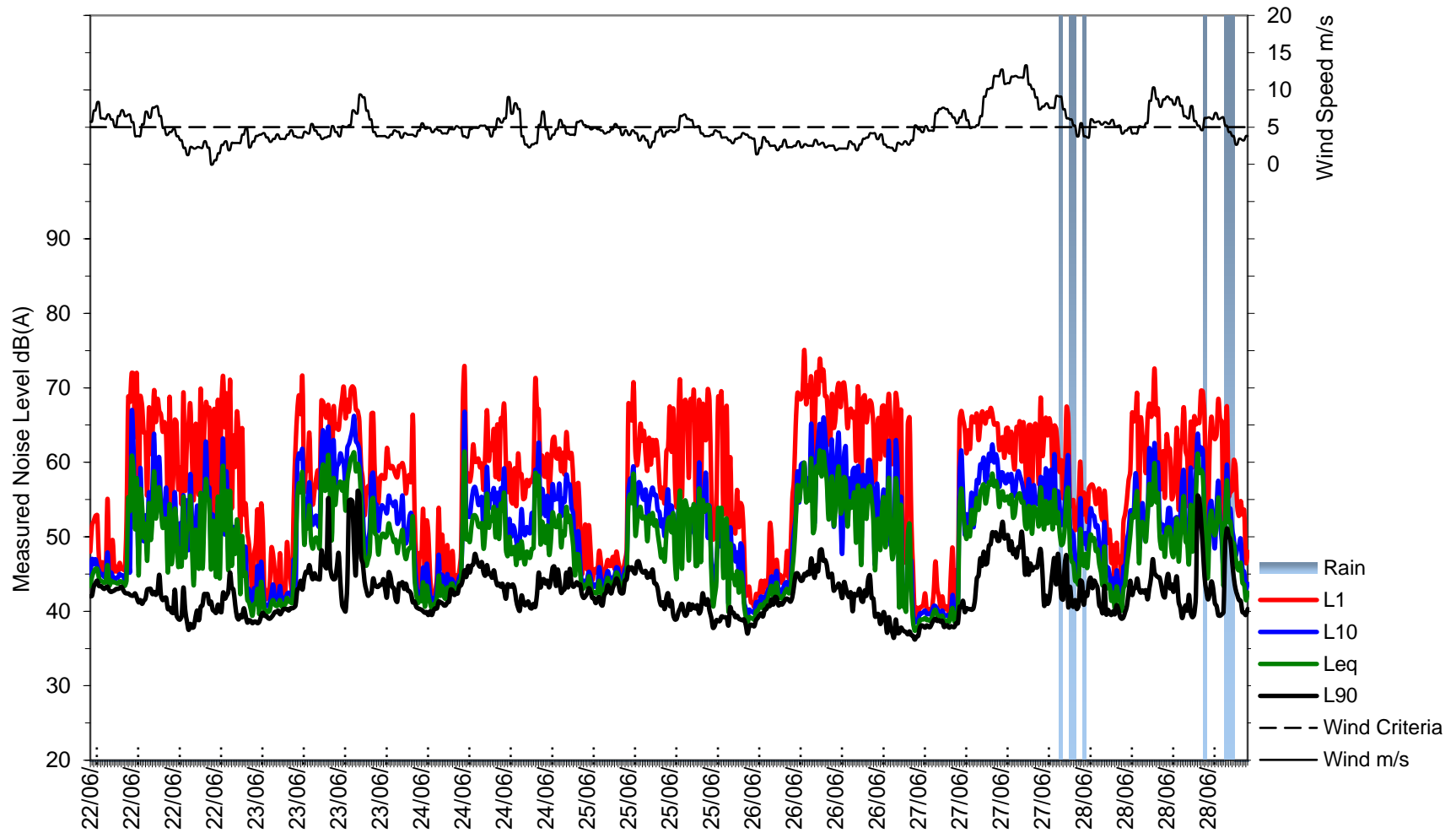




Diagram 1: Map showing location of nesting tree and location of views

Sight lines study

Views from Visitor Centre Precinct

Images 1-3 are views north of the existing Kurnell Visitor Centre facing northwest. It shows sight lines to the WBSE nest obscured by existing tree canopy.



Image 1: View from location 1

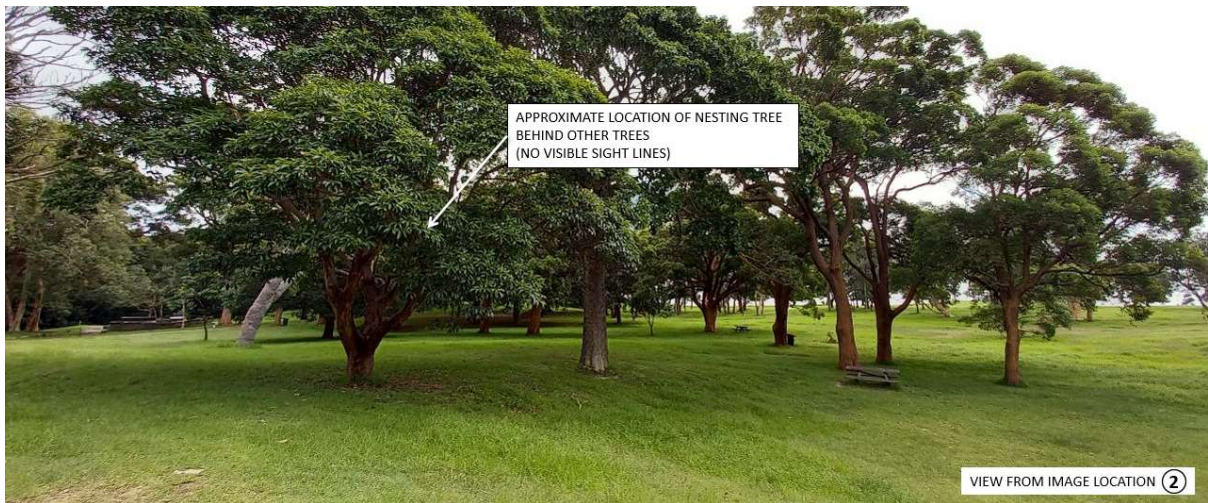


Image 2: View from location 2



Image 3: View from location 3

Views from Commemoration Flat carpark precinct

Images 4-5 are views from the Commemoration Flat carpark facing west. It shows sight lines to the WBSE nest obscured by existing tree canopy.



Image 4: View from location 4



Image 5: View from location 5

Views from Foreshore east precinct

Images 6-7 are views from the foreshore north of Commemoration Flat facing south-west.

- At location 6 sight lines to the WBSE nest are obscured by existing tree canopy.
- At location 7 there are visible sight lines to the WBSE nest.



Image 6: View from location 6



Image 7: View from location 7

Views from Sea Wall precinct

Images 8-10 are views from the foreshore north of the WBSE nest facing south / south-east. It shows sight lines to the WBSE nest obscured by existing tree canopy.



Image 8: View from location 8



Image 9: View from location 9



Image 10: View from location 10

Views from Cricket Pitch Carpark precinct

Images 11-12 are views from the Cricket Pitch carpark precinct. Image 11 is an image from the western section of the precinct facing northeast. Image 12 is an image from the eastern section of the precinct facing north. Both images show sight lines to the WBSE nest obscured by existing tree canopy.



Image 11: View from location 11



Image 12: View from location 12

Views from Meeting Place precinct

Images 13-15 are views from the Meeting Place precinct facing north/northwest.

- At location 13 being the western edge of the Meeting Place precinct sight lines to the WBSE nest are obscured.
- At locations 14 and 15, there are visible sight lines to the WBSE nest.
- At location 16 sight lines to the WBSE nest are obscured by existing tree canopy.



Image 13: View from location 13



Image 14: View from location 14



Image 15: View from location 15



Image 16: View from location 16

Views from Picnic Shelters

Images 17-18 are views from picnic shelter locations at the Commemoration Flat precinct facing west. It shows sight lines to the WBSE nest obscured by existing tree canopy.



Image 17: View from location 17



Image 18: View from location 18

Appendix F. Kamay Botany Bay Park Amphibian Test of Significance (ELA 2022).

10 May 2022

Our ref: 22SUT-1817

NSW National Parks and Wildlife Service
21 Cape Solander Dr,
Kurnell 2231

Attention: Phuong Le

Dear Phuong,

Kamay Botany Bay National Park Amphibian Test of Significance

Eco Logical Australia PTY LTD (ELA) was engaged by NSW National Parks and Wildlife Service (NPWS) to prepare a Test of Significance (ToS) to accompany the Kamay Master Plan Stage 1 Review of Environmental Factors (REF), which assesses proposed works within Kamay Botany Bay National Park (Figure 1). The ToS is required for ecological impacts associated under the proposed works and conducted in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). ToS for the *Litoria aurea* (Green and Golden Bell Frog – GGBF) and *Crinia tinnula* (Wallum Froglet) and its local occurrence are in Appendix A. Appendix B addresses the GGBF Assessment of Significance (AoS) required to meet the requirements of the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act).

LITORIA AUREA (GREEN AND GOLDEN BELL FROG)

Listed as Endangered (BC Act) and Vulnerable (EPBC Act)

The GGBF is an endemic Australian tree frog that is a member of the family Hylidae. Broadly, the species has been previously recorded as far as Yuraygir National Park on the North Coast of NSW to around Lakes Entrance in south-eastern Victoria (DEWHA 2009). Breeding sites for the Green and Golden Bell Frog include a wide variety of natural waterbodies except fast flowing streams (DEWHA 2009). It has been found they tend to prefer to breed in waterbodies that are still, shallow, ephemeral, unshaded, with aquatic plants and free of the Plague Minnow (*Gambusia holbrooki*) and other predatory fish (DEWHA 2009). Breeding habitat also includes many human-created environments, including highly disturbed sites such as abandoned mines and quarries (DEWHA 2009) as well as artificial wetlands (DEWHA 2009). Non-breeding habitat for the GGBF appears to be within 50 m of waterbodies as the species is not found to disperse away from waterbodies into more terrestrial non-breeding habitats (100-300 m from the breeding site) such that is the case for other Australian frog species (Lemckert 2004). During the day they typically shelter in denser vegetation and often in emergent aquatic vegetation where they are known to bask in available sunlight.

The GGBF was not recorded during the surveys undertaken for this assessment. There are historical records of the species from Kamay Botany Bay National Park. It is assumed the GGBF could occupy any suitable habitat that occurs within its geographical range.

CRINIA TINNULA (WALLUM FROGLET)

Listed as *Vulnerable* (BC Act)

The Wallum Froglet occurs in lowland coastal areas of subtropical eastern Australia from Littabella National Park, south-east Queensland, south to Kurnell, and central New South Wales. The Wallum Froglet can be found in acidic wetlands (pH 4.3-5.2) within Melaleuca swamps, sedgeland, wet or dry heathland and wallum/woodland areas in the sandy coastal lowlands (<100m asl) (OEH 2017). They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests, but only where the waters are acidic. The Wallum Froglet is a nocturnal, terrestrial and cryptic species. Males call from secluded positions at the water's edge or from among sedge tussocks near the water level (OEH 2017). Calling typically follows rains heavy enough to fill the breeding site and the tadpoles are physiologically adapted to acidic waters.

In accordance with Section 7.3 of the BC Act, impacts to threatened species and threatened ecological communities are required to be assessed. As such, ELA undertook the required ToS (5-part test) for both species in accordance with the BC Act. An AoS for the GGBF was also completed in accordance with the EPBC Act.

METHODOLOGY

The study area boundary was provided by NPWS. The extent of works boundary (shown in Figure 2) was mapped by georeferencing designs within the masterplan document, and creating polygons as ESRI Shapefiles. This boundary was used for impact area calculations, and totals 5.28 ha.

ELA identified any hydrolines mapped within the study area (Figure 2), and focused the survey effort along these, keeping survey transect start points to less than 500 m apart. Visual spotlighting and call playback surveys were completed along the survey transects where edges of suitable breeding habitat were identified. Surveys sampled the available range of waterbodies within the study area including creek lines, sodden grassy areas, sedgeland and heathy melaleuca vegetation.

The surveys were undertaken over two weeks between 16 – 30 March 2022 by two ecologists (Table 1, Figure 2). Surveys started after sunset when it was deemed dark enough for frogs to become active and so more visible. Sites 1-5 were surveyed four times, site 6 was surveyed twice before it was deemed to not contain appropriate habitat for either the GGBF or the Wallum Froglet, no other threatened amphibian habitat were identified in the vicinity.

RESULTS

Table 1: Survey effort

Date	Weather (BOM station 066037)	Team
16/03/2022	Temperature: 25.6°C Rain total: 20.4mm Relative Humidity: 95%	Leura Kowald – Ecologist Alice Ridyard – Graduate Ecologist
22/03/2022	Temperature: 28.8°C	Leura Kowald – Ecologist

Date	Weather (BOM station 066037)	Team
	Rain total: 0.8mm Relative Humidity: 73%	Aleksei Atkin – Senior Ecologist
24/03/2022	Temperature: 22.1°C Rain total: 1.4mm Relative Humidity: 93%	Leura Kowald – Ecologist Aleksei Atkin – Senior Ecologist
30/03/2022	Temperature: 22.6°C Rain total: 18.2mm Relative Humidity: 92%	Leura Kowald – Ecologist Michael Gregor - Ecologist

Table 2: Summary of species identified during targeted survey

Site	Scientific name	Common name
1	<i>Limnodynastes peronii</i> <i>Crinia signifera</i> <i>Litoria verreauxii</i>	Striped Marsh Frog Common Eastern Froglet Whistling Tree Frog
2	<i>Limnodynastes peronii</i>	Striped Marsh Frog
3	<i>Limnodynastes peronii</i> <i>Crinia signifera</i>	Striped Marsh Frog Common Eastern Froglet
4	<i>Limnodynastes peronii</i> <i>Crinia signifera</i> <i>Uperoleia laevigata</i>	Striped Marsh Frog Common Eastern Froglet Smooth Toadlet
5	<i>Limnodynastes peronii</i> <i>Crinia signifera</i> <i>Litoria verreauxii</i>	Striped Marsh Frog Common Eastern Froglet Whistling Tree Frog
6	N/A	N/A

MITIGATION MEASURES

ELA considers that with appropriate implementation of mitigation measures the impacts to potential GGBF population will be minimised and mitigated. These include:

- access,
- protection and demolition plans,
- the Technical Specification,
- the Setout plans
- additional details defining the demolition and construction methodology.

Water retention tanks in the form of rainwater tanks are to be added to catch initial rainfall from the proposed new Information Centre roof and allow the water to be redirected down the creek line over a longer time than currently is the case in order to reduce the impact of higher water volumes from the

increased roof catchment. During works in and along creek lines, soil compaction would be avoided by use of small (<3 tonne) earthmoving equipment. Repairs and upgrades to existing concrete pathways will have minimal impacts. Repairs to the sea wall will stabilise damage from past storm events and be designed to reduce erosion. Revegetation of sections of lawn to increase the area of native vegetation and fauna habitat forms part of the proposal. Additionally, pipes within which creeks currently flow will be removed in sections, further increasing potential habitat for the GGBF within the site.

ELA recommends the following controls to minimise potential impact to the GGBF and Wallum Froglet:

- Erosion and sediment control, water quality management.
- Identifying measures to protect areas of significant habitat value from construction activities and vehicle access.
- Protection of vegetation outside the immediate works area.
- Pollution control and protection.
- Zero waste policy and safe disposal of all wastes off site.
- Containment and management of spills (oil, fuel, or other products).
- Methods of contamination and removing spilt material from any vehicles including fuels and oils.
- Wash down procedures against introduction of chytrid, phytophthora and weed species to/from site in accordance with Saving Our Species Hygiene Protocols (DPIE 2020).
- Site environmental control on vehicle and materials storage.

CONCLUSION

The ToS has concluded that the impacts on GGBF and the Wallum Froglet listed under the BC Act will not be significant and no Species Impact Statement or further Biodiversity Assessment is required (Appendix A). The AoS has concluded that the impacts on GGFB listed under the EPBC Act will not be significant, and the work will not be a controlled action and therefore no Commonwealth referral is required (Appendix B).

If you have any questions regarding these assessments, please do not hesitate to contact me at Aleksei.Atkin@ecoaus.com.au.

Regards,

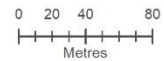


Aleksei Atkin
Senior Ecologist



Survey Efforts

- Study Area
- Extent of Works
- Culvert
- Drain Pipe
- Old Path
- Pathway
- ▲ Survey Start Point
- Species Sighting
- Survey Effort
- Strahler Stream Order**
- 1st Order Stream



Datum/Projection:
GDA 1994 MGA Zone 56
Project: 22SUT1817-EH Date: 4/7/2022

nearmap
Imagery: 21/12/2021



Figure 2: Survey effort



Figure 3: *Crinia signifera* (Common Eastern Froglet) next to a bottle cap



Figure 4: *Limnodynastes peronii* (Striped Marsh Frog) in leaf litter



Figure 5: Creek line between site 2 and 3



Figure 6: Culvert in figure 2

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Appendix A Test of Significance (BC Act)

The 'Test of Significance' (ToS) or 5-part test is applied to species, populations and ecological communities listed on Schedules 1 and 2 of the BC Act and Schedules 4, 4A and 5 of the *Fisheries Management Act* (FM Act). The assessment sets out 5 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether a significant impact is likely. All factors must be considered, and an overall conclusion made based on all factors in combination.

LITORIA AUREA (GREEN AND GOLDEN BELL FROG)

Endangered under the BC Act

BC Act	Question	Response
7.3.1 a)	In the case of a threatened species: whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Green and Golden Bell Frogs have been historically recorded within Kamay Botany Bay National Park. Applying a cautionary principal and assuming anywhere within the GGBF range they could occur it is assumed there could be a population of GGBF within the study area. Targeted survey for the GGBF consistent with the NSW Survey Guide for Threatened Frogs were undertaken between 16- 30 March 2022. GGBF were not detected during the survey period.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	Not applicable. GGBF is an endangered species.
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	Not applicable. GGBF is an endangered species.
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community: The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	The proposed works will directly impact on potential GGBF habitat. The proposed works cover an area totalling 5.28 ha. The proposed works will not result in the substantial modification of the composition of the GGBF potential habitat.
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	The area of disturbance is located around the current Kurnell information centre. Post construction, further isolation or fragmentation is not expected.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The proposed activity will require a works area of 5.28 ha. As such, there will be no significant reduction of structure of species complexity will occur.

BC Act	Question	Response
7.3.1 d)	Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed activity would not affect any declared areas of outstanding biodiversity value.
7.3.1 e)	Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>Key Threatening Processes (KTP) relevant to this proposal with respect to GGBF include:</p> <ul style="list-style-type: none"> Invasion of chytrid. <p>The proposal will not increase KTP operating on GGBF. Construction techniques should adopt pathogen management techniques and specific amphibian hygiene protocols. Any weed invasion should be controlled by NPWS.</p>
Conclusion	Is there likely to be a significant impact?	No.

The proposed activity will require a works area of 5.28 ha of potential GGBF habitat. In conclusion, it is unlikely to constitute a significant impact given:

- The proposed works are unlikely to result in fragmentation or isolation of fauna habitat beyond that already occurring, and the water bodies available for breeding will remain connected and untouched.
- Revegetation of sections of lawn to increase the area of native vegetation and fauna habitat forms part of the proposal. Additionally, pipes within which creeks currently flow will be removed in sections, further increasing potential habitat for the GGBF within the site.

Consequently, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not recommended for the proposal with respect to GGBF endangered species listed under the BC Act.

CRINIA TINNULA (WALLUM FROGLET)

Vulnerable under the BC Act

BC Act	Question	Response
7.3.1 a)	In the case of a threatened species: whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Wallum Froglet have been recorded within Kamay Botany Bay National Park. Targeted survey for the Wallum Froglet consistent with the NSW Survey Guide for Threatened Frogs were undertaken between 16- 30 March 2022. The Wallum Froglet was not detected during the survey period.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	Not applicable. The Wallum Froglet is a vulnerable species.
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	Not applicable. The Wallum Froglet is a vulnerable species.
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community: The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	The proposed works will directly impact on potential Wallum Froglet habitat. The proposed works will result in an area totalling 5.28 ha being disturbed. The proposed works will not result in the substantial modification of the composition of the Wallum Froglet habitat.
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	The area of disturbance is located around the current Kurnell information centre. Further isolation or fragmentation is not expected post construction.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The proposed activity will require a works area of 5.28 ha. This is a relatively small area of more widespread habitat. As such, there will be no reduction of structure of species complexity will occur.
7.3.1 d)	Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed activity would not affect any declared areas of outstanding biodiversity value.

BC Act	Question	Response
7.3.1 e)	Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	Key Threatening Process (KTP) relevant to this proposal with respect to the Wallum Froglet includes: <ul style="list-style-type: none"> Invasion of chytrid. The proposal will not increase KTP operating on the Wallum Froglet. Construction techniques should adopt pathogen management techniques. Any weed invasion should be controlled by NPWS.
Conclusion	Is there likely to be a significant impact?	No.

The proposed activity will require a works area of 5.28 ha of potential Wallum Froglet habitat. In conclusion, it is unlikely to constitute a significant impact given:

- The proposed works are unlikely to result in fragmentation or isolation of fauna habitat beyond that already occurring, and the water bodies available for breeding will remain connected and untouched.
- Revegetation of sections of lawn to increase the area of native vegetation and fauna habitat forms part of the proposal. Additionally, pipes within which creeks currently flow will be removed in sections, further increasing potential habitat for the Wallum Froglet within the site.

Consequently, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not recommended for the proposal with respect to the Wallum Froglet vulnerable species listed under the BC Act.

Appendix B Assessment of Significance (EPBC Act)

LITORIA AUREA (GREEN AND GOLDEN BELL FROG)

Vulnerable under the EPBC Act

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1)	lead to a long-term decrease in the size of an important population of a species	Green and Golden Bell Frogs have been historically recorded within Kamay Botany Bay National Park. Applying a cautionary principal and assuming anywhere within the GGBF range they could occur it is assumed there could be a population of GGBF within the study area. Targeted survey for the GGBF consistent with the NSW Survey Guide for Threatened Frogs were undertaken between 16- 30 March 2022. GGBF were not detected during the survey period. It is unlikely the proposed works would result in a further decrease in GGBF population.
2)	reduce the area of occupancy of an important population	The proposed works area is unlikely to have long term impact on the potential population due to it being an upgrade to existing infrastructure and also formalises informal pathways and reduce trampling.
3)	fragment an existing important population into two or more populations	Fragmentation is unlikely as there is no further impact to the study area due to the works being an upgrade of existing infrastructure around the information centre and formalising existing informal carparks.
4)	adversely affect habitat critical to the survival of a species	Limited clearing of vegetation or creek lines is anticipated in association with the proposed works. The replacement of one creek line and removal of a pipe will reinstate more creek line and improve habitat quality. Habitat critical to the survival of GGBF is unlikely to be adversely impacted.
5)	disrupt the breeding cycle of an important population	The proposed works are unlikely to disrupt the breeding cycle of GGBF due to the works upgrading existing infrastructure and reinstating one section of creek line. This will not impact on the potential GGBF population as breeding habitat will not be reduced or modified.
6)	modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The quality of habitat long term will not be destroyed, removed or isolated. The habitat will be modified and aimed to be improved.
7)	result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Mitigation measures are recommended and if followed a low likelihood of invasive species causing decline of a potential population or its habitat.
8)	introduce disease that may cause the species to decline, or	Potential for Chytrid to be introduced during the construction process. Mitigation measures are recommended and, if followed, a low likelihood of a disease-causing decline of a potential population.

Criterion	Question	Response
9)	interfere substantially with the recovery of the species.	The proposed works align with the Saving our Species recovery plan and will not interfere with the recovery of the species but improve the habitat should a GGBF population be present in the study area.
Conclusion	Is there likely to be a significant impact?	No

In conclusion, the impacts on potential GGBF population listed under the EPBC Act will not be significant, and the work will not be a controlled action and therefore no Commonwealth referral is required under the EPBC Act.



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