

Terrestrial Environment Report

New Marine Facilities to Service
Mandorah and Cox Peninsula

ZMD01890



Prepared for
Department of Infrastructure, Planning and
Logistics

29 January 2022

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1 Introduction

1.1 Project Background

The existing Mandorah Jetty and Boat Ramp are key infrastructure facilities servicing the Mandorah, Wagait and Belyuen communities, as well as visitors to the area from Darwin and surrounds. Mandorah Jetty supports the only ferry service from Darwin to the Cox Peninsula. The Mandorah boat ramp is located just south of the Jetty, with both facilities sharing a common onshore carpark facility.

Previous studies (e.g. Jacobs, 2016 and 2019) identified shortcomings in the design of the existing facilities, such as Disability Discrimination Act (DDA) non-compliance of the existing Jetty, and investigated various options to improve the ferry berthing facility and boat ramp. The Department of Infrastructure, Planning and Logistics (DIPL) have developed and assessed options for new marine facilities at Mandorah. The key project objectives included selection and design of a facility that:

- > Addresses issues faced by the existing Mandorah Jetty and boat ramp. These issues include the highly exposed nature of the site, DDA non-compliance, passenger safety issues and safety and sedimentation issues of the existing boat ramp;
- > Minimises construction and whole-of-life costs;
- > Allows for uninterrupted ferry service operation during construction; and
- > Provides a safe and enjoyable passenger experience.

DIPL and Cardno have now developed, assessed and designed a preferred option for new marine facilities at Mandorah. The facilities comprise a dredged basin, two large breakwaters, boat ramp, gangway and pontoon, and onshore ferry terminal and parking facilities (**Figure 1-1**).

1.2 Site Location and Study Areas

Mandorah is located near the eastern tip of the Cox Peninsula in the Northern Territory, approximately six kilometres to the west of Darwin (**Figure 1-1**). Access to Mandorah from Darwin is via the regular ferry service, or by driving approximately 120 km along the road network.

Study areas have been defined for terrestrial environment assessment and investigations based on the potential area of project impacts (**Figure 1-2**). This includes the direct project footprint and anticipated disturbance areas. Two study areas have been defined:

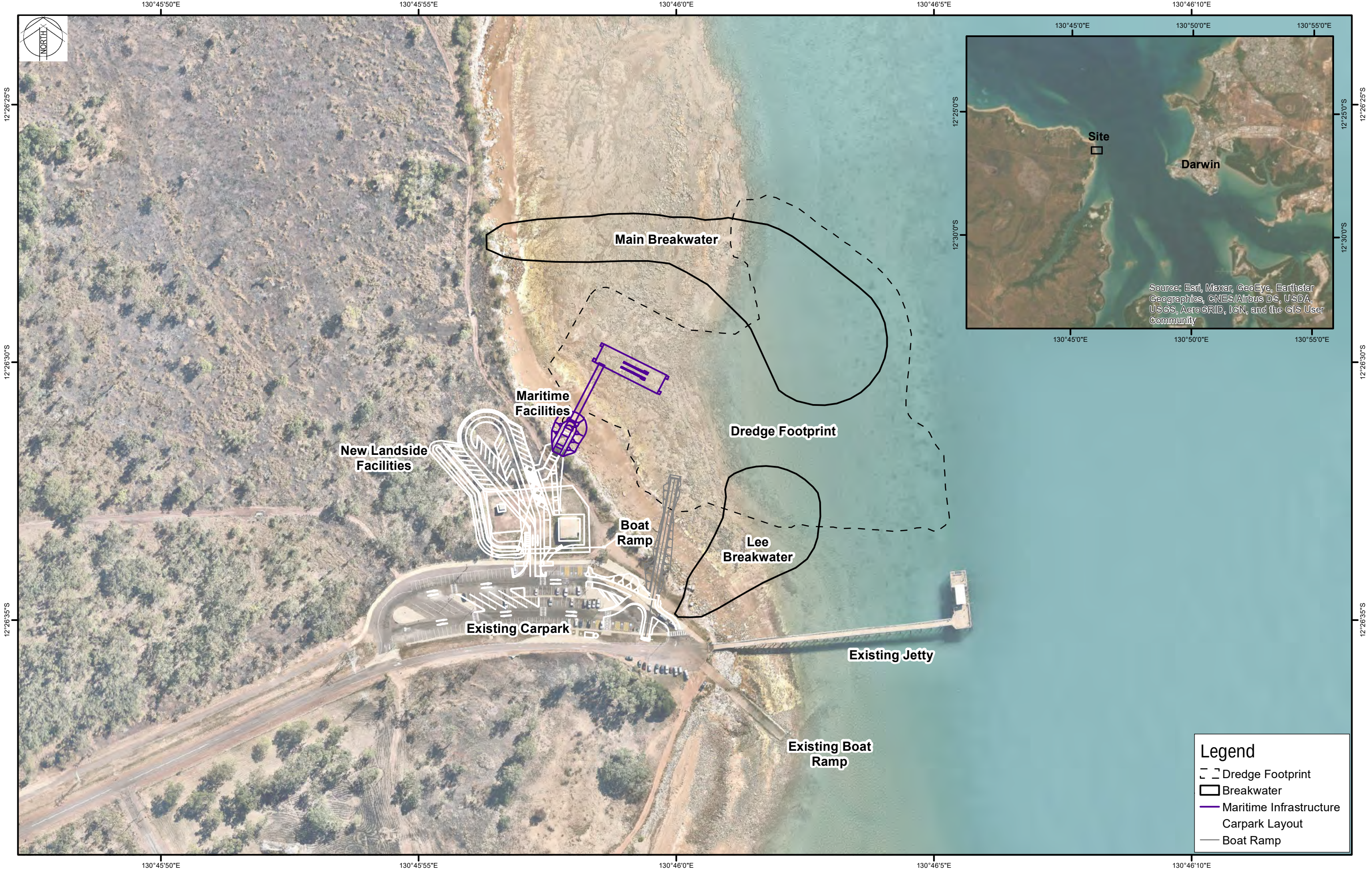
- > Project Site Study Area: Captures the direct project footprint of new infrastructure. This was defined based on the latest design project layouts; and
- > Broader Project Study Area: Captures areas of likely project disturbance due to access, transport, laydown areas, temporary works areas and site facilities.

1.3 Relevant Legislation

The reason for developing an understanding of the terrestrial environment at the project site is so that potential environmental impacts can be identified and mitigated. Northern Territory and Commonwealth legislation is in place to enforce the requirement for such environmental risk assessment and management.

The NT *Environment Protection Act 2019* (EP Act) aims to protect the environment through sustainable development and manage significant disturbances through an environmental approval process. Under the act, the NT EPA regulates the environment impact assessment process to identify potential environmental impacts of development proposals.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage





Perth, Western Australia

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TERRESTRIAL ENVIRONMENT STUDY AREAS

MANDORAH MARINE FACILITIES
TERRESTRIAL ENVIRONMENT REPORT

FIGURE 1-2

sites, referred to as Matters of National Environmental Significance (MNES). Developments likely to have significant impact on MNES require referral under the provisions of the EPBC Act.

Territory and Commonwealth legislation applicable to the project and this referral is summarised in **Table 1-1** and **Table 1-2**, respectively.

Table 1-1 Relevant Territory Legislation

Document	Purpose / Objectives	Agency
<i>Environment Protection Act 2019 (EP Act)</i>	> Protect the environment of the Territory; > Promote ecologically sustainable development so that the wellbeing of the people of the Territory is maintained or improved without adverse impact on the environment of the Territory; > Recognise the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment of the Territory; > Provide for broad community involvement during the process of environmental impact assessment and environmental approval; > Recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes.	Department of Environment, Parks and Water Security
<i>Environment Protection Regulations 2020 (EP Regulations)</i>	Support and guide the implementation of the EP Act.	Department of Environment, Parks and Water Security
<i>Northern Territory Environment Protection Authority Act 2012 (NT EPA Act)</i>	> Promote ecologically sustainable development; > Protect the environment, having regard to the need to enable ecologically sustainable development; > Promote effective waste management and waste minimisation strategies; and > Enhance community and business confidence in the environmental protection regime of the Territory.	Department of Environment, Parks and Water Security
<i>Waste Management and Pollution Control Act 1998</i>	> Protect, and where practicable to restore and enhance the quality of, the Territory environment by: - Preventing pollution; - Reducing the likelihood of pollution occurring; - Effectively responding to pollution; - Avoiding and reducing the generation of waste; - Increasing the re-use and re-cycling of waste; and - Effectively managing waste disposal; > Encourage ecologically sustainable development; and > To facilitate the implementation of national environment protection measures made under the National Environment Protection Council (Northern Territory) Act 1994 (described below).	Department of Environment, Parks and Water Security

Document	Purpose / Objectives	Agency
<i>Waste Management and Pollution Control (Administration) Regulations 1998</i>	Details regulations to administer the <i>Waste Management and Pollution Control Act 1998</i> .	Department of Environment, Parks and Water Security
<i>National Environment Protection Council (Northern Territory) Act 1994</i>	The object of this Act is to ensure that, by means of the establishment and operation of the National Environment Protection Council: > People enjoy the benefit of equivalent protection from air, water or soil pollution and from noise, wherever they live in Australia; and > Decisions of the business community are not distorted, and markets are not fragmented, by variations between participating jurisdictions in relation to the adoption or implementation of major environment protection measures.	Department of Environment, Parks and Water Security
<i>Territory Parks and Wildlife Conservation Act 1976 (TPWC Act)</i>	> Provides for the protection, conservation and sustainable utilisation of wildlife; and > Provides protection of listed threatened species for which proponents must consider direct and indirect impacts on a listed threatened species or place covered under this Act.	Department of Environment, Parks and Water Security
<i>Territory Parks and Wildlife Regulations 2001</i>	Details regulations under the <i>Territory Parks and Wildlife Conservation Act 1976</i> .	Department of Environment, Parks and Water Security
<i>Water Act 1992</i>	> Provides for the investigation, allocation, use, control, protection, management and administration of water resources, including extraction of groundwater, waste water management and water pollution; and > Provides for water allocation plans, drilling licences, bore construction permits, water extraction licences, waste discharge licences, fees and charges, and penalties for offences against the Act.	Department of Environment, Parks and Water Security
<i>Water Regulations 1992</i>	Details regulations under the <i>Water Act 1992</i> .	Department of Environment, Parks and Water Security

Table 1-2 Relevant Commonwealth Legislation

Document	Purpose / Objectives	Agency
<i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i>	> Provides for the protection of the environment and conservation of biodiversity, particularly species and places of national significance. > Invoked only if a development is likely to have environmental impacts of national significance	Australian Government Department of Agriculture, Water and the Environment
<i>National Environment Protection Measures (Implementation) Act 1998</i>	The objects of this Act are: > To make provision for the implementation of national environment protection measures in respect of certain activities carried on by or on behalf of the Commonwealth and Commonwealth authorities; and > To protect, restore and enhance the quality of the environment in Australia, having regard to the need to maintain ecologically sustainable development; and	Australian Government Department of Agriculture, Water and the Environment

	To ensure that the community has access to relevant and meaningful information about pollution.	
<i>National Environment Protection Measures (Implementation) Regulations 1999</i>	Details regulations under the <i>National Environment Protection Measures (Implementation) Act 1998</i> .	Australian Government Department of Agriculture, Water and the Environment
<i>National Environment Protection (Assessment of Site Contamination) Measure 1999</i>	The purpose of the Measure is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, land owners, developers and industry. The desired environmental outcome for this Measure is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.	Australian Government Department of Agriculture, Water and the Environment

1.4 Purpose and Structure of this Document

The purpose of this Terrestrial Environment Report is to describe the terrestrial quality, ecosystems, flora and fauna relevant to the proposed project. The report summarises and assesses existing information relating to the terrestrial environment through desktop review and identifies knowledge gaps where further field investigations were required and undertaken. These field investigations are also documented in this report.

The aim of the report is to identify the existing composition and quality of the terrestrial environment and likely presence of flora and fauna within the project area, to allow potential project impacts to be quantified and/or risk assessed.

The document has been structured as follows:

- > This Section (1) introduces the project and context and purpose of this report;
- > **Section 2** details desktop investigations of the terrestrial environment, including database searches and review of existing data;
- > **Section 3** details the identification of relevant data gaps, dictating the need for further field investigations;
- > **Section 4** outlines terrestrial environmental field investigations undertaken for the project, including methodology and results; and
- > **Section 5** outlines the conclusions of the investigations and their implications in terms of the overall project.

1.5 Reference Documents

Various investigations and studies have been carried out as part of the overall development and design project to date. This report documents a component of these investigations. The following documents are referenced in, or should be given due consideration when reading, this report:

- > Directly relevant:
 - *Environmental Referral Report* (Cardno, 2022a): This document provides the necessary details to refer the project to the NT EPA. This *Terrestrial Environment Report* is an appendix to the referral document, providing the necessary context for assessing risk to the terrestrial environment from the project;
 - *Draft Construction Environmental Management Plan (CEMP)* (Cardno, 2022b): Defines likely construction activities and controls required to avoid or minimise environmental impact; and
 - *Asbestos Asset Survey* (Cardno, 2021) – **Appendix A**.
- > Relevant to the overall project:

- *Marine Environment Report* (Cardno, 2022c): Details the marine environment and ecology relevant to the project site, similar to the function of this report for the terrestrial environment.
- *Design Report* (Cardno, 2022d): Details the design requirements, basis, inputs, calculations and outcomes for the new proposed infrastructure;
- *Geotechnical Report* (Cardno, 2022e): Details the geotechnical information and investigations for the project site that inform design of the new proposed infrastructure;
- *Metocean Report* (Cardno, 2022f): Details the metocean information and investigations for the project site that inform design of the new proposed infrastructure;
- *Sediment Transport Report* (Cardno, 2022g): Details coastal processes investigations undertaken to date, to inform design and environmental aspects of the project;
- *SAP Implementation Report* (Cardno, 2022h): Details marine sediment quality investigations undertaken to understand any contamination within the dredging and disturbance area and guide proper handling and disposal of dredge material; and
- *Draft Dredging and Disposal Management Plan (DDMP)* (Cardno, 2022i): Defines the dredging actions and necessary controls to avoid or minimise risk for, and impact to, the marine environment.

2 Desktop Investigations

2.1 Terrestrial Flora and Fauna

The desktop review was undertaken based on published literature, technical reports, publicly accessible databases and mapping relevant to the Darwin Region, Project site and its surrounds. The desktop review provided background on the area's environmental status and informed the gap analysis and, therefore, required field investigations. Sources consulted during the desktop review include:

- > EPBC Act 1999 Protected Matters Search Tool to identify threatened species and Matters of National Environmental Significance (NES) likely to occur at the project site (accessed 18 February 2020);
- > Atlas of Living Australia and Australia's Virtual Herbarium databases to identify known records of threatened, least concern and pest species recorded within the vicinity of the project site (these resources include Herbarium HERBREC's records) (accessed 19 February 2020);
- > Northern Territory Department of Environment, Parks and Water Security (DEPWS) natural resources maps to identify known records of vegetation, threatened communities, threatened species and pest species (accessed on 18 February 2020); and
- > Environmental Management Register and Contaminated Land Register for the properties on which works are proposed.

Raw database search outcomes are included as **Appendix B**.

2.1.1 Terrestrial Ecology

2.1.1.1 Species Distribution

The Northern Territory Flora and Fauna Atlases were questioned on 18th February 2020. The following was found with regards to records of terrestrial flora and fauna within the terrestrial footprint portion of the proposed project:

- > No known records of threatened, significant and restricted range flora species occur therein;
- > Eight known flora records among seven native flora species are known in the locality;
- > 68 known flora records among 37 introduced flora species are known to occur in the locality; and
- > 61 known fauna records, including four records of threatened species and 16 records of significant species. Fauna records correspond to 30 bird and one terrestrial mammal species.

Table 2-1 and **2-2** shows list of flora and fauna recorded within 500m of the Study Area, respectively.

Table 2-1 NT Flora Atlas Records within 500m of the project footprint

Family	Scientific Name	Common Name	Species Type	Number of records	TPWC Act	EPBC Act
Acanthaceae	<i>Ruellia tuberosa</i>	Ruellia	*	2	-	-
Amaranthaceae	<i>Gomphrena celosioides</i>	Gomphrena Weed	*	2	-	-
Asteraceae	<i>Tridax procumbens</i>	Tridax, Tridax Daisy	*	2	-	-
Convolvulaceae	<i>Ipomoea pes-tigridis</i>	Ipomoea	*	1	-	-
Convolvulaceae	<i>Ipomoea quamoclit</i>	Ipomoea	*	2	-	-
Convolvulaceae	<i>Merremia dissecta</i>	White Convolvulus Creeper	*	1	-	-

Family	Scientific Name	Common Name	Species Type	Number of records	TPWC Act	EPBC Act
Cyperaceae	<i>Cyperus rotundus</i>	Nutgrass	*	2	-	-
Euphorbiaceae	<i>Euphorbia hirta</i>	Asthma Herb	*	2	-	-
Euphorbiaceae	<i>Euphorbia heterophylla</i>	Painted Spurge	*	1	-	-
Fabaceae	<i>Crotalaria goreensis</i>	Rattlepod	*	1	-	-
Fabaceae	<i>Desmodium tortuosum</i>	Desmodium	*	2	-	-
Fabaceae	<i>Desmodium triflorum</i>	Desmodium	*	2	-	-
Fabaceae	<i>Indigofera tinctoria</i>	Indigo	*	2	-	-
Fabaceae	<i>Leucaena leucocephala</i>	Coffee Bush	*	1	-	-
Fabaceae	<i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>	Coffee Bush	*	2	-	-
Fabaceae	<i>Macroptilium atropurpureum</i>	Sirat	*	1	-	-
Fabaceae	<i>Stylosanthes hamata</i>	Verano Stylo	*	1	-	-
Lamiaceae	<i>Mesosphaerum suaveolens</i>	Mint Weed	B	1	-	-
Malvaceae	<i>Sida acuta</i>	Spiny-head Sida	B	1	-	-
Malvaceae	<i>Sida cordifolia</i>	Flannel Weed	B	2	-	-
Meliaceae	<i>Khaya senegalensis</i>	African Mahogany	*	1	-	-
Passifloraceae	<i>Passiflora foetida</i>	Wild Passionfruit	*	2	-	-
Phyllanthaceae	<i>Phyllanthus amarus</i>	Phyllanthus	*	1	-	-
Plantaginaceae	<i>Scoparia dulcis</i>	Scoparia	N	1	NE	-
Poaceae	<i>Cenchrus spp.</i>	Mission Grass	A/B	2	-	-
Poaceae	<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>	Forest Bluegrass	N	1	LC	-
Poaceae	<i>Bothriochloa pertusa</i>	Indian Bluegrass	*	2	-	-
Poaceae	<i>Cenchrus ciliaris</i>	Buffel Grass	*	2	-	-
Poaceae	<i>Cenchrus echinatus</i>	Mossman River Grass	B	1	-	-
Poaceae	<i>Cenchrus pedicellatus</i>	Pennisetum	*	8	-	-
Poaceae	<i>Cenchrus polystachios</i>	Pennisetum	B	9	-	-
Poaceae	<i>Chloris barbata</i>	Purple-top Rhodes Grass	*	2	-	-
Poaceae	<i>Chrysopogon aciculatus</i>	Chrysopogon	*	1	-	-

Family	Scientific Name	Common Name	Species Type	Number of records	TPWC Act	EPBC Act
Poaceae	<i>Digitaria ciliaris</i>	Summer Grass	*	1	-	-
Poaceae	<i>Echinochloa colona</i>	Barnyard Grass	N	1	LC	-
Poaceae	<i>Eragrostis tenuifolia</i>	Lovegrass	*	1	-	-
Poaceae	<i>Melinis repens</i>	Red Natal Grass	*	1	-	-
Poaceae	<i>Sporobolus fertilis</i>	-	*	1	-	-
Poaceae	<i>Urochloa mosambicensis</i>	Sabi Grass	*	1	-	-
Poaceae	<i>Urochloa piligera</i>	Hairy Armgrass	N	1	LC	-
Poaceae	<i>Urochloa subquadrifera</i>	Green Summer Grass	N	1	LC	-
Rubiaceae	<i>Oldenlandia corymbosa</i> var. <i>corymbosa</i>	Oldenlandia	*	1	-	-
Solanaceae	<i>Physalis angulata</i>	Wild Gooseberry	N	1	LC	-
Zygophyllaceae	<i>Tribulus cistoides</i>	Tribulus	N	1	LC	-
Notes: * = exotic; N = native; LC = Least Concern; NE = Not Evaluated; A = Class A declared weed; B = Class B declared weed TPWC Act = Territory Parks and Wildlife Conservation Act 2006; EPBC Act = Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.						

Table 2-2 NT Fauna Atlas Records within 500m of the project footprint

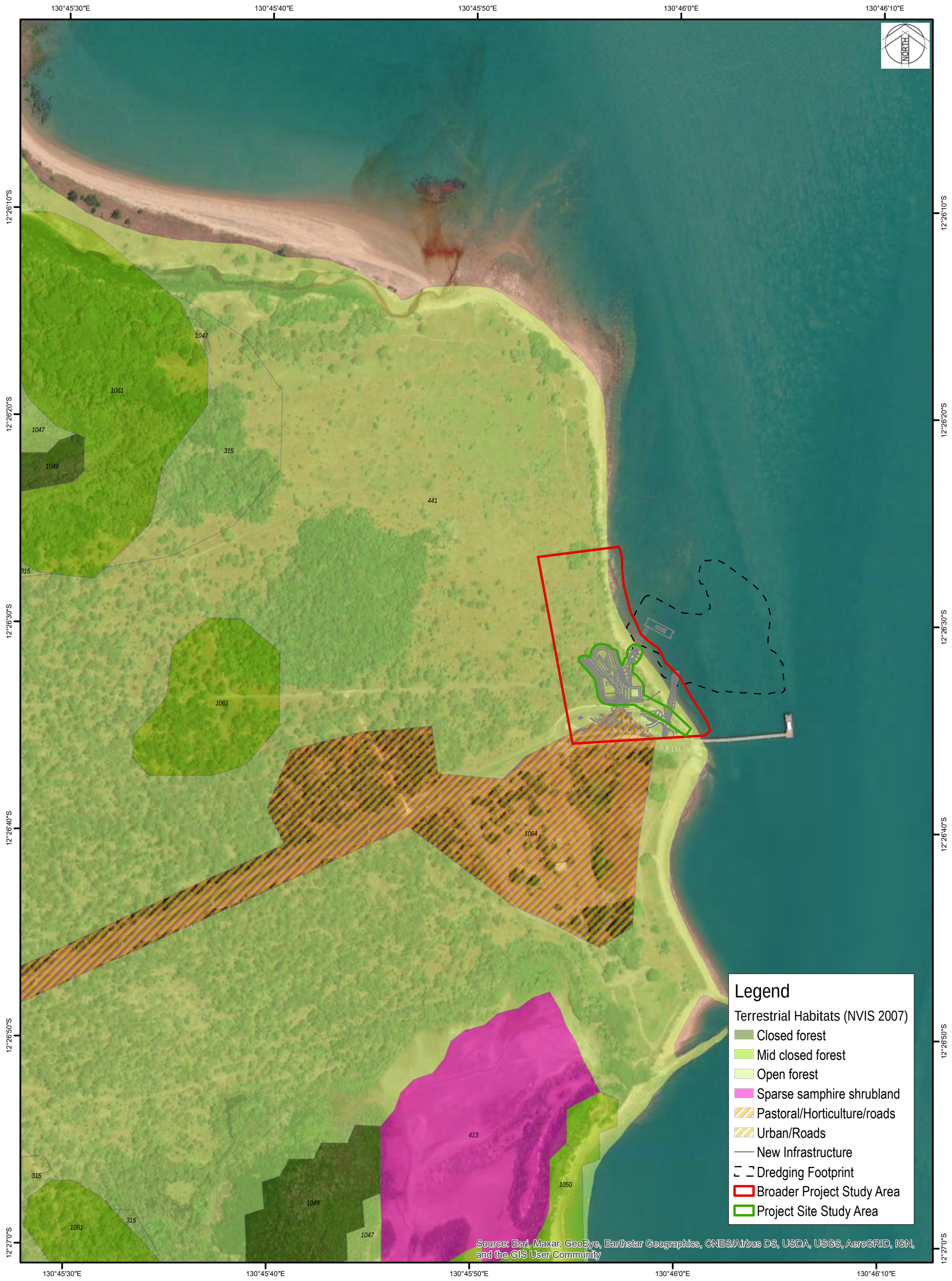
Scientific Name	Common Name	Species Type	Number of records	TPWC Act	EPBC Act
Birds					
<i>Actitis hypoleucos</i>	Common Sandpiper	S	2	LC	-
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	N	1	LC	-
<i>Cacatua sanguinea</i>	Little Corella	N	1	LC	-
<i>Centropus phasianinus</i>	Pheasant Coucal	N	1	LC	-
<i>Chlamydera nuchalis</i>	Great Bowerbird	N	1	LC	-
<i>Chroicocephalus novaehollandiae</i>	Silver Gull	N	1	LC	-
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	N	1	LC	-
<i>Corvus orru</i>	Torresian Crow	N	1	LC	-
<i>Dacelo leachii</i>	Blue-winged Kookaburra	N	1	LC	-
<i>Dicaeum hirundinaceum</i>	Mistletoebird	N	1	LC	-
<i>Egretta sacra</i>	Eastern Reef Egret	S	2	LC	-
<i>Eolophus roseicapilla</i>	Galah	N	1	LC	-

Scientific Name	Common Name	Species Type	Number of records	TPWC Act	EPBC Act
<i>Esacus magnirostris</i>	Beach Stone-curlew	N	6	LC	-
<i>Gelochelidon macrotarsa</i>	Australian Gull-billed Tern	N	3	LC	-
<i>Geopelia placida</i>	Peaceful Dove	N	1	LC	-
<i>Grallina cyanoleuca</i>	Magpie-lark	N	6	LC	-
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	S	6	LC	Mi
<i>Haliastur indus</i>	Brahminy Kite	N	2	LC	-
<i>Merops ornatus</i>	Rainbow Bee-eater	S	2	LC	Mi
<i>Milvus migrans</i>	Black Kite	N	6	LC	-
<i>Numenius madagascariensis</i>	Far Eastern Curlew	N, S	6	VU	CR, Mi
<i>Numenius phaeopus</i>	Whimbrel	S	4	NT	Mi
<i>Phalacrocorax varius</i>	Pied Cormorant	N	1	LC	-
<i>Sphecotheres vieilloti</i>	Australasian Figbird	N	1	LC	-
<i>Thalasseus bergii</i>	Crested Tern	N	4	LC	-
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher	N	1	LC	-
<i>Todiramphus sanctus</i>	Sacred Kingfisher	N	1	LC	-
<i>Trichoglossus rubritorquis</i>	Red-collared Lorikeet	N	1	LC	-
<i>Vanellus miles</i>	Masked Lapwing	N	1	LC	-
Reptiles					
<i>Fordonia leucobalia</i>	White-bellied Mangrove Snake	N	1	LC	-
Notes: * = exotic; N = native; S = Significant Species; DD = Data Deficient; LC = Least Concern; NE = Not Evaluated; VU = Vulnerable; CR = Critically Endangered; Mi = Migratory; NT = Near Threatened;					

2.1.1.2 Terrestrial Flora

The National Vegetation Information System (NVIS) vegetation mapping 2007 Level 2 indicates that Open Forest (DENR, 2020) is the structural formation class of vegetation within the terrestrial footprint of the proposed marine facilities project (**Figure 2-1**).

In accordance with the Greater Darwin Region 1:100,000 Landcover Mapping (GTRDWV_100, DENR 2003), the terrestrial footprint of the proposed project is located within the 'cleared land' and 'Eucalypt woodland' map unit classes, with nearby 'Drainage open woodland' (**Figure 2-2**) Hempel (2003) describes the cleared land map unit as land where native vegetation has undergone significant land cover change. This includes land cleared for industrial, urban residential, rural residential, horticultural and plantation forest development. Degraded areas with substantial erosion or run-off sites and weed infestations, are also included within this map unit class. Eucalypt Woodland is the most widespread land cover type derived in the satellite mapping by DENR (2003), described as Woodland occurring in shallow soils on undulating uplands, rises and rugged low hills. Grassland ground cover interspersed with a variety of shrubs and vines.



Legend

Terrestrial Habitats (NVIS 2007)

- Closed forest
- Mid closed forest
- Open forest
- Sparse samphire shrubland
- Pastoral/Horticulture/roads
- Urban/Roads
- New Infrastructure
- Dredging Footprint
- Broader Project Study Area
- Project Site Study Area

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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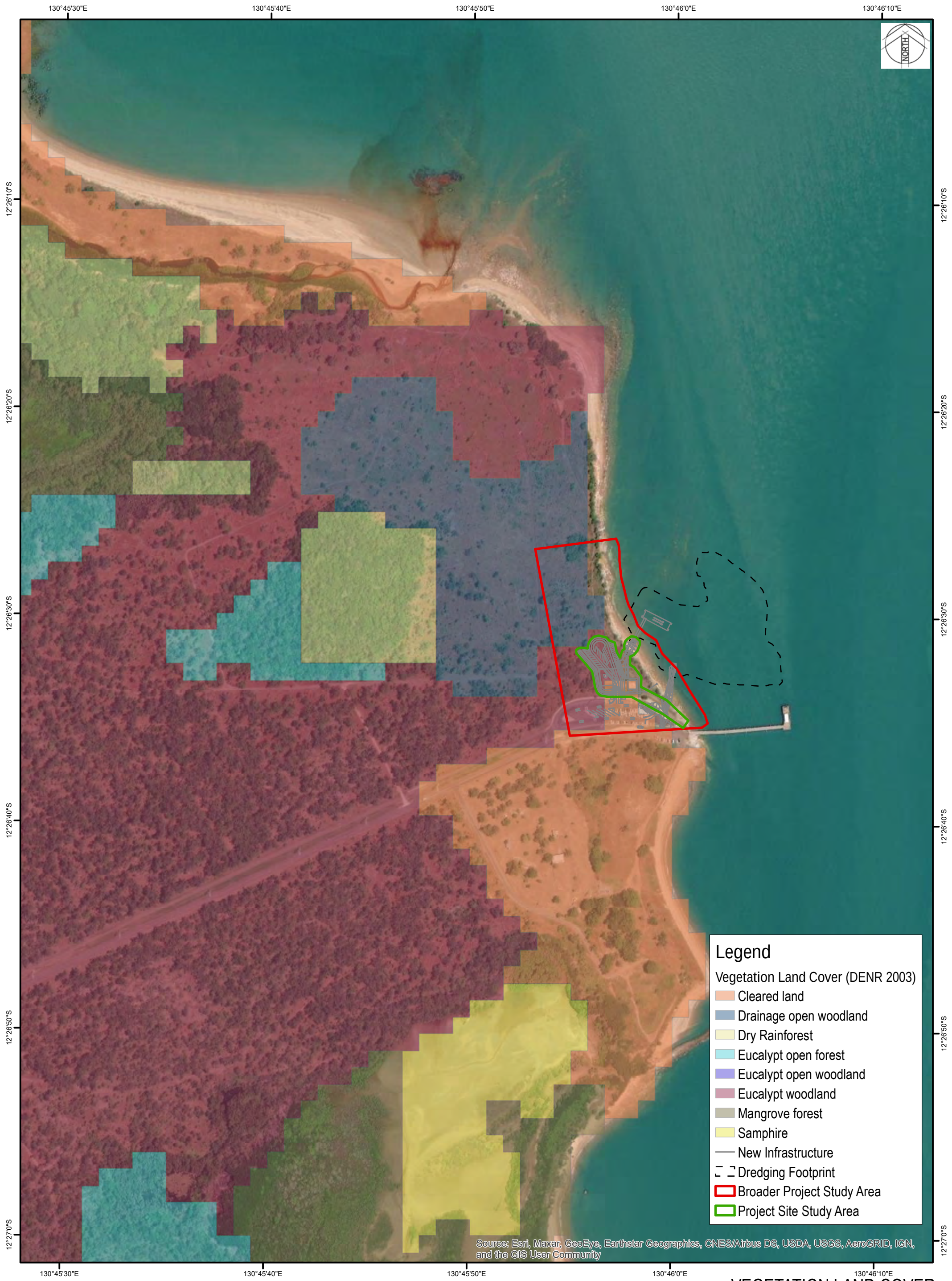
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TERRESTRIAL HABITATS

MANDORAH MARINE FACILITIES
TERRESTRIAL ENVIRONMENT REPORT

FIGURE 2-1



Legend

Vegetation Land Cover (DENR 2003)

- Cleared land
- Drainage open woodland
- Dry Rainforest
- Eucalypt open forest
- Eucalypt open woodland
- Eucalypt woodland
- Mangrove forest
- Samphire
- New Infrastructure
- Dredging Footprint
- Broader Project Study Area
- Project Site Study Area

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Darwin, Northern Territory

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VEGETATION LAND COVER FOR GREATER DARWIN REGION

MANDORAH MARINE FACILITIES
TERRESTRIAL ENVIRONMENT REPORT

FIGURE 2-2

2.1.1.3 Invasive Species

The *Northern Territory Weeds Management Act 2001* defines declared weed species as a plant identified for eradication, control or prevention of entry in all parts of the Territory and are declared under the following:

- > **Class A** To be eradicated;
- > **Class B** Growth and spread to be prevented; and
- > **Class C** Not to be introduced to the Territory.

The NTG Natural Resource Maps (NR Maps) service indicates the below declared weeds have been previously identified within and immediately adjacent to the terrestrial portion of the Project Study Area. The declared weeds NR Maps report is provided in **Appendix B**.

- > *Cenchrus polystachios* (Mission grass, perennial) **Class B**; and
- > *Cenchrus pedicellatus* (Mission grass, annual) **Not Declared**.

While annual mission grass is not a declared weed in the NT, it is recommended that both types be controlled at the same time. Furthermore, both *Cenchrus polystachion* and *Cenchrus pedicellatus* (perennial and annual mission grass) are subject to a threat abatement plan under the EPBC Act 1999 as they have been identified as a key threatening process. The following plan will be consulted to inform the contractors weed management plan: *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses* (Department of Sustainability, Environment, Water, Population and Communities, 2020).

2.1.2 Matters of Conservation Significance

In the Northern Territory, there are 67 sites of conservation significance (SCS) identified as the most important sites requiring protection to conserve their biodiversity values. The terrestrial footprint portion of the project is located within the Darwin Harbour site of conservation significance (SOCS) (Pavey et al., 2009). Darwin Harbour SOCS supports a range of estuarine, freshwater and terrestrial environments. Locally significant vegetation includes rainforests and mangroves. Fifteen threatened species are reported from this SOCS, including two plants, twelve vertebrates and one invertebrate. Mangroves and rainforest are important vegetation within this SOCS. The Darwin Harbour SOCS map (**Appendix B**) does not indicate that threatened species have been recorded at Mandorah, including the terrestrial footprint portion of the project.

DEWA's Protected Matters Search Tool (PMST) was questioned to identify MNES listed under the EPBC Act with potential to occur within 10km locality surrounding the Project Site. The PMST report indicated the following:

- > No World Heritage Properties were identified within the 10 km locality;
- > No National Heritage Places were identified within the 10 km locality;
- > No Wetlands of International Importance were identified within the 10 km locality;
- > No Threatened Ecological Communities were identified within the 10 km locality;
- > Overall, 39 Listed Threatened Species and 70 Listed Migratory Species were identified by the PMST, including:
 - Five terrestrial (not listed 'Marine') bird species (four 'Vulnerable', one 'Endangered');
 - One 'Migratory' terrestrial bird species;
 - Ten terrestrial mammals (seven 'Vulnerable' and three 'Endangered'). Terrestrial mammals included six ground-dwelling species, two microbats and two arboreal species; and
 - One 'Vulnerable' terrestrial reptile.

Details of terrestrial species identified is provided in **Appendix D** and marine species identified are reported in the *Marine Environment Report* (Cardno, 2022c).

2.2 Terrestrial Environmental Quality

The physical and aesthetics characteristics of the soils within the Project Study Area have been previously disturbed through land clearing and development of the existing civil infrastructure.

While the chemical composition of the soils has not been historically characterised, the non-industrial land uses and bitumen encapsulation of sub soils does not provide a basis for soil contamination. No areas within Project Study Area are listed on the NT EPA public register for contaminated land audits, pollution abandonment notices or reported incidents. It is not believed that the area has been previously audited, however.

North of the existing carpark, the Radio Australia shed facility has the potential to contain asbestos containing materials (ACMs) due to the popularity of asbestos in building materials at the time the building and infrastructure was constructed. This is discussed further in **Section 4.2**.

3 Information Gap Analysis

The desktop review identified data gaps regarding the terrestrial environmental quality, flora and fauna within the Project Study Area. Further field investigations were undertaken to provide the appropriate characterisation of these environmental values necessary for assessment of the Project's impacts on the terrestrial environment.

Although the site has been previously developed, the desktop review did not find historical land and soils data required to determine the contamination status of the existing Site and surrounds. Given the age of the existing Radio Australia building it was considered necessary to advance an asbestos asset survey for the site to determine the presence or absence of asbestos contamination within the Project Study Area.

Although the desktop review gathered datasets illustrating the spatial distribution of vegetation and habitat (**Figure 2-1**, **Figure 2-2**), data gaps regarding site-specific detail on the distribution of flora and fauna were identified. Further field investigations were therefore carried out to identify current flora assemblages and suitable habitat for faunal species of concern within the terrestrial portion of the Project's footprint.

The additional field investigations ensure the subsequent 'likelihood of occurrence' assessment for terrestrial fauna is informed by up to date observations of any suitable habitat and foraging sources which may be affected by the Project. Summary of the identified data gaps and required further investigations is provided in **Table 3-1**.

Table 3-1 Identified data gaps requiring additional investigation

Relevance	Identified data gap	Required further investigation
Terrestrial Environmental Quality	Lack of understanding of contamination status of existing building and surrounding area to be disturbed by project.	Asbestos and soil investigation in vicinity of building.
Terrestrial Flora	Lack of detailed understanding of flora present within the project site.	Field survey of vegetation and terrestrial habitat in the Project Site Study Area.
Terrestrial Fauna	Lack of understanding of habitat and foraging sources for terrestrial fauna at the project site, to inform likelihood of occurrence assessment.	As above including recording of incidental fauna and fauna habitat siting.

4 Field Investigations

4.1 Terrestrial Field Survey

4.1.1 Aims and Objectives

The results of the desktop assessment have been interpreted to determine the nature of field surveys for the project study area. The findings of the desktop investigations include:

- > Cleared land: Desktop searches indicate that the existing vegetation mapping at the terrestrial footprint portion of the proposed development consist of Cleared Land. Generally, Cleared Land has low biodiversity value for flora and fauna as sub-standard or no suitable resources would occur in highly disturbed lands;
- > Terrestrial fauna species: a total of eight terrestrial mammal species were predicted to occur within the 10 km locality. Given that the terrestrial footprint area is mapped as Cleared Land, it is predicted that limited suitable habitat will be present for those mammal species. A similar prediction would apply to the sole terrestrial reptile species (a snake) predicted to occur within the 10 km locality; and
- > Highly mobile fauna species: Most (but not all) of the fauna species predicted to occur within the 10 km locality are birds, mainly species associated with aquatic environments. Presence of roosting and/or nesting habitat will require confirmation with surveys. Given that the terrestrial footprint is mapped as Cleared Land, it is expected no or sub-standard habitat be present. Also, as these species are highly mobile, the possibility of the project not resulting in impacts, including significant impacts, on bird species is reasonable.

On the basis of these observations, the following terrestrial field survey objectives were derived:

- > Ground-truthing existing vegetation mapping applicable to areas within the Project footprint;
- > Identification of native vegetative zones, habitat condition, and fauna attributes (e.g. grass cover, tree hollows); and
- > Opportunistically collect flora and fauna records, including presence of threatened and introduced species.

4.1.2 Survey Area

The habitat survey covered the terrestrial footprint of the Project including a 10m buffer zone where no RWA's or physical restrictions existed. Survey locations are presented in **Figure 4-1**.

4.1.3 Sampling Methods

Terrestrial habitat surveys were undertaken in general accordance with the following guidelines:

- > Brocklehurst et. al. (2007) Northern Territory Guidelines and Field Methodology for Vegetation and Survey Mapping.

Field surveys consisted of the following:

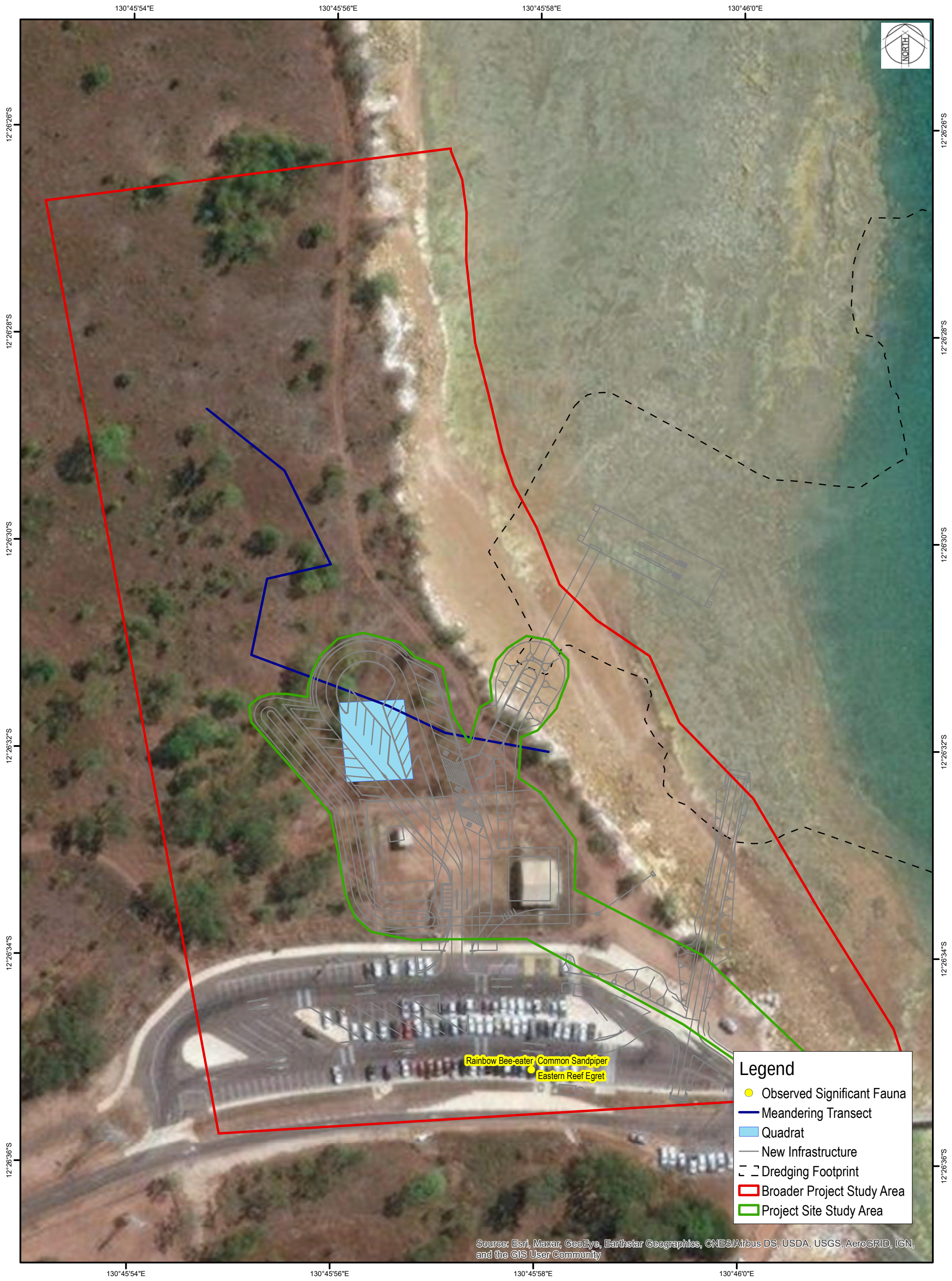
- > A random meander transect (RMT) across the terrestrial footprint of the proposed project. The aim of the RMT is to ground-truth existing vegetation mapping and identify native vegetation zones;
- > Where native vegetation was located, at least one 20m x 20m floristic plot was undertaken per vegetation type. In floristic plots relevant floristic information will be collected to identify definitive vegetation types (DVT) and its condition (where vegetation condition indicators are available). The flora survey data was recorded in accordance to the National Vegetation Information System (NVIS), including dominant growth form, percent cover, height and dominant genus and species of the three vegetation strata (i.e. upper, mid and ground); and
- > General fauna habitat assessment included identification of direct and indirect evidence of fauna habitat such as records of fauna, nests, burrows, scats, footprints, three hollows and other suitable evidence characteristic of Northern Territory native fauna.

4.1.4 Terrestrial Ecology

4.1.4.1 Flora

Vegetation communities have been assessed during the desktop review supplemented by field surveys in March 2020 which focused on ground-truthing existing vegetation mapping applicable to areas within the Project footprint. The proposed infrastructure location has been evaluated through habitat assessment which included identification of native vegetative zones, habitat condition, and fauna attributes (i.e. grass cover, tree hollows).

The area can be characterised as *Terminalia spp* open woodland providing for a mixed sparse shrubland understory and *Cenchrus spp* mixed low tussock grassland. The field investigations identified 18 native terrestrial floral species within the Project footprint. All species recorded during the field investigation are found in **Table 4-1**. It should be noted that the likelihood of encountering all species present in the study was reduced by a large density weed infestation at the time of the survey. This community is considered regionally widespread and would not experience extensive clearing as a result of the Project. A summary of the survey area is presented in **Table 4-2**.



Darwin, Northern Territory

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VEGETATION SURVEY AREA

MANDORAH MARINE FACILITIES
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FIGURE 3-1

Table 4-1 Native terrestrial floral species identified

Common name	Genus	Species
Kakadu/Billy-Goat Plum	<i>Terminalia</i>	<i>ferdinandiana</i>
Sand-binder	<i>Ipomea</i>	<i>pes-caprae</i>
Large-leaf Cabbage Gum	<i>Eucalyptus</i>	<i>grandifolia</i>
Darwin Woollybutt	<i>Eucalyptus</i>	<i>miniate</i>
Darwin Stringbark	<i>Eucalyptus</i>	<i>tetradonta</i>
Northern Black Wattle	<i>Acacia</i>	<i>aurculiformis</i>
Velvet Wattle	<i>Acacia</i>	<i>holosericea</i>
Green Plum	<i>Buchanania</i>	<i>obovata</i>
Jack/beach Bean	<i>Canavalia</i>	<i>rosea</i>
N/A (tussock grass)	<i>Cymbopogon</i>	<i>procerus</i>
Fig	<i>Ficus</i>	<i>scobina</i>
Whip Vine	<i>Flagellaria</i>	<i>indica</i>
Speargrass	<i>Heteropogon</i>	<i>contortus</i>
Current bush	<i>Ixora</i>	<i>klanderana</i>
Coffee bush	<i>Leucaena</i>	<i>leucocephala</i>
N/A (multi stemmed shrub)	<i>Trema</i>	<i>Tomentosa-aspera</i>
Cocky Apple	<i>Planchonia</i>	<i>careya</i>
N/A (coastal shrub)	<i>Premna</i>	<i>Serratifolia</i>

Table 4-2 Terrestrial condition of Project footprint

Site locality	Terrestrial footprint north of existing carpark	Habitat photos at central point of survey site (March 2020)	
Location	-12°26'32", 130°45'57"		
Landform and Soil			
Habitat type	Open woodland/forest, cleared land/dirt road		
Vegetation community	<i>Terminalia spp</i> mid-open woodland/mixed sparse shrubland/mixed low tussock grassland. This vegetation community is considered regionally extensive and not subjected to extensive clearing.		
Dominant flora species	<i>Terminalia ferdinandiana</i> and <i>Cenchrus spp.</i>		
Habitat condition	Weed grass species thick and dominant, cleared area for dirt track parallel to the cliff form.		
Weeds	<i>Cenchrus spp.</i> dominant at ground level in some areas		

4.1.4.2 Vegetation Mapping

The field investigations determined the vegetation mapping of DENR (2003) and NVIS (2007) was inaccurately classified or incomplete. DENR (2003) categorises the area north of the existing carpark as “Eucalypt woodland” while NVIS (2007) describes the area as open forest. However, field investigations found the area consisted of *Terminalia spp* mid-open woodland and cleared land including a dirt track seen in **Figure 4-2** and **Figure 4-4**.

4.1.4.3 Weeds

The field investigation recorded high densities of *Cenchrus spp* commonly known as mission grass throughout the study area. The weed infestation is categorised as large density, consisting of 15% seedlings, 20% juveniles and 65% adults.



Figure 4-2 Mission grass infestation within the project footprint

4.1.4.4 Fauna habitat

Terrestrial Habitats within the Project footprint can be placed in the following categories based on the resources available to fauna and their landscape: *Terminalia* woodland, coastal cliff and intertidal zone.

Terminalia Woodland

Terminalia spp mid-open woodland is the abundant native vegetation type throughout the terrestrial footprint of the project. The *Terminalia spp* woodland wasn't found to be providing habitat for any species listed under the TPWC Act.

Field surveys did not record tree hollows, consistent leaf litter or stags within the habitat unit. One bird's nest was observed; however, no birds were observed during the survey. These habitat resources provide habitat for an array of species including reptiles, birds, bats and arboreal mammals. The lack of debris which provides habitat for ground dwelling animals can be explained by fires which occur in the area yearly.

Coastal Cliff

The low-lying cliffs which run from the existing boat ramp and jetty past the northern point of the proposed carpark and breakwater are formed by sedimentary rock commonly known as Porcelainite which has been naturally eroded, largely by wave action from the ocean. The previously mentioned *Cenchrus spp* infestation

prevailed close to the edge of the cliff where few *casurina*, *eucalypt* and *terminalia* species were observed along the narrow cliff edge, no nest or signs or foraging were observed along the cliff edge. An example of the coastal cliff habitat within the footprint is shown in **Figure 4-3**.

Intertidal Zone

The intertidal zone of the Project footprint consists of coastal sandflats, fringing reef and saline claypans. **Figure 4-3** shows the intertidal zone captured during terrestrial habitat surveys. The intertidal zone did not contain mangrove forests which may provide habitat for migratory species listed under the EPBC Act as likely to occur within the 10 km locality, including the Saltwater Crocodile (*Crocodylus porosus*), Black Butcher Bird (*Cracticus quoyi*), Red-Headed Honey Eater (*Myzomela erythrocephala*), White-Bellied Sea Eagle (*Haliaeetus leucogaster*), Eastern Osprey (*Pandion haliaetus*) and Eastern Reef Egret (*Ardea sarca*).



Figure 4-3 Coastal cliff and intertidal zone

Cleared Land

Areas of cleared land were observed during terrestrial surveys including the Radio Australia fenced property north of the existing carpark and a dirt track running parallel to the cliff form. **Figure 4-4** shows land cleared for an existing property and track which connects the existing carpark to Wagait Beach approximately 500m to the north.



Figure 4-4 Track and existing property north of existing carpark

4.2 Asbestos Assessment

Cardno conducted a hazardous material survey and assessment of the fenced property north of the existing carpark in order to confirm the location, condition and risk presented by any asbestos containing materials (ACMs) within the existing building structure and its surrounds including the preliminary assessment of the nature and extent of ACM soil contamination. Methodologies and findings of the survey are detailed separately in an asbestos asset survey report provided in **Appendix A**.

Summary of the survey and risk assessment's findings include the following:

- > No ACMs were assumed or identified within the Radio Australia shed facility during this investigation;
- > Cement board fragments of ACM were found on soil surfaces closely surrounding the Radio Australia shed facility. Following assessment of these ACMs they were found to have medium potential to release asbestos fibres however were removed from the site negating their posed risk;
- > Pipe gaskets located north of the Radio Australia were confirmed and/or assumed to be ACM and remain in situ on site. Assessment of these ACMs found they have very low potential to release asbestos fibres; and
- > The presence of ACM soils within the sub surface remains unknown and would require further intrusive soil investigation to confirm, prior to, or as part of, earthworks and civil construction.

4.3 Acid Sulfate Soils

The proposed area to be cleared is a well-drained, previously disturbed area classed 'Main roads' the risk of exposing Acid Sulfate Soils was determined to be low, prior to any ground disturbance CRS soil testing will be conducted at an appropriate site density and to a soil depth immediately below the proposed disturbance. In the unlikely event that they are uncovered then an Acid Sulfate Soil management plan will be developed by the contractor in accordance with the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et.al, 2014).

5 Conclusions and Project Implications

5.1 Terrestrial Fauna Likelihood of Occurrence

A likelihood of occurrence assessment has been undertaken for terrestrial fauna ‘species of concern’, incorporating the outcomes of database searches and findings of the site investigation. Species of concern are defined as:

- > Threatened species with potential to occur in the Study Area;
- > Migratory species with potential to occur in the Study Area; and
- > Other listed species with potential to occur in the Study Area.

Table 5-1 Likelihood of occurrence criteria for species of concern for the project

Likelihood of Occurrence	Criteria
Unlikely	Species that fit into one or more of the following criteria: - Species highly restricted to certain geographical areas not overlapping the Study Area. - Species that have specific habitat requirements that are not present in the Study Area.
Low	Species that fit into one or more of the following criteria: - Have not been recorded previously in the Study Area and for which the Study Area is beyond the current distribution range. - Use specific habitats or resources not present in the Project Area.
Moderate	Species that fit one or more of the following criteria: - Have infrequently been recorded previously in the Study Area. - Use specific habitats or resources present in the Project Area, but in a poor or modified condition. - Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically or during migration.
High	Species that fit one or more of the following criteria: - Have frequently been recorded previously in the Study Area. - Use habitat types or resources that are present in the Project Area, that are abundant and/or in good condition. - Are known to, or likely to, maintain resident populations surrounding the Project Area. - Are known to, or likely to, visit the Project Area during regular seasonal movements or migration.

The species that require specific environmental risk assessment for the project are those that have been listed by the EPBC Act or TPWC Act and have moderate to high likelihood of occurring in the study area. **Table 5-2** outlines these species, their listed status and the justification for their likelihood assignment. Note that several bird species meeting these criteria have been listed as marine fauna (due to being listed as ‘Marine’ by the EPBC Act) in the *Marine Environment Report* (Cardno, 2022c). The full likelihood assessment table is provided as **Appendix D**.

Table 5-2 Terrestrial species of concern with moderate to high likelihood of occurrence in the study area

Scientific name	Common name	EPBC Act	TPWC Act	Likelihood of occurrence in Study Area	Justification
Birds					
<i>Cuculus optatus</i> (M)	Oriental Cuckoo	-	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project

					Area, but in a poor or modified condition. Previously recorded in Study Area.
<i>Erythrotriorchis radiatus</i> (T)	Red Goshawk	V	V	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Erythrura gouldiae</i> (T)	Gouldian Finch	E	E	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Falco hypoleucos</i> (T)	Grey Falcon	VU	VU	Moderate	Species or species habitat likely to occur within Study Area. Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically.
<i>Geophaps smithii smithii</i> (T)	Partridge Pigeon (eastern)	VU	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Tyto novaehollandiae kimberli</i> (T)	Masked Owl (northern)	VU	VU	Moderate	Species or species habitat likely to occur within Study Area. Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically.
Mammals					
<i>Antechinus bellus</i> (T)	Fawn Antechinus	VU	EN	Moderate	Species or species habitat likely to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Conilurus penicillatus</i> (T)	Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma	VU	EN	Moderate	Species or species habitat may occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Dasyurus hallucatus</i> (T)	Northern Quoll [Dambimangari], Wiminji [Martu]	E	C	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.

<i>Mesembriomys gouldii</i> (T)	Black-footed Tree-rat, Djintamoonga, Manbul	EN	VU	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.
<i>Trichosurus vulpecula arnhemensis</i> (T)	Northern Brushtail Possum	V	E	Moderate	Species or species habitat known to occur in Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.

Key:

C = Critically endangered, DD = Data deficient, E = Endangered, LC = Least concern, N = Near Threatened, V = Vulnerable, EPBC Act: M = Migratory, T = Threatened

5.2 Summary of Findings

Following a desktop review of available information, supplemented by terrestrial field surveys the following findings have been made for the project area:

- > Vegetative communities within the terrestrial footprint portion of the proposed development consists of cleared land and relatively sparse natural vegetation and are, therefore, expected to have relatively low biodiversity value for flora and fauna;
- > Listed fauna species with 'moderate' likelihood of occurrence at the project site are predominantly birds. With the exception of one birds' nest, no presence of roosting and/or nesting habitat was observed during field surveys; and
- > A total of five terrestrial mammal species are considered to have 'moderate' likelihood of occurrence at the project site. There are very few or no historical records of these mammals at the site. No mammals, reptiles or evidence of recent occurrence was observed during field surveys, which is likely associated with the proportion of cleared/degraded land and human activity in the area.

5.3 Potential Impacts

Project activities that have the potential to impact on the *Terrestrial Environmental Quality* and *Terrestrial Ecosystems* environmental factors (EP Act) are detailed below. The potential impacts and environmental values at risk have been further assessed in the *Environmental Referral Report* (Cardno, 2022a), including an EPBC Act 'self-assessment' of MNES (primarily relating to listed fauna).

5.3.1 Direct Loss of Vegetation / Habitat

Clearing and earthworks will be required through site preparation activities and will result in the direct loss of terrestrial vegetation communities and therefore fauna habitat associated with *Terminalia spp* open woodland, mixed sparse shrubland understory and *Cenchrus spp* mixed low tussock grassland.

The vegetation communities to be impacted are not considered to be *Threatened Ecological Communities* or *Priority Ecological Communities* and are relatively small compared with the distribution of vegetation communities mapped outside of the Project Study Area during desktop investigations. In addition, no evidence of nesting or foraging was observed during field surveys to suggest fauna of conservation significance were currently, or recently, inhabiting the immediate area.

5.3.2 Loss of Vegetation / Habitat Outside of the Project Footprint

Several indirect pathways to vegetation and habitat loss are evident during civil construction and development such as accidental clearing and fires originating from hot work activities, overheating machinery and smoking.

Their occurrence is mitigated through the implementation of the Construction Environmental Management Plan (CEMP).

5.3.3 Degradation of Vegetation / Habitat Communities

The potential deterioration of vegetation health through smothering caused by increased dust, the diversion of surface water, altering of hydrological regimes causing drainage shadow effects and accidental toxic effects caused by leaks and spills. Again, their occurrence would be mitigated through the implementation of the CEMP.

5.3.4 Introduction and Spread of Weeds

Clearing and earthworks involving the moving of machinery and importation of foreign fill material have the potential to promote the dispersion of weeds and/or their propagules. *Cenchrus spp* (mission grass) identified within the terrestrial footprint of the Project during this investigation is a Declared Weed under the *Northern Territory Weeds Management Act 2001* and has the potential to further impact native flora through increased rates of competition for light, nutrients, water and space.

5.3.5 Direct Loss and/or Injury to Fauna

Direct loss of, or injury to fauna may occur as a result of clearing and earthworks, fire arising from hot work or overheating of vehicles or machinery and vehicle strikes (physical interaction). The accidental ingestion of solid or liquid waste, chemicals or fuels may also lead to illness or death of individual fauna. In all cases the impact is likely to be localised and restricted to individuals only, thereby not threatening species at the population level. Fauna with limited mobility, including reptiles and small mammals and marsupials, are most susceptible to being injured or killed by clearing or earth-moving machinery during construction.

5.3.6 Changes in Fauna Behaviour

The physical presence of infrastructure, noise emissions, light spill, and vehicular and human traffic associated with construction and operation activities may modify typical fauna behaviour. Such aspects may displace fauna from habitat within the vicinity of the Project activities, resulting in a local decrease in fauna abundance.

Displaced fauna are likely to relocate to other areas of similar habitat as the habitats associated within the Project Study Area are well represented in the Cox Peninsula Hedland area and are not of conservation significance. The larger and more mobile fauna such as mammals, reptiles, bats and birds will move into the adjacent habitat. The smaller, less mobile species such as skinks, geckoes and frogs, are less likely to move and local loss is expected.

Light emissions may cause behavioural changes in localised terrestrial populations. Light sources may attract insect predators such as birds and bats through the attraction and concentration of insects in localised well-lit areas. It is considered unlikely that the project will affect the conservation status of any fauna species

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APPENDIX

A

ASBESTOS ASSET SURVEY

Asbestos Asset Survey

Mandorah New Marine Facilities

DZ1910



Prepared for
Department of Infrastructure, Planning and
Logistics

1 November 2021

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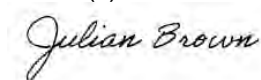
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Rev 0.1	27/10/2021	Draft	JB	MH
Rev 1.0	1/11/2021	Client Revision	JB	MH

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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1 Introduction

Cardno was engaged by The Department of Infrastructure, Planning and Logistics (DIPL) to conduct an Asbestos Asset Survey regarding the below structures and surfaces associated with the future Mandorah Marina Facilities found at Sec 50, Picnic Point, Northern Territory:

- > Radio Australia shed facility
- > Ground surfaces surrounding the shed facility including water tank stand and laydown area

The environmental investigation, by way of an Asbestos Asset Survey (the assessment), was undertaken by Cardno on 22 September 2021 to assess the potential presence of asbestos containing materials ACMs within the existing building structure and preliminarily assess the nature and extent of ACM soil contamination.

1.1 Objectives

The purpose of this survey is to locate, as far as reasonably practicable, the presence, type and extent of any suspect ACMs at the site subject to the limitations detailed in **Section 1.2**, and to provide a suitable risk assessment and recommended control actions based on the condition of the materials at the time of the survey.

1.2 Limitations

The survey attempted to locate all ACM at the site, however, only physically accessible materials could be located, and materials could only be assessed without impacting on the functionality and integrity of the infrastructure/asset. Therefore, it is possible that materials which may be concealed within inaccessible areas / voids, or are contained within operational electrical or mechanical equipment, may not have been located during the survey. Such concealed and / or inaccessible areas may fall into a number of categories:

1. Inside all piping, infrastructure or cavities.
2. Electrical switch boards (locked at the time of inspection).
3. Those areas accessible only by dismantling equipment, performing minor local demolition works or disturbing live electrical control or transmission equipment, or entering restricted high voltage enclosures. The second small building falls into this category and was not accessed during the survey. The door was labelled with a Caution Warning sign for asbestos seen in **Photo 12**
4. Service shafts, ducts etc. concealed within the asset structure or internal areas of plant or equipment or beneath hardstand.
5. Totally inaccessible areas such as voids and cavities created and intimately concealed within the asset structure. These voids may only be accessible during upgrade works.
6. In soils below the surface.

Cardno derived the data in this summary report from visual inspections and risk assessment. Data and information. Information obtained from visual inspections is only representative of the ACM conditions at that time and should not be inferred to represent ACM condition at some point in the past or future.

The assessment findings provided in this summary report are based on site conditions unique to the project, and legislation and guidelines that existed at the time the assessment was conducted and the report prepared.

Cardno shall not be liable for the contents of this summary report where the Client has failed to consider the entirety of this summary report and/or where the report recommendations are implemented by consultants other than Cardno. In the above circumstances, the Client relies on this report at their own risk.

Cardno disclaims any responsibility for claims or damages arising out of the Client's use of this summary report for anything other than the purposes given in the summary report. Cardno accepts no responsibility to third parties to whom this summary report or any part of this report is made known whether or not such disclosure is authorised. All third parties rely on this report at their own risk.

No inspection can be guaranteed to locate all asbestos or ACM in a specific location. The assessment cannot be regarded as absolute, without extensive invasion of structures. Future refurbishment, renovation

or demolition of site structures / assets may expose situations which were concealed or otherwise impractical to access during this assessment.

The Client must not rely on an inspection or report as indicating that a site or an asset is “asbestos free”. All that the report can be relied upon to show is that no asbestos was found (or that only such asbestos was found as was reported to be found) in the course of the inspection.

2 Site Description

The survey was conducted at Sec 50, Picnic Point, Northern Territory (the site) on 22/09/2021. For the purpose of this report the carpark and Charles Point Road is taken to run east-west, directly adjacent to the site. A locality map is provided below in **Figure 2-1**.

Through field observations and information provided by DIPL, Cardno understands the following information about the building and site:

- > Two building structures exist on the site in addition to old water tower structures and associated pipework.
- > The large existing shed was originally built for Radio Australia in the late 1960's / early 1970's
- > The building is a steel and timber framed shed with external aluminium cladding and a concrete floor.
- > The large Radio Australia shed was unused at the time of survey.

A Site Plan is presented in **Appendix AB** and may be referred to for locations described in this report.

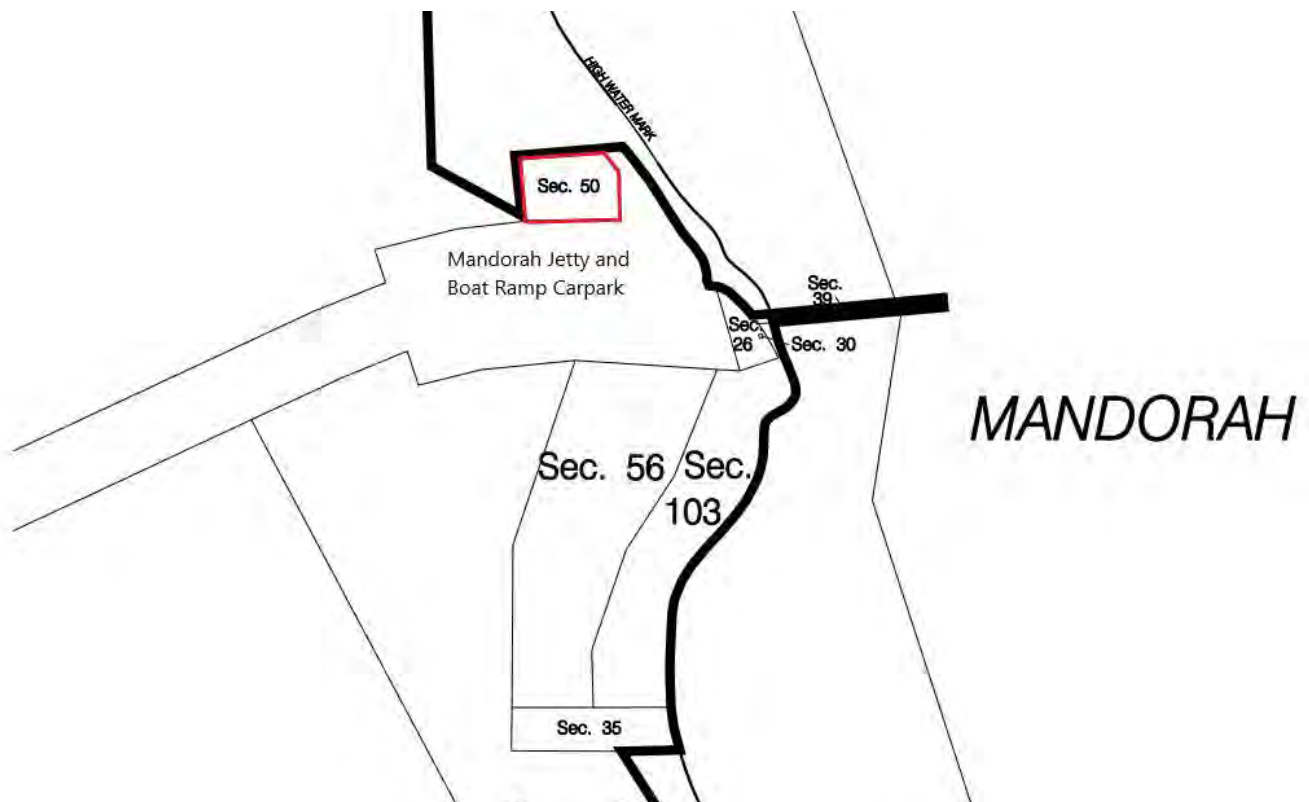


Figure 2-1 Locality Map – Sec 50 highlighted in red

3 Scope of works

3.1 Asbestos Asset Survey

The survey consisted of a visual inspection of onsite structures, assets and ground surfaces with sampling of materials undertaken by a trained and experienced surveyor. Analysis of materials was carried out by NATA certified laboratories. Materials are assumed to contain asbestos where:

- > Laboratory analysis has confirmed the presence of asbestos in a visually similar material; or
- > Materials visually appear to be asbestos containing but no sample was collected, for example due to access restraints.

Samples were typically collected using a hand tools or collected by hand ensuring appropriate PPE. Where non-friable asbestos debris/fragments were found below 10 m² and where appropriate (i.e. the extent and severity of impact is suitably limited), hand picking 'Emu Bob' of ACM was conducted to remove the identified risk and provide appropriate delineation.

Suspected ACM identified during the visual inspection were removed and submitted for asbestos analysis by means of Phase Contrast Microscopy (PCM) at a NATA accredited laboratory. A total of four (4) samples were collected and submitted for analysis as part of this survey. No other assumed ACMs were collected and disposed of during the survey.

3.2 Exclusions

Certain areas of the site were inaccessible at the time of the inspection. This includes areas/materials that were inaccessible due to being 'live electrical' equipment. Table 1 lists those areas/materials that were inaccessible.

Table 3-1 Inaccessible Areas and Materials

Location	Explanation
Plant Room – North West Corner of Sec 50	Building was not accessed under client advice it would remain and has an existing asbestos register (Photos 11, 12 Appendix AC)
Pipework at the height of old water tower structure.	Unsafe height and structural integrity of the tower unknown (Photo 24, Appendix AC)

In addition, unless noted specifically the survey did not cover:

- > Wall/ceiling panelling behind laminations/coverings;
- > Concealed floor coverings beneath carpet or superficial floor coverings;
- > Fuses within 'live' electrical panelling. Older fuses may contain asbestos containing flashguards.
- > Hidden and/or inaccessible locations such as in or under concrete slabs, in or under vinyl/linoleum/carpet, wall cavities, hidden storage areas or similar.
- > Lift wells and inaccessible/unidentified shafts, cavities and the like.
- > Subsurface areas e.g. asbestos in fill/soil.
- > Materials dumped, hidden, or otherwise placed in locations which one could not reasonably anticipate.

Materials other than asbestos are generally outside the scope as identification can require specialised analysis/inspection techniques.

Settled dust is generally not sampled or commented on. Settled dust may contain asbestos, particularly if it is in the vicinity of ACMs or areas where ACMs have been removed during past maintenance or construction work

3.3 ACM Assessment Criteria

3.3.1 Material Assessment

A Material Assessment of each ACM identified during the survey is undertaken to assess the potential for asbestos fibres to release from an ACM.

The key parameters which determine the of fibre released from an ACM when subject to disturbance are:

- > The type of product;
- > Level of deterioration / extent of damage;
- > Asbestos type; and
- > Surface treatment (if any)

Each of these principle parameters is scored between 0 and 3 before being added together to provide a Material Assessment Rating between 2 and 12. A low Material Assessment Rating indicates a low potential for fibre release with a high rating indicating a high potential for fibre release. Non-asbestos containing materials have not been scored. The Material Assessment Scoresheet used during the survey is provided in **Table 3-2**.

Table 3-2 Material Assessment Scoresheet

Sample	Example	Score
Product Type (or debris from product)	Asbestos reinforced composite (plastic, resins, mastics, roofing felts, vinyl floor tiles, semi-rigid paints or decorative finishes, asbestos cement etc.)	1
	Asbestos insulation board, mill boards, other low density insulation boards, asbestos textiles, gaskets, ropes and woven textiles, asbestos paper and felt.	2
	Thermal insulation (e.g. pipe and boiler lagging), sprayed asbestos, loose asbestos, asbestos mattresses and packing.	3
Extent of damage/deterioration	Good conditions: no visible damage.	0
	Low damage: a few scratches or surface marks, broken edges on boards, tiles etc.	1
	Medium Damage: significant breakage of materials or several small areas where material has been damaged revealing loose asbestos fibres.	2
	High damage or delamination of materials, sprays and thermal insulation. Visible asbestos debris.	3
Surface Treatment	Composite Materials containing asbestos, reinforced plastics, vinyl floor tiles, mastic/caulking, resins/	0
	Enclosed sprays and lagging, asbestos insulating board (with exposed face painted or encapsulated), asbestos cement sheets/	1
	Unsealed asbestos insulating board, or encapsulated lagging and sprays/	2
	Unsealed lagging and sprays.	3
Asbestos Types	Chrysolite	1
	Amphibole asbestos excluding crocidolite	2
	Crocidolite	3

3.3.2 Risk Assessment Rating

Following the positive or assumptive identification of an ACM and the completion of the Material Assessment (**Section 3.3.1**), a Risk Assessment Rating detailed in **Table 3-3** is completed for each item. The Risk Assessment Rating informs control measures or required remedial actions; induction and training; air monitoring; and health surveillance requirements. It also assists in the prioritisation of implementing these management actions.

The Risk Assessment Rating categories are described as 'High', 'Medium', 'Low', or 'Very low' and have been assigned to each positive or assumptive identification of ACMs during the survey. A 'High' Risk Assessment Rating indicates a material that will more readily release airborne fibres if disturbed.

Table 3-3 Risk Assessment Based on Material Assessment Score

Material Assessment Score	Potential to Release Asbestos Fibres
10 or more	High
7-9	Medium
5-6	Low
4 or less	Very Low

3.3.3 ACM Classification

ACMs are classified as friable or non-friable in accordance with the *Work Health and Safety Regulations 2011*. Cardno has classified all identified ACMs noted during this survey as friable or nonfriable in accordance with the criteria set out in the Regulations (**Section 4**). This will assist the Client with the on-going management of ACMs and any necessary abatement works.

Generally, asbestos abatement works require a license issued by a regulator. The requirement for an asbestos licence to undertake asbestos abatement works are as follows:

- > Class A (or friable) licence is required for works involving:
 - Friable asbestos;
 - Asbestos contaminated dust associated with the removal of friable asbestos.
- > Class B license (or bonded) (or Class A (or friable)) licence is required for works involving:
 - More than 10m² of non-friable asbestos;
 - Asbestos contaminated dust associated with the removal of more than 10m² of non-friable asbestos.
- > No license is required for works involving:
 - Up to 10m² of non-friable asbestos;
 - Asbestos contaminated dust:
 - That is associated with the removal of up to 10m² of non-friable asbestos.
 - That is not associated with the removal of friable/non-friable asbestos and is only a 'minor contamination'

3.4 Control Actions

Based on the observations and on site judgement during the survey in addition to the Risk Assessment Rating for each identified/assumed ACM noted on site, recommended Control Measures as detailed in have been applied to each occurrence in the Asbestos Containing Materials Register in **Section 4**.

Table 3-4 Recommended Control Measures

Control Reference	Action
C1	Manage in-situ
C2	Incorporate into a current / develop an Asbestos Management Plan
C3	Label as asbestos containing in accordance with Australian Standard 1319-1994 Safety Signs for the Occupational Environment
C4	Re-inspect conditions every 5 years or sooner if deemed necessary in accordance with the <i>Work Health and Safety Regulations 2011 & Code of Practice How to Manage and Control Asbestos in the Workplace</i> , Safe Work Australia (2018)
C5	Consider further sampling/analysis to establish whether asbestos is present within the material
C6	Consider further sampling/analysis to establish whether asbestos is present within the associated dust

Control Reference	Action
C7	Consider further sampling/analysis to establish whether asbestos is present within the sub-soil
C8	Seal damaged edges with an appropriate sealant such as Emerclad paint
C9	Encapsulate/enclose in accordance with the <i>Work Health and Safety Regulations 2011 & Code of Practice How to Manage and Control Asbestos in the Workplace</i> , Safe Work Australia (2018)
C10	Seal-off area and erect appropriate warning signage in accordance with Australian Standard 1319- 1994 Safety Signs for the Occupational Environment
C11	Undertake a suitable and sufficient Risk Assessment prior to access, which may include the use of appropriate PPE & RPE
C12	Restrict access to maintenance/service personnel
C13	Restrict access to all personnel
C14	Remove in accordance with the <i>Work Health and Safety Regulations 2011 & Code of Practice How to Manage and Control Asbestos in the Workplace</i> , Safe Work Australia (2018). Including but not limited to preworks in the area that may disturb the material.
C15	Undertake a dust sampling regime within the area in accordance with the <i>Work Health and Safety Regulations 2011 & Code of Practice How to Manage and Control Asbestos in the Workplace</i> , Safe Work Australia (2018)
C16	Undertake airborne fibre monitoring within the area in accordance with <i>Work Health and Safety Regulations 2011, Code of Practice How to Manage and Control Asbestos in the Workplace</i> Safe Work Australia (2016) & <i>Code of Practice How to Manage and Control Asbestos in the Workplace</i> , Safe Work Australia (2018)

4 Asbestos Containing Material Register

The below table is a register of all identified ACMs on site on 22/09/2021 (subject to the aforementioned limitations), confirmed through visual inspection, laboratory analysis and/or assumed to be consistent in manufactured appearance to other samples analysed. This register should be read in conjunction with all other components of this report including the appended site plan and photo log.

Table 4-1 Sec 50 ACM Register

Item location / Plan reference	Sample ID / Assumed	Photo Number	Friable / Non-friable	Product type	Extent of damage	Surface Treatment	Asbestos Type / NATA Test Results	Risk Assessment Score (Material + Risk rating)	Recommended Control Actions
South perimeter of existing shed / 2-3D	M-AS1	Photos 14 and 15	Non-friable	Cement board fragment (2)	Loose broken fragment on the ground (3)	Unsealed FCS (1)	All types detected (3) / Positive Test	9 ~ Medium Potential to release asbestos fibres	C7
South-east corner of Radio Australia shed / C5	M-AS2	Photos 16, 17 and 18	Non-friable	Cement board fragment (2)	Loose broken fragment on the ground (3)	Unsealed FCS (1)	All types detected (3) / Positive Test	9 ~ Medium Potential to release asbestos fibres	C7
Northern perimeter of Radio Australia shed / 2A	M-AS3	Photos 19, 20 and 21	Non-friable	Cement board fragment (2)	Loose broken fragment on the ground (3)	Unsealed FCS (1)	All types detected (3) / Positive Test	9 ~ Medium Potential to release asbestos fibres	C7
External pipework north of Radio Australia shed / WATER TANK SLAB	M-AS4	Photos 22 and 23	Non-friable	Pipe Gasket	Low damage (1)	Sealed gasket (1)	Chrysotile (1) / Positive Test	3 ~ Very low potential to release asbestos fibres	C2, C3, C8, C11, C14
External pipework north of Radio Australia shed / WATER TANK SLAB	Assumed. Same pipework installation as M-AS4	Photo 24	Non-friable	Pipe Gasket	Low damage (1)	Sealed gasket (1)	Chrysotile (1) / Assumed Positive	3 ~ Very low potential to release asbestos fibres	C2, C3, C8, C11, C14

Notes: FCS=Fibre Cement Sheetting

4.1 Laboratory Sample Analysis

Asbestos sample analysis results are detailed in **Table 4-2** below. Laboratory analysis certificates are provided in **Appendix AD**.

Table 4-2 ACM Laboratory Analysis Results

Sample ID	Sample Description	Result
M-AS1	Approximate Sample 67g / 120 x 45 x 15mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected
M-AS2	Approximate Sample 12g / 50 x 15 x 10mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected
M-AS3	Approximate Sample 26g / 50 x 40 x 10mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected
M-AS4	Approximate Sample <1g / 10 x 10 x 5mm Sample consisted of: Fibrous material	Chrysotile asbestos detected.

5 Conclusions and Recommendations

5.1 Summary of Findings

Cardno were commissioned to conduct a hazardous material survey and assessment of Sec 50, Picnic Point, Northern Territory in order to confirm the location, condition and risk presented by ACMs within the existing building structure. The extent of the inspection (subject to limitations stated in Section 1.2) also serves to preliminarily assess the nature and extent of ACM soil contamination at Sec 50. Within the Scope and Limitations of the survey and subsequent risk assessment the following was concluded:

- > No ACMs were assumed or identified within the Radio Australia shed facility during this investigation;
- > Cement board fragments of ACM were found on soil surfaces closely surrounding the Radio Australia shed facility. Following assessment of these ACMs they were found to have medium potential to release asbestos fibres however were removed from the site negating their posed risk.
- > Pipe gaskets located north of the Radio Australia were confirmed and/or assumed to be ACM and remain in situ on site. Assessment of these ACMs found they have very low potential to release asbestos fibres.
- > The presence of ACM soils with in the sub surface remains unknown and would require further intrusive soil investigation to confirm their presence or absence.

5.2 Recommendations

Following completion of necessary on-site investigation and sample analysis, there are further detailed site and/or work-specific precautions that must be included in the management, control and removal of ACMs. In addition to those included in the ACM Register (Section 4), the following recommendations and precautions should be considered:

- > This document should be held as an Asbestos Register of the Radio Australia shed inspected and subsequently updated when reassessment of risk is required. (i.e. when future works create disturbance and previously unknown ACMs are identified);
- > If during future disturbance of material that may contain asbestos is identified on site then expert advice should be sought and the material assumed to be ACM until confirmed by laboratory analysis;
- > In accordance with the *Work Health and Safety Regulations 2011*, any works conducted requiring the control of asbestos and ACMs in the place of work, or in plant at the place of work, should be recorded in this register. (Details should be recorded in the Asbestos Control Log provided in **Appendix AA**);
- > Removal of ACMs identified during this survey which remain on site should only be removed by a licenced asbestos removalist. If asbestos materials become significantly damaged and/or produce visible dust and debris, then HSEQ management systems are expected to be required in line with *Work Health and Safety Regulations 2011*
- > Prior to excavation works on site the sub soil of Sec 50 should be characterised by way of an asbestos in soil investigation to determine the presence/absence of ACM in soils by a suitably qualified consultancy to ensure the safety of construction and maintenance personnel.

APPENDIX

AA

ACM CONTROL LOG

ASBESTOS MATERIALS CONTROL LOG

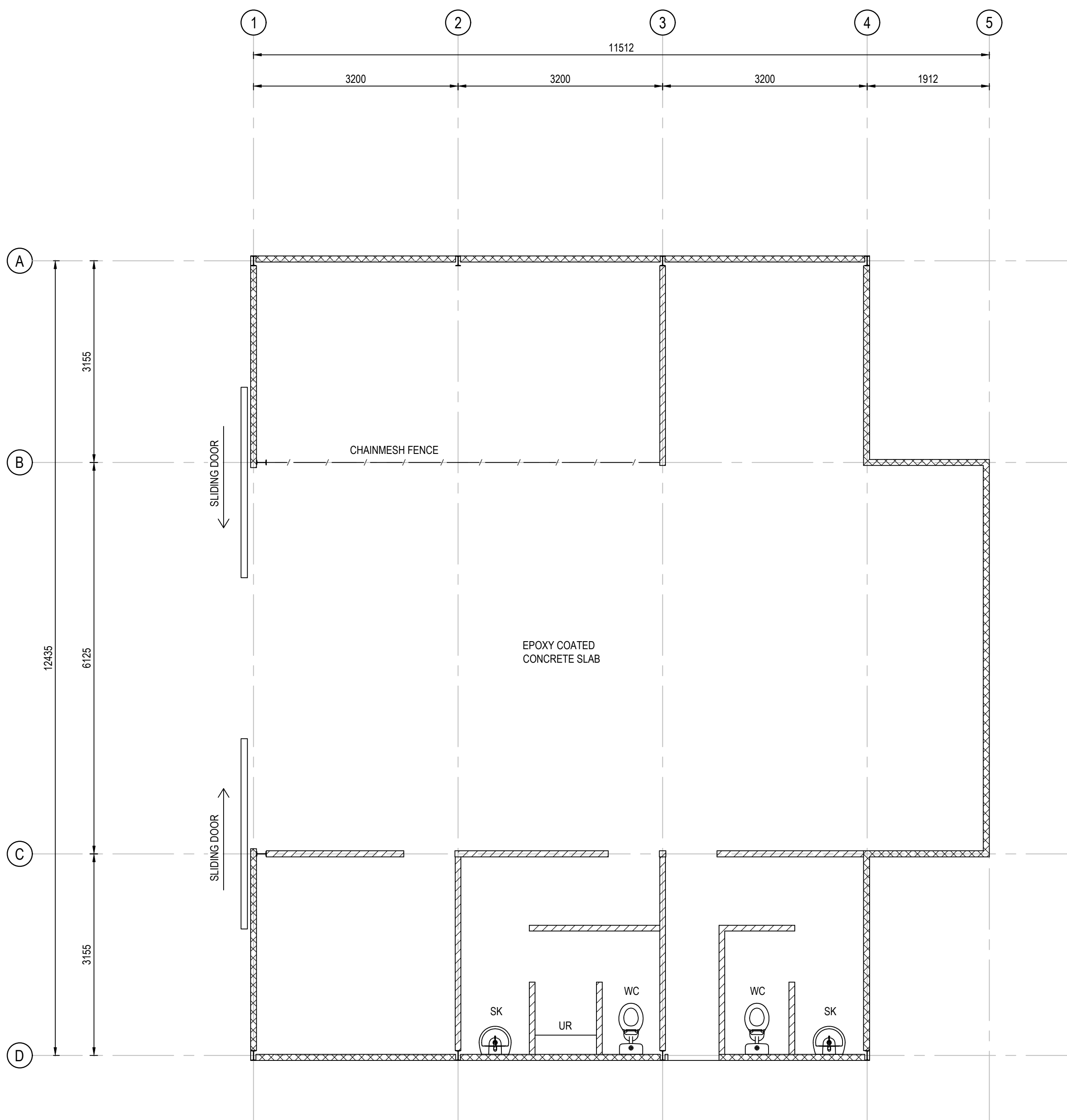
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Mandorah New Marine Facilities

APPENDIX

AB

SITE PLAN



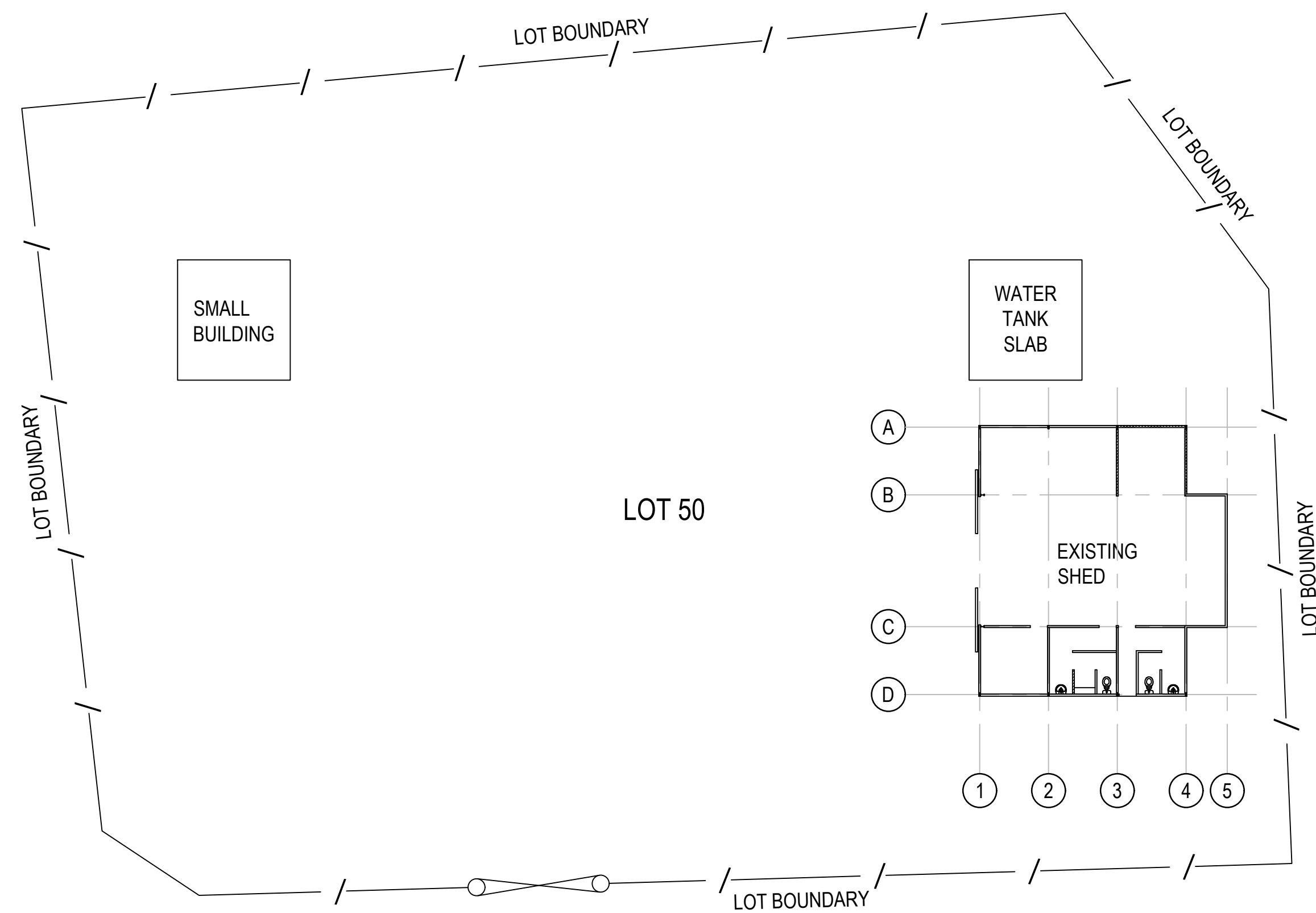
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SCALE 1:50

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Drawn SL	Date AUG. '21	Client DIPL			
Checked	Date	Project MANDORAH JETTY EXISTING SHED	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES		
Designed	Date				
Verified	Date		Scale AS SHOWN	Size A1	
Approved			Drawing Number DZ1910-EN-SK02	Revision -	
		Title PLAN			



SITE PLAN
SCALE APPROX. 1:200

=					
Rev.	Date	Description	Des.	Verif.	Appd.

Drawn	Date
SL	AUG. '2
Checked	Date
Designed	Date
Verified	Date
Approved	

Title	SITE PLAN
-------	-----------

		Scale AS SHOWN	Size A1
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DZ1910-EN-SK01

Revision

Mandorah New Marine Facilities

APPENDIX

AC

PHOTO LOG



Photo 1 Southern Wall of Radio Australia shed building



Photo 2 Eastern wall of Radio Australia shed building



Photo 3 Eastern wall of Radio Australia shed building



Photo 4 Entrance to/western wall of Radio Australia shed building



Photo 5 Steel framed latticed framed truss



Photo 6 HW purlins, bolted truss top chord



Photo 7 HW internal studs wall framing



Photo 8 HW studs wall framing, sisalation



Photo 9 HW external studs wall framing



Photo 10 Typical HW internal wall framing



Photo 11 Existing SMALL BUILDING found north west corner of the site



Photo 12 Existing SMALL BUILDING, asbestos caution



Photo 13 Southern external wall



Photo 14 Southern external wall, ACM fragment marked in pink



Photo 15 Southern external wall, ACM fragment marked in pink Sample M-AS1



Photo 16 South eastern corner, external wall, ACM fragment marked in pink



Photo 17 South eastern corner, external wall, ACM fragment marked in pink



Photo 18 South eastern corner, external wall, ACM fragment marked in pink



Photo 19 Northern perimeter, external wall, ACM fragment marked in pink



Photo 20 Northern perimeter, external wall, ACM fragment marked in pink



Photo 21 Northern perimeter, external wall, ACM fragment marked in pink



Photo 22 Water tank slab, north of RA shed, ACM pipe gaskets marked in pink



Photo 23 Water tank slab, north of RA shed, ACM pipe gaskets marked in pink



Photo 24 Water tank tower, north of RA shed, assumed ACM pipe gaskets

Mandorah New Marine Facilities

APPENDIX

AD

LABORATORY RESULTS

Cardno NT
93 Mitchell Street, Level 6
Darwin
NT 0800



NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025—Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention: Julian Brown
Report 826791-AID
Project Name **MONDARAH**
Project ID **DZ1910**
Received Date Sep 22, 2021
Date Reported Sep 27, 2021

Methodology:

Asbestos Fibre
 Identification

Conducted in accordance with the Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples and in-house Method LTM-ASB-8020 by polarised light microscopy (PLM) and dispersion staining (DS) techniques.

NOTE: Positive Trace Analysis results indicate the sample contains detectable respirable fibres.

Unknown Mineral
 Fibres

Mineral fibres of unknown type, as determined by PLM with DS, may require another analytical technique, such as Electron Microscopy, to confirm unequivocal identity.

NOTE: While Actinolite, Anthophyllite and Tremolite asbestos may be detected by PLM with DS, due to variability in the optical properties of these materials, AS4964 requires that these are reported as UMF unless confirmed by an independent technique.

Subsampling Soil
 Samples

The whole sample submitted is first dried and then passed through a 10mm sieve followed by a 2mm sieve. All fibrous matter greater than 10mm, greater than 2mm as well as the material passing through the 2mm sieve are retained and analysed for the presence of asbestos. If the sub 2mm fraction is greater than approximately 30 to 60g then a sub-sampling routine based on ISO 3082:2009(E) is employed.

NOTE: Depending on the nature and size of the soil sample, the sub-2 mm residue material may need to be sub-sampled for trace analysis, in accordance with AS 4964-2004.

Bonded asbestos-
 containing material
 (ACM)

The material is first examined and any fibres isolated for identification by PLM and DS. Where required, interfering matrices may be removed by disintegration using a range of heat, chemical or physical treatments, possibly in combination. The resultant material is then further examined in accordance with AS 4964 - 2004.

NOTE: Even after disintegration it may be difficult to detect the presence of asbestos in some asbestos-containing bulk materials using PLM and DS. This is due to the low grade or small length or diameter of the asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials. Vinyl/asbestos floor tiles, some asbestos-containing sealants and mastics, asbestos-containing epoxy resins and some ore samples are examples of these types of material, which are difficult to analyse.

Limit of Reporting

The performance limitation of the AS 4964 (2004) method for non-homogeneous samples is around 0.1 g/kg (equivalent to 0.01% (w/w)). Where no asbestos is found by PLM and DS, including Trace Analysis, this is considered to be at the nominal reporting limit of 0.01% (w/w).

The NEPM screening level of 0.001% (w/w) is intended as an on-site determination, not a laboratory Limit of Reporting (LOR), per se. Examination of a large sample size (e.g. 500 mL) may improve the likelihood of detecting asbestos, particularly AF, to aid assessment against the NEPM criteria. Gravimetric determinations to this level of accuracy are outside of AS 4964 and hence NATA Accreditation does not cover the performance of this service (non-NATA results shown with an asterisk).

NOTE: NATA News March 2014, p.7, states in relation to AS 4964: "This is a qualitative method with a nominal reporting limit of 0.01 % " and that currently in Australia "there is no validated method available for the quantification of asbestos". This report is consistent with the analytical procedures and reporting recommendations in the NEPM and the WA DoH.

Project Name MONDARAH
Project ID DZ1910
Date Sampled Sep 22, 2021
Report 826791-AID

Client Sample ID	Eurofins Sample No.	Date Sampled	Sample Description	Result
M-AS1	21-Se46360	Sep 22, 2021	Approximate Sample 67g / 120 x 45 x 15mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected.
M-AS2	21-Se46361	Sep 22, 2021	Approximate Sample 12g / 50 x 15 x 10mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected.
M-AS3	21-Se46362	Sep 22, 2021	Approximate Sample 26g / 50 x 40 x 10mm Sample consisted of: Cement board	Chrysotile, amosite and crocidolite asbestos detected.
M-AS4	21-Se46363	Sep 22, 2021	Approximate Sample <1g / 10 x 10 x 5mm Sample consisted of: Fibrous material	Chrysotile asbestos detected.

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Asbestos - LTM-ASB-8020	Melbourne	Sep 23, 2021	Indefinite

Company Name:	Cardno NT	Order No.:		Received:	Sep 22, 2021 12:15 PM
Address:	93 Mitchell Street, Level 6 Darwin NT 0800	Report #:	826791	Due:	Sep 30, 2021
Project Name:	MONDARAH	Phone:	8 8942 8200	Priority:	5 Day
Project ID:	DZ1910	Fax:		Contact Name:	Julian Brown
Eurofins Analytical Services Manager : Michael Morrison					

Sample Detail						Asbestos Absence / Presence
Melbourne Laboratory - NATA # 1261 Site # 1254						X
Sydney Laboratory - NATA # 1261 Site # 18217						
Brisbane Laboratory - NATA # 1261 Site # 20794						
Mayfield Laboratory - NATA # 1261 Site # 25079						
Perth Laboratory - NATA # 2377 Site # 2370						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	M-AS1	Sep 22, 2021		Building Materials	M21-Se46360	X
2	M-AS2	Sep 22, 2021		Building Materials	M21-Se46361	X
3	M-AS3	Sep 22, 2021		Building Materials	M21-Se46362	X
4	M-AS4	Sep 22, 2021		Building Materials	M21-Se46363	X
Test Counts						4

Internal Quality Control Review and Glossary

General

1. QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Samples were analysed on an 'as received' basis.
4. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
5. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Units

% w/w: weight for weight basis	grams per kilogram
Filter loading:	fibres/100 graticule areas
Reported Concentration:	fibres/mL
Flowrate:	L/min

Terms

Dry	Sample is dried by heating prior to analysis
LOR	Limit of Reporting
COC	Chain of Custody
SRA	Sample Receipt Advice
ISO	International Standards Organisation
AS	Australian Standards
WA DOH	Reference document for the NEPM. Government of Western Australia, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009), including supporting document Recommended Procedures for Laboratory Analysis of Asbestos in Soil (2011)
NEPM	National Environment Protection (Assessment of Site Contamination) Measure, 2013 (as amended)
ACM	Asbestos Containing Materials. Asbestos contained within a non-asbestos matrix, typically presented in bonded and/or sound condition. For the purposes of the NEPM, ACM is generally restricted to those materials that do not pass a 7mm x 7mm sieve.
AF	Asbestos Fines. Asbestos containing materials, including friable, weathered and bonded materials, able to pass a 7mm x 7mm sieve. Considered under the NEPM as equivalent to "non-bonded / friable".
FA	Fibrous Asbestos. Asbestos containing materials in a friable and/or severely weathered condition. For the purposes of the NEPM, FA is generally restricted to those materials that do not pass a 7mm x 7mm sieve.
Friable	Asbestos-containing materials of any size that may be broken or crumbled by hand pressure. For the purposes of the NEPM, this includes both AF and FA. It is outside of the laboratory's remit to assess degree of friability.
Trace Analysis	Analytical procedure used to detect the presence of respirable fibres in the matrix.

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	N/A
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N/A	Not applicable

Asbestos Counter/Identifier:

Sheha Prakash Senior Analyst-Asbestos (VIC)

Authorised by:

Emily Daos Senior Analyst-Asbestos (VIC)



Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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APPENDIX

B

DATABASE SEARCH RECORDS

Darwin Harbour

Location and Description

Darwin Harbour is a large indented embayment with three main arms – East, Middle and West. Two major rivers, the Elizabeth and Darwin Rivers drain into the Harbour and the city of Darwin is located on the north-eastern shore. The shoreline is dominated by mangroves, which largely remain in undisturbed condition and the Site contains more than 5% of the Northern Territory's entire mangrove area. Darwin Harbour has one of the richest coastal environments anywhere in the Asia Pacific region, and occurs within one of the world's least impacted marine regions. The coastal and mangrove environments are backed by savanna woodlands and patches of monsoon rainforest.

Tenure and Land Use

The Darwin Harbour Site, especially its west and south-west portions, is predominantly vacant Crown land. The remainder is mostly freehold land associated with the cities of Darwin and Palmerston. The land uses within the Site are many and varied - the freehold portions support a mix of commercial, residential and industrial land uses. The Harbour has port facilities and supports tourism, recreation and aquaculture. Approximately 3% of the Site is managed as conservation reserves.

Significance Rating

International Significance

Ecological Values

Darwin Harbour supports a range of estuarine, freshwater and terrestrial environments including extensive areas of tidal mudflats and one of the largest and most diverse areas of mangroves in the Northern Territory. The mangroves of Darwin Harbour support a highly specialised fauna and 14 bird species that are entirely restricted to mangrove environments (e.g. Chestnut Rail, White-breasted Whistler and Mangrove Golden Whistler). The Harbour itself supports a diverse range of marine species including dugongs, dolphins, marine turtles and a large variety of fish. A total of 15 threatened species are reported from within the Site.

Management Issues

Future urban and industrial developments around Darwin Harbour represent a major management issue for this Site. The north-eastern part of Darwin Harbour catchment is already highly developed and native vegetation and tidal flats have been cleared and drained. Further major industrial developments around Middle Arm are currently



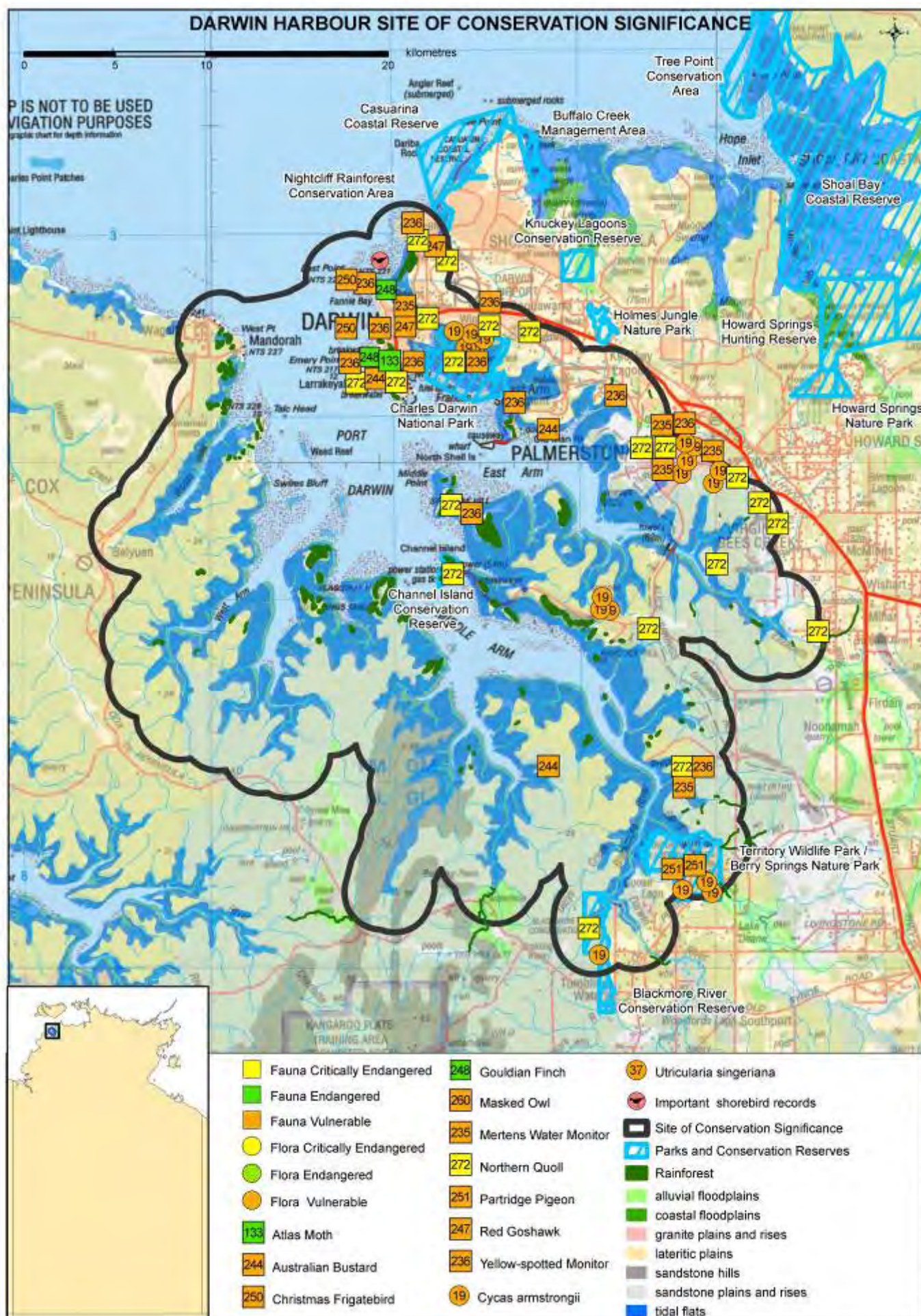
being considered. Water pollution from run-off and industry and sea-level rise will also potentially affect the Harbour environment.

Condition

In comparison with marine areas near other major cities, Darwin Harbour is in good condition. However, a range of human activities do impact on the marine and coastal environments and these are likely to intensify in future years.

Current Conservation Initiatives

A regional plan of management has been developed for Darwin Harbour and its catchment area, and priority actions are being implemented. Ecosystem monitoring and research groups have been established to direct strategic research and co-ordinate monitoring activities within the Harbour.



DARWIN HARBOUR - SITE OF CONSERVATION SIGNIFICANCE

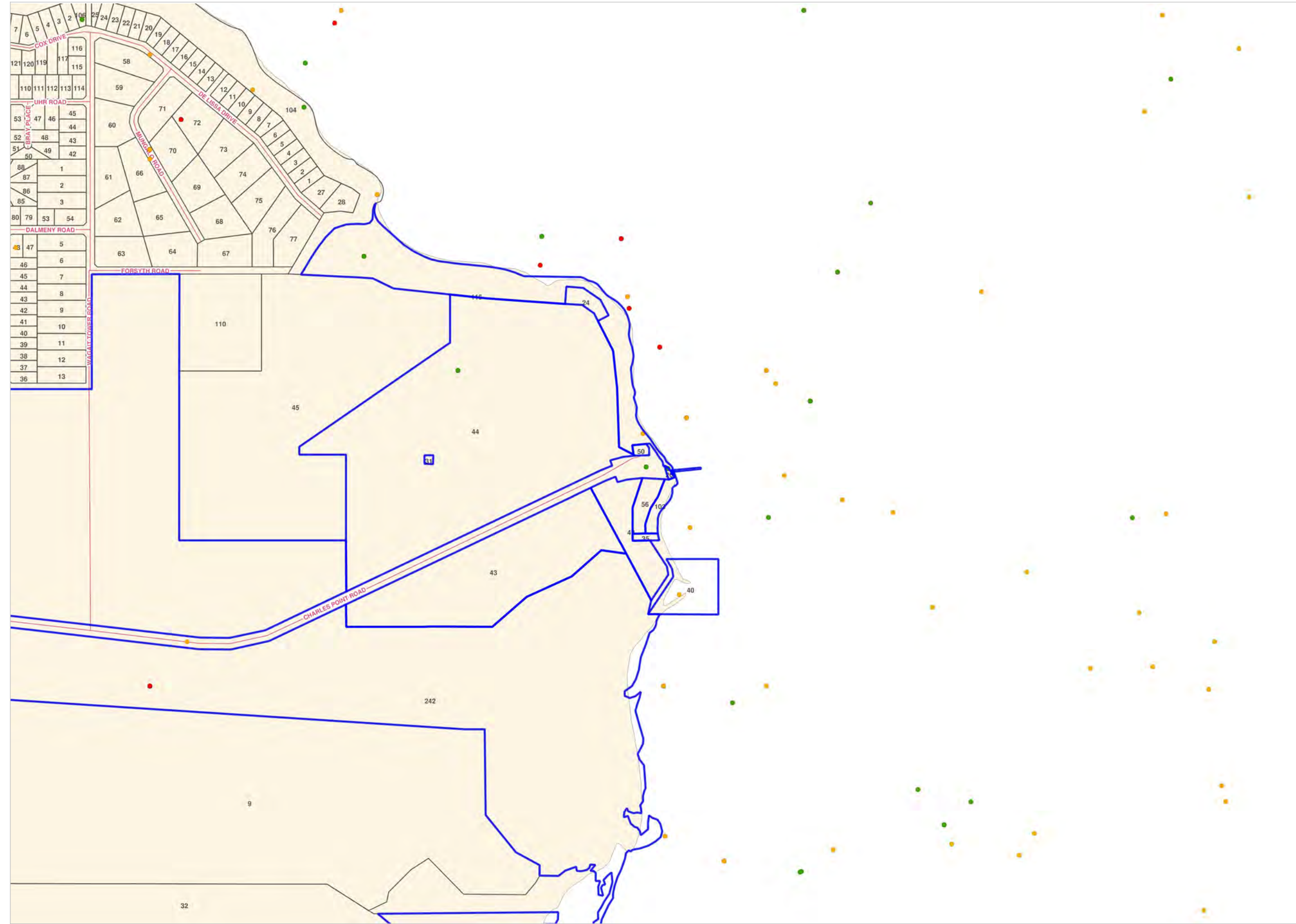
LOCATION	SOCS Number	6 (NT Parks and Conservation Masterplan Map Number 12)
	Latitude/Longitude	12° 34' South, 130° 52' East (at centre)
	Bioregion	Darwin Coastal (98%), Pine Creek (2%)
	Description	The site includes the tidal flats (222 km²) within the Harbour from East Point around to West Point (including the major sub-embayments of East Arm, Middle Arm, West Arm, Woods Inlet, Frances Bay and Fannie Bay) and a buffering terrestrial area (527 km²). Sub-tidal waters of the Harbour are not included in this assessment. The rivers that flow into the Harbour (including the Darwin, Blackmore and Elizabeth Rivers and Berry Creek) have small catchments and lack the large floodplains and freshwater wetlands that characterise many other coastal areas around the Top End. Much of the area behind the extensive tidal flats in this site is high ground forested with woodland rather than wetlands (Darwin Harbour Advisory Committee 2003). The extensive tidal flats associated with nearby Shoal Bay and the sand sheets of the Howard River are also recognised as sites of high conservation significance in the NT.
THREATENED SPECIES	Significance Rating	International Significance
	Threatened plants and animals (Listings at National/NT level CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near Threatened, LC - Least Concern, DD - Data Deficient)	15 threatened species are reported from this site. Plants ▪ <i>Cycas armstrongii</i> (-/VU) ▪ <i>Utricularia singeriana</i> (-/VU) Vertebrates ▪ Australian Bustard <i>Ardeotis australis</i> (-/VU) ▪ Christmas Frigatebird <i>Fregata andrewsi</i> (VU/-) ▪ Gouldian Finch <i>Erythrura gouldiae</i> (EN/EN) ▪ Masked Owl <i>Tyto novaehollandiae kimberlii</i> (VU/VU) ▪ Partridge Pigeon <i>Geophaps smithii</i> (VU/VU) ▪ Red Goshawk <i>Erythrotriorchis radiatus</i> (VU/VU) ▪ Northern Quoll <i>Dasyurus hallucatus</i> (EN/CR) ▪ Merten's Water Monitor <i>Varanus mertensi</i> (-/VU) ▪ Yellow-spotted Monitor <i>Varanus panoptes</i> (-/VU) ▪ Flatback Turtle <i>Natator depressus</i> (VU/DD) ▪ Green Turtle <i>Chelonia mydas</i> (VU/LC) ▪ Hawksbill Turtle <i>Eretmochelys imbricata</i> (VU/-) Invertebrates ▪ Atlas Moth <i>Attacus wardi</i> (-/EN) There are only historic records of <i>Utricularia singeriana</i> and the Atlas Moth from this site, and suitable habitat may no longer be present.
ENDEMIC SPECIES	Significance Rating	Not Significant
	Notes	Endemic to the bioregion: One vertebrate (<i>Ramphotyphlops noma</i>) and two plant species (<i>Spermacoce phalloides</i>, <i>Typhonium praetermissum</i>) recorded in this site are NT endemics and are only known from the Darwin Coastal bioregion. Endemic to the NT: 77 plant and 12 vertebrate species recorded in the site are only known from the NT. Other: 12 plant and one vertebrate species (Lewin's Rail) are only known from the site or the Darwin Coastal bioregion within the NT, but are also found in other states. There is a collection of records of vagrant bird species from Darwin Harbour/Shoal Bay that have not been recorded elsewhere in the NT.
WILDLIFE AGGREGATIONS	Significance Rating	Not Significant
	Marine turtles	Flatback, Hawksbill, and Green Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.
	Seabirds	Significant aggregations of seabirds are not known from this site (Chatto 2001).
	Waterbirds	This site lacks a large area of freshwater wetland and supports relatively low numbers of waterbirds (Chatto 2006).
	Shorebirds	Although large areas of mudflats occur around Darwin Harbour during periods of low tide, high numbers of shorebirds have not been recorded. The highest count is 3000 individuals in 1994 (Chatto 2003).
	Other aggregations	None known
WETLANDS	Significance Rating	National Significance
	Ramsar criteria met	Not assessed
	DIWA criteria met	Darwin Harbour is listed as a wetland of national significance in the Directory of Important Wetlands in Australia (DIWA: NT029 Port Darwin). The site meets criteria 1, 2, 3, 4, 5, 6 and includes wetland types: A1, A2, A3, A6, A7, and A9.
	Notes	Darwin Harbour is a good example of a shallow branching embayment of the Top End Region, supporting one of the largest discrete areas of mangrove swamp in the NT (DIWA). Within the Darwin Harbour catchment there are series of ponding systems (Dambos) that may play an important role in filtering organic material before it is delivered to the harbour. Many of these are not included within the current boundary of the site (R. Wasson, Charles Darwin University, pers. comm.).

DARWIN HARBOUR - SITE OF CONSERVATION SIGNIFICANCE

	Rivers	The Darwin, Blackmore and Elizabeth Rivers and Berry Creek flow into Darwin Harbour. All are relatively small Top End rivers.
FLORA	Significance Rating	National Significance
	Notes	Rainforest: About 1150 ha of mostly dry rainforest (or 0.4% of the NT rainforest estate) occur as small patches around the margin of the tidal flats in this site. One patch is >100 ha but most patches are small (<10 ha) (Russell-Smith 1991). Large areas of rainforest or vine-thicket habitat occur within the Harbour on peninsulas or 'hinterland islands' such as Blaydin Point, Wickham Point, Flagstaff Hill and Kings Table. Fire-sensitive vine-thicket communities have become particularly well developed in these habitats due to the protection offered by the surrounding mangroves, which unlike savannah woodlands, do not burn. Other: Mangroves fringe the whole embayment of Darwin Harbour and comprise one of the largest (~20 400 ha) and most floristically diverse (~41 species) areas of mangroves in the NT (Duke 2006). Mangrove communities within the Harbour have been identified and mapped by Brocklehurst and Edmeades (1996).
OTHER ENVIRONMENTAL VALUES		The mangroves of Darwin Harbour support a highly specialised fauna including over 306 invertebrate species and 112 species of mammals, bats and birds (Metcalf 2007). Mangroves in north-western Australia support distinctive fauna and more mangrove-endemic bird species than any other region in the world (Noske 1996). Some of the highly specialised bird species that occur in Darwin Harbour include the Mangrove Gerygone, Mangrove Robin, Mangrove Golden Whistler and Chestnut Rail. A group of colubrid snakes including the White-bellied Mangrove Snake <i>Fordonia leucobalia</i>, are also part of the distinctive mangrove fauna found in Darwin Harbour, and compliments the wider, but poorly-known, community of sea-snakes in the area (Whiting 2003). In terms of faunal diversity, Darwin Harbour is one of the richest mangrove systems in the Indo-west Pacific region. Each of the eight different floristic assemblages defined in Darwin Harbour mangroves (Brocklehurst and Edmeades 1996) supports a distinctive faunal community. In particular, the most seaward assemblage, with <i>Sonneratia alba</i> dominant, is an exceptionally productive mangrove community with the highest primary productivity (Metcalf 1999) and faunal diversity and abundance of any assemblage in the harbour (Metcalf 2007). Eight sites around Darwin Harbour are listed on the Register of the National Estate for their natural values including: Berry Springs Nature Park, Darwin Foreshores, <i>Pachystoma pubescens</i> Sites 1 and 2, Channel Island Reefs, Imaluk Creek Area, Southport Area, and the Darwin Harbour Wetlands (Australian Heritage Council). 80 species recorded from this site are listed under international conventions or bilateral agreements protecting migratory animals. Dugongs are common in the Harbour (Whiting 2004). The marine areas within this site are likely to encompass other significant biodiversity values and these are currently being explored and collated in a project by the Marine Biodiversity Group of NRETAS (K. Edyvane, NRETAS, pers. comm.).
MANAGEMENT ISSUES		Fire: The current fire regime in the Darwin region differs from that in other sparsely populated savanna areas of the NT and is ad hoc and closely linked to tenure (Price and Baker 2007). The frequency of late dry season fires is lower in the Darwin region than other areas (Price and Baker 2007), but exotic grasses are increasing fuel loads and the intensity of fires (Kean and Price 2003). In the period 1993-2004, 43% of the site was burnt in fewer than three years, and 24% was burnt in more than six years. Feral animals: Feral cat, dog, rat, pig and Cane Toad are present in the site. Marine pest incursions remain a concern given the proximity of Darwin Harbour to Asia (Smit 2003). Weeds: Four Weeds of National Significance (<i>Lantana camara</i>, <i>Mimosa pigra</i>, <i>Salvinia molesta</i>, <i>Parkinsonia aculeata</i>), 25 declared Category A and B weeds and 12 other undeclared but problematic environmental weeds (high priority weeds: Smith 2001) are recorded from this site. The aquatic weed <i>Cabomba caroliniana</i> is reported from Darwin River (Smith 2002). Other: The north-eastern part of Darwin Harbour catchment is highly developed and native vegetation and tidal flats have been cleared and drained. With the current rapid growth of the city of Darwin, further pressure is likely to come from future recreational, residential and industrial developments within the Harbour (Wightman 2006). Major industrial developments around Middle Arm are currently being considered. Nutrient enrichment from sewerage discharge and storm water run-off may affect mangrove communities in the Harbour (Dames and Moore 1984 in Wightman 2006). Despite having a macrotidal range of 7.8 m, the waters of Darwin Harbour are not particularly well flushed and recent research and modelling indicates that pollution may circulate within the upper reaches of the Harbour for considerable periods (Williams, 2006). Pollution and increased turbidity (e.g. from dredging) associated with future developments within the Harbour, may therefore affect water quality and the biodiversity values. The potential rise in sea level predicted in response to global climate change may affect mangrove communities in Darwin Harbour, especially in areas where coastal developments exclude the landward retreat of coastal ecosystems. Although mangroves are generally well adapted to the dynamic conditions at the land-sea interface, recovery from severe disturbance (e.g. storms, cyclones, clear-felling) may be very slow (Metcalf, 2007). Indeed, severely damaged mangroves may take several decades to recover and such delayed recovery times increase their vulnerability to disturbance (McGuinness 1992).

DARWIN HARBOUR - SITE OF CONSERVATION SIGNIFICANCE

MANAGEMENT INFORMATION	NRM groups	Belyuen Land Management Group (Belyuen), Larrakia Rangers (Darwin) (Northern Land Council 2006).
	Protected areas	Blackmore River Conservation Reserve (4 km ² / 0.6% of site), Channel Island Conservation Reserve (1 km ² / 0.1% of site), Charles Darwin National Park (10 km ² / 1% of site), Territory Wildlife Park/Berry Springs Nature Park (11 km ² / 1% of site).
	Current management plans	Site-specific plans: Charles Darwin National Park Plan of Management (PWCNT undated); Darwin Harbour Regional Plan of Management (Darwin Harbour Advisory Committee 2003). National recovery plans for threatened species: marine turtles (Environment Australia 2003); Northern Quoll (Hill and Ward in prep.); Partridge Pigeon and Masked Owl (Woinarski 2004a), Gouldian Finch (O'Malley 2006); Red Goshawk (Baker-Gabb in prep.). Other management plans: Australian Weeds Strategy (NRMMC 2007); Threat Abatement Plan for Predation by Feral Cats (Environment Australia, 1999); Threat Abatement Plan for Predation, habitat degradation, competition and disease transmission by feral pigs (DEH 2005); FIREPLAN: Fire management for the savanna community (Russell-Smith <i>et al.</i> in prep.).
	Monitoring programs and research projects	Fire in the tropical savannas is mapped continuously under the North Australia Fire Information Project http://www.firenorth.org.au/nafi/app/init.jsp Numerous programs and sites exist for monitoring water quality and ecological condition within the Darwin Harbour catchment area and a summary of them is reported by the Darwin Harbour Advisory Committee (2005). Fauna and vegetation are monitored at permanent sites in NT parks within the Darwin region including the Territory Wildlife Park and Charles Darwin National Park (Calnan <i>et al.</i> 2008). Populations of the rare ground orchid <i>Nervilia peltata</i> (D. Liddle, NRETAS unpubl.) and <i>Cycas armstrongii</i> (Liddle 2004) are monitored under different fire regimes at permanent plots in Charles Darwin National Park. There is an ongoing program of monitoring and removal of Saltwater Crocodiles from within Darwin Harbour and Shoal Bay (Nichols and Letnic in press). Dolphins are surveyed monthly along transects within Darwin Harbour and Shoal Bay (C. Palmer, NRETAS unpubl.). Research on the biodiversity of mangrove habitats in Darwin Harbour involving surveys of vertebrate and invertebrate fauna in disturbed and undisturbed mangroves was conducted from 1999-2002 (Metcalf 2007). The methodology developed has since been applied for mangrove monitoring purposes. A two year study of primary productivity within the eight different mangrove assemblages was conducted at eight sites in the three arms of Darwin Harbour from 1997-1999 (Metcalf 1999). Monitoring of mangrove productivity was continued for a 3rd year by DIPE. Recommended methodology for monitoring of flora and soils in mangrove habitats of Darwin Harbour was developed by DIPE (Moritz-Zimmern <i>et al.</i> 2002), developed further in a research framework (Comley 2002) and later applied at the Darwin LNG plant (McHugh 2004). Commercial mangrove monitoring programs for aquaculture developments in Darwin Harbour including Wild River and Tiger International subsequently adopted this monitoring methodology for impact assessment purposes. Research on the distribution and role of Dambo wetland systems in the Darwin Harbour catchment (R. Wasson, Charles Darwin University, pers. comm.). Research on the use of mangrove habitats by fish in Darwin Harbour was conducted from 1998 to 2001 including development of a trophic model for the harbour (Martin 2004). As part of the Environmental Management Plan for the Darwin LNG Plant, Conoco Phillips established in 2002 a mangrove monitoring program at Wickham Point with matched control sites in Darwin Harbour. The monitoring program has provided over 6 years of valuable baseline data on mangrove flora and invertebrate fauna (URS 2003; Metcalfe 2005; 2006).
KEY REFERENCES	Management recommendations	Continue to implement the Darwin Harbour Regional Plan of Management (NRETA 2005). Develop a fire management strategy for the Darwin region that identifies clear objectives, roles and responsibilities (Price and Baker 2007). Prevent the spread of exotic grasses, especially mission grasses and gamba grass, into new areas in the Darwin region and reduce populations in areas with high conservation value or where fires threaten properties (Kean and Price 2003). Assess the data for Darwin Harbour against Ramsar criteria and consider listing as a wetland of international significance (S. Blanch, Environment Centre NT, pers. comm.). Consider expanding the boundary of the site to the catchment boundary to incorporate Dambo wetland systems (R. Wasson, Charles Darwin University, pers. comm.).
	Papers and reports	Darwin Harbour Advisory Committee (2003). <i>Darwin Harbour Regional Plan of Management</i>. Department of Infrastructure, Planning and Environment, Darwin. Darwin Harbour Advisory Committee (2005). <i>A Review of Environmental Monitoring of the Darwin Harbour Region and Recommendations for Integrated Monitoring</i>. Darwin Harbour Advisory Committee, Darwin. DIWA (A Directory of Important Wetlands in Australia). <i>Australian Wetlands Database</i>. Department of Environment, Water, Heritage & the Arts, Canberra ACT (accessed November 2007). Metcalf, K. (2007). <i>The biological diversity, recovery from disturbance and rehabilitation of mangroves in Darwin Harbour</i>. PhD thesis. Charles Darwin University, Darwin.
	Contributors	Kristin Metcalfe, Consultant Environmental Scientist, Darwin



Legend

- Threatened Fauna
- Significant Fauna
- Native Fauna
- Introduced Fauna
- Waterbird Colonies (STATUS)
 - Unknown
 - Low
 - Regionally High
 - National
- Seabird Colonies (STATUS)
 - Unknown
 - Low
 - Regionally High
 - National
 - International



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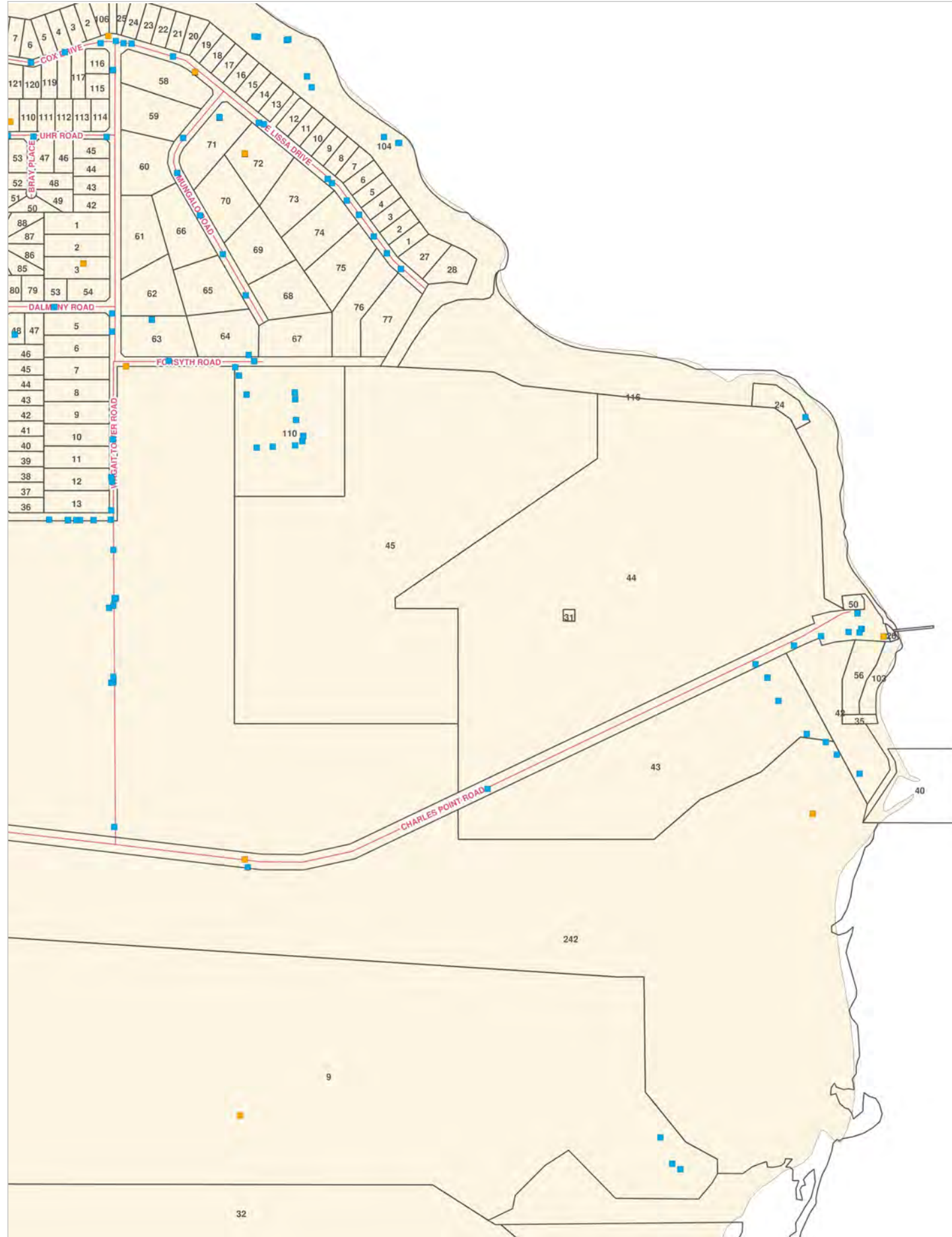
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Legend

- Threatened Flora
- Restricted Range Flora
- Significant Flora
- Native Flora
- Introduced Flora

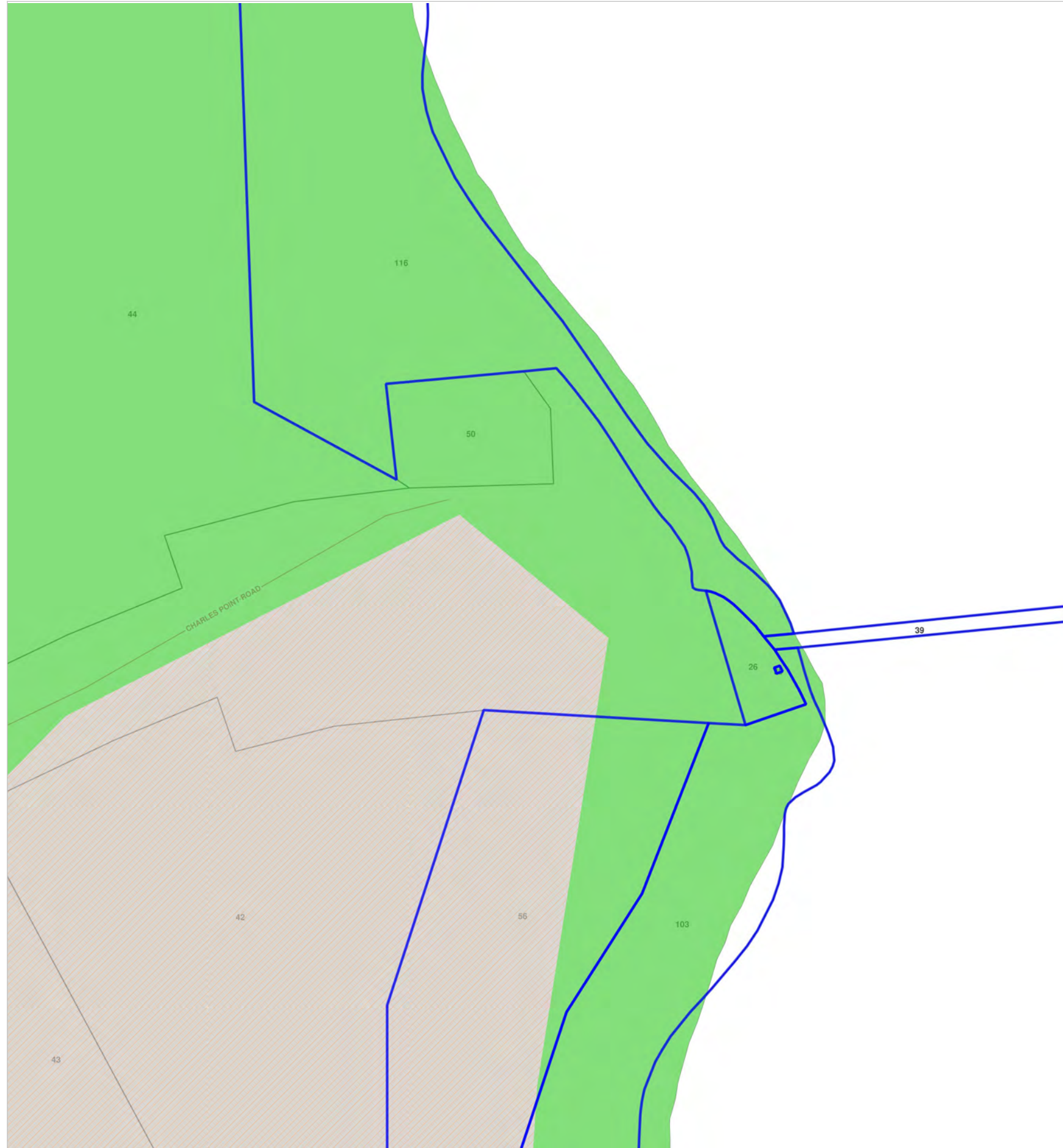


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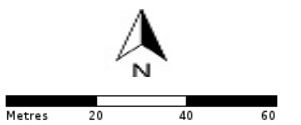
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Legend

- NVIS 2007 Level 2
- Closed forest
 - Mid closed forest
 - Open forest
 - Woodland
 - Open woodland
 - Open shrubland
 - Sparse shrubland
 - Open palmland
 - Closed tussock grassland
 - Tussock grassland
 - Open tussock grassland
 - Sparse tussock grassland
 - Hummock grassland
 - Open hummock grassland
 - Forbland
 - Sparse samphire shrubland
 - Inland salt lake
 - Pastoral/Horticulture/roads
 - Plantations/roads
 - Rural/Residential/roads
 - Urban/Roads
 - Unknown



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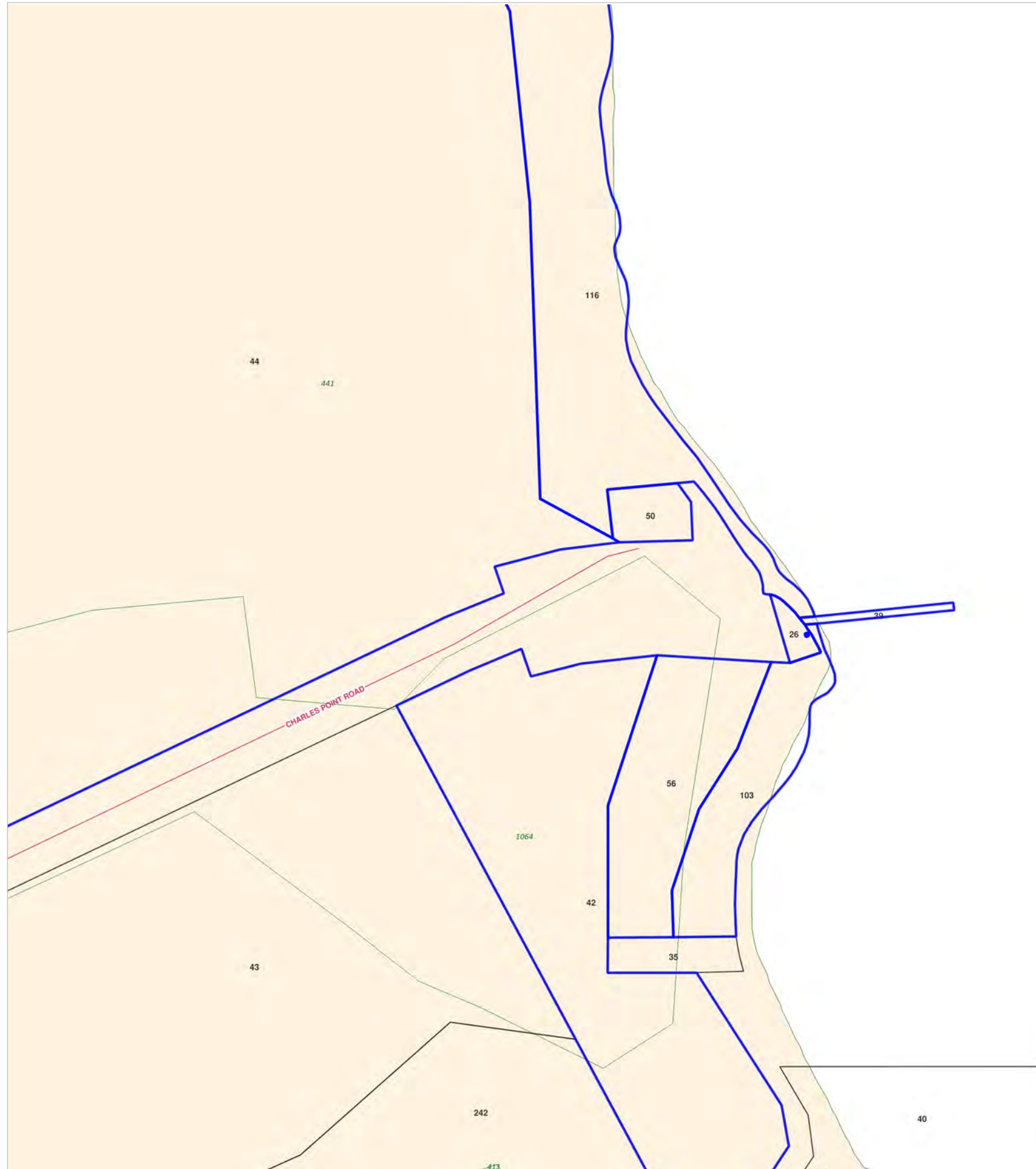
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Legend

NVIS 2007



Metres 50 100

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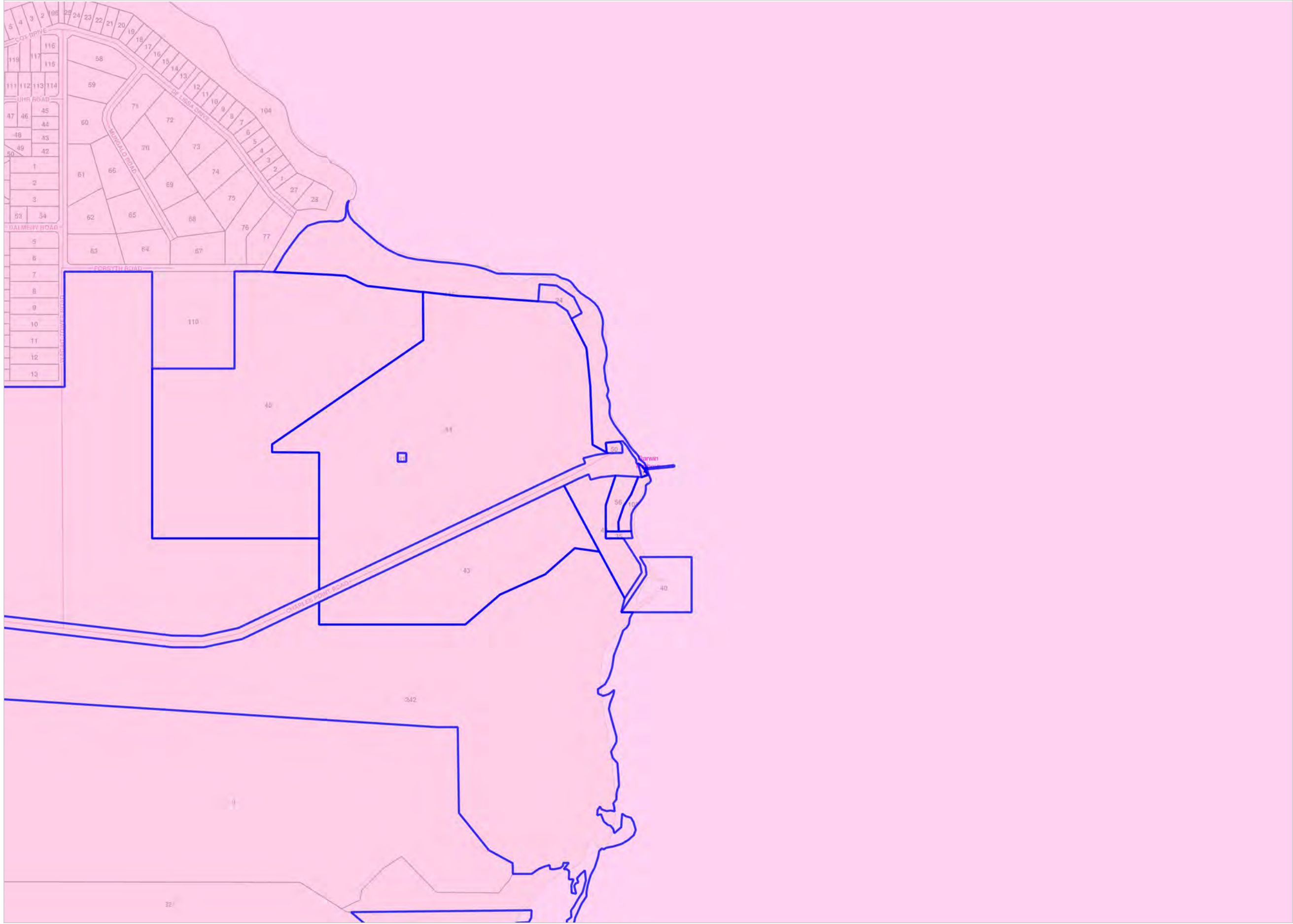
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NR MAPS

Mandorah_Significant Biodiversity Areas



Legend

Sites of Conservation Significance (Significance)

- International
- National

Sites of Botanical Significance

-

Directory of Important Wetlands

-



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EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/11/21 17:56:07

[Summary](#)

[Details](#)

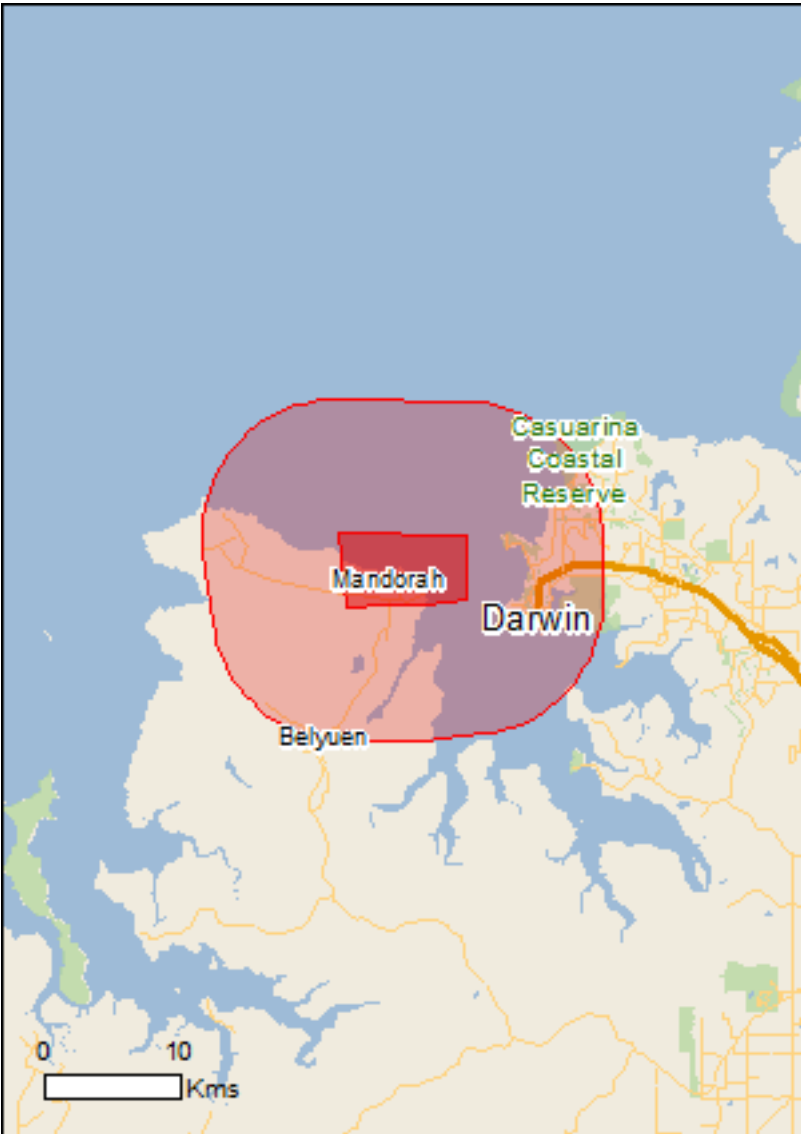
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

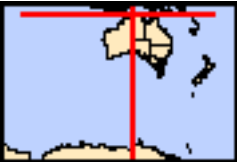
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	39
Listed Migratory Species:	70

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	16
Commonwealth Heritage Places:	7
Listed Marine Species:	109
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat likely to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Stylidium ensatum a triggerplant [86366]	Endangered	Species or species habitat may occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[[Resource Information](#)]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area

Migratory Marine Species

Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		area Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Name	Threatened	Type of Presence
Xenus cinereus		
Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

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

Name
Commonwealth Land -
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Department of Administrative Services
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs
Commonwealth Land - Department of Transport & Regional Development
Commonwealth Land - Deputy Crown Solicitor
Defence - AUSTRALIAN ARMY BAND - DARWIN
Defence - DARWIN RELOCATIONS CENTRE
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE
Defence - Esanda Builidng
Defence - LARRAKEYAH BARRACKS
Defence - Patrol Boat Base (DARWIN NAVAL BASE)
Defence - RAAF BASE DARWIN
Defence - STOKES HILL OIL FUEL INSTALLATION
Defence - WINNELLIE ONE
Defence - WINNELLIE TWO

Commonwealth Heritage Places	[Resource Information]
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Name	State	Status
Historic		
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	Listed place

Listed Marine Species	[Resource Information]
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* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		within area Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]	Endangered*	Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]		Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Halicampus brocki Brock's Pipefish [66219]		area Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]	Endangered	Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]		Breeding known to occur within area
Natator depressus Flatback Turtle [59257]		Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]	Endangered	Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]		Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area

Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Casuarina	NT
Charles Darwin	NT
George Brown Darwin	NT

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311] Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171] Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507] Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, Thorny Sensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223] Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pennisetum polystachyon		within area
Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris		
Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

Nationally Important Wetlands		[Resource Information]
Name		State
Port Darwin		NT

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-12.451737 130.713912,-12.40463 130.707389,-12.406475 130.79322,-12.447546 130.793907,-12.450563 130.767299,-12.451737 130.713912

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

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APPENDIX

C

NR MAPS DECLARED WEEDS

NR MAPS

Declared Weeds



Legend

Weed Records (DENSITY CLASS)

- Scattered
- ✕ Scattered (Treated)
- Moderate
- ✕ Moderate (Treated)
- Dense
- ✕ Dense (Treated)
- Very Dense
- ✕ Very Dense (Treated)
- Unknown Density
- ✕ Unknown Density (Treated)

TENURE_TYPES

- Freehold
- Vacant
- Perpetual Pastoral Lease
- Reserve
- Government
- Crown Lease Term
- Crown Lease Perpetual
- Right to Freehold Title
- Special Purpose Lease
- Pastoral Lease
- Registered Mining Lease
- Other Lease



Metres 20 40

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Geospatial Services Branch



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Parks and Water Security
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APPENDIX

D

TERRESTRIAL FAUNA LIKELIHOOD ASSESSMENT

Likelihood of occurrence	Criteria
Unlikely	Species that fit into one or more of the following criteria: - Species highly restricted to certain geographical areas not overlapping the Study Area. - Species that have specific habitat requirements that are not present in the Study Area.
Low	Species that fit into one or more of the following criteria: - Have not been recorded previously in the Study Area and for which the Study Area is beyond the current distribution range. - Use specific habitats or resources not present in the Project Area.
Moderate	Species that fit one or more of the following criteria: - Have infrequently been recorded previously in the Study Area. - Use specific habitats or resources present in the Project Area, but in a poor or modified condition. - Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically or during migration.
High	Species that fit one or more of the following criteria: - Have frequently been recorded previously in the Study Area. - Use habitat types or resources that are present in the Project Area, that are abundant and/or in good condition. - Are known to, or likely to, maintain resident populations surrounding the Project Area. - Are known to, or likely to, visit the Project Area during regular seasonal movements or migration.

Key:

CR = Critically endangered

EN = Endangered

VU = Vulnerable

NE = Near threatened

DD = Data deficient

EPBC Act Protected Matters Categories

(T) – Threatened

(M) – Migratory

Table D1 Likelihood assessment of listed terrestrial species with potential to occur in the project study area

Scientific name	Common name	EPBC Act	TPWC Act	Distribution and habitat*	No. of records and source	Likelihood of occurrence in Study Area	Justification
Birds							
<i>Cuculus optatus</i> (M)	Oriental Cuckoo	-	-	Usually inhabits rainforest and monsoon forest edges; roadsides, river flats, mangroves and islands and leafy trees in paddocks.	1- NT Fauna Atlas	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. Previously recorded in Study Area.
<i>Erythroriorchis radiatus</i> (T)	Red Goshawk	VU	VU	The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the goshawk requires for prey. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Erythrura gouldiae</i> (T)	Gouldian Finch	EN	EN	Distributed throughout tropical northern sub-coastal areas from Western Australia to the Gulf of Carpentaria and central Cape York Peninsula. Gouldian Finchs prefer tropical savanna woodlands with grassy understories https://www.birdlife.org.au/bird-profile/gouldian-finch	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Falco hypoleucos</i> (T)	Grey Falcon	VU	VU	The species occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and WA. Usually restricted to shrubland, grassland and wooded	-	Moderate	Species or species habitat likely to occur within Study Area.

				watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.			Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically. No previous records in Study Area.
<i>Geophaps smithii smithii</i> (T)	Partridge Pigeon (eastern)	VU	-	The Partridge Pigeon can be found across the Top End towards the Kimberley. Being sparsely distributed throughout central and eastern regions of Arnhem Land. Inhabiting Lowland eucalypt open forests and woodlands, with grassy understoreys https://nt.gov.au/_data/assets/pdf_file/0003/206355/partridge-pigeon.pdf	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Tyto novaehollandiae kimberli</i> (T)	Masked Owl (northern)	VU	VU	In northern Australia, the Masked Owl has been recorded from riparian forest, rainforest, open forest, <i>Melaleuca</i> swamps and the edges of mangroves, as well as along the margins of sugar cane fields	-	Moderate	Species or species habitat likely to occur within Study Area. Are unlikely to maintain sedentary populations, however may seasonally use resources within the Project Area, opportunistically. No previous records in Study Area.
Mammals							
<i>Antechinus bellus</i> (T)	Fawn Antechinus	VU	EN	The fawn antechinus is the only species of Antechinus found in the savannah woodland and tall open forest of the Top End of the Northern Territory (NT) (Watson & Calaby 2008). The species is restricted to the NT, largely to the mainland but there is one record of the species from the Tiwi Islands.	-	Moderate	Species or species habitat likely to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition.

							No previous records in Study Area.
<i>Conilurus penicillatus</i> (T)	Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma	VU	EN	In the NT, this species has been recorded from near-coastal areas from near the mouth of the Victoria River in the west to the Pellew Islands in the east, and including Bathurst, Melville, Inglis and Centre Islands and Groote Eylandt (Parker 1973; Kemper and Schmitt 1992; Woinarski 2000). There are no recent records from much of this historically recorded range, and it is currently known to persist in the NT only on Cobourg Peninsula, Bathurst, Melville and Inglis Islands, and Groote Eylandt. The preferred habitat of the brush-tailed rabbit-rat is eucalypt tall open forest (Firth et al. 2006a). However, at least on Cobourg Peninsula, it also occurs on coastal grasslands (with scattered large <i>Casuarina equisetifolia</i> trees, beaches, and stunted eucalypt woodlands on stony slopes (Frith and Calaby 1974; PWCNT 2001)). It shelters in tree hollows, hollow logs and, less frequently, in the crowns of pandanus or sand-palms (Firth et al. 2006b). Most foraging is on the ground, but it is also partly arboreal.	-	Moderate	Species or species habitat may occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Dasyurus hallucatus</i> (T)	Northern Quoll [Dambimangari], Wiminji [Martu]	EN	CR	In the Northern Territory (NT), it is restricted to the Top End. A 1905 record from Alexandria (Thomas 1906) marks the southern limit of its known NT distribution, now far from any recent records. It has been recorded from Groote Eylandt and the nearby Northeast and Winchelsea Islands, Marchinbar Island (in the Wessel group), Inglis Island (in the English Company Islands group) and Vanderlin Island (Sir Edward Pellew group). Recently, it has also been translocated to Astell and Pobassoo islands in the English Company island group. The northern quoll is a generalist predator, consuming a wide range of invertebrates and small vertebrate prey. It dens in hollow logs, rock crevices and caves, and in tree hollows. Most foraging is on the ground, but it is also an adept climber. It occurs in a wide range of habitats, but the most suitable habitats appear to be rocky areas. It was common in many eucalypt open forests.	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Macroderma gigas</i> (T)	Ghost Bat	VU	NE	The species' current range in northern Australia ranges from relatively arid conditions in the Pilbara region of Western Australia to humid rainforests of northern Queensland. One of the largest known colonies occurs in a series of gold mine workings at Pine Creek in the Northern Territory. Elsewhere in the Territory they have been recorded throughout the mainland	-	Low	Species or species habitat likely to occur within Study Area. Use specific habitats or resources not present in the Project Area.

				Top End north of approximately 17° latitude as well as Elcho Island, Groote Eylandt and other nearby islands. The distribution of Ghost Bats is influenced by the availability of suitable caves and mines for roost sites. There are likely to be very few maternity sites across Australia (only ten are known) which probably explains the strong genetic differentiation of populations across Australia.			No previous records in Study Area.
<i>Mesembriomys gouldii</i> (T)	Black-footed Tree-rat, Djintamoonga, Manbul	EN	VU	Found in the Top End of the Northern Territory (NT) in tropical woodlands and open forests in coastal areas. Also occurs in the Kimberley in Western Australia, and the east and west coastal areas of Cape York Peninsula south to Townsville and inland to the Lynd Junction, where it is far less common. Black-footed tree-rats are fairly solitary, nocturnal animals, sheltering in tree hollows and pandanus stands during the day (Griffiths et al. 2002).	-	Moderate	Species or species habitat known to occur within Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.
<i>Petrogale concinna canescens</i> (T)	Nabarlek	EN	VU	<i>Petrogale c. canescens</i> has been recorded in scattered populations from sandstone cliffs bordering the Arafura Swamp (in the east) to the Daly River catchment (in the west). Nabarleks are restricted to rocky areas (sandstone or granite), especially on steep slopes, with large boulders, caves and crevices (Churchill 1997). They may move from these to forage in adjacent flat areas (Sanson et al 1985).	-	Low	Species or species habitat likely to occur within Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.
<i>Phascogale pirate</i> (T)	Northern Brush-tailed Phascogale	VU	EN	Recent taxonomic studies (Rhind et al. 2001, Spencer et al. 2001) have suggested that the northern population of brush-tailed phascogale is specifically distinct from that in south-western and south-eastern Australia. As redefined, the northern brush-tailed phascogale is restricted to the Top End of the Northern Territory (NT), and is taxonomically distinct from populations in the Kimberley and Cape York Peninsula. There are relatively few records in the NT: the most recent (since 1980) are from the Tiwi Islands, Cobourgh Peninsula, West Island (in the Sir Edward Pellew group, but now considered extinct there), Kakadu National Park (notably around Jabiru and near Jim Jim ranger station), and Litchfield National Park. There are older records from the Gove and Katherine areas. There have been no detailed studies of the northern brush-tailed phascogale, but its ecology is probably similar to that	-	Low	Species or species habitat likely to occur within Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.

				reported for its temperate relatives (Rhind 1998). The diet is predominantly invertebrates with some small vertebrates. It is a nocturnal mammal, feeding both in trees and on the ground. It shelters in tree hollows during the day. Most records are from tall open forests dominated by <i>Eucalyptus miniata</i> (Darwin woollybutt) and <i>E. tetradonta</i> (Darwin stringybark).			
<i>Saccolaimus saccolaimus nudicluniatu</i> (T)	Bare-rumped Sheath-tailed Bat, Bare-rumped	VU	DD	It was first recorded in the Northern Territory in 1979, and there have been very few (<5) records since (McKean et al. 1981; Thomson 1991). All confirmed records have been from the Kakadu lowlands. McKean et al. (1981) asserted that it was likely to be more widespread in the north of the NT, but the very few records since, despite substantial survey work on microchiropteran bats (e.g. Milne et al. 2003, 2004), suggest that this may not be the case. This is a high-flying insectivorous bat. Specimens were collected from open Pandanus woodland fringing the sedgeland of the South Alligator River in Kakadu National Park (Friend and Braithwaite 1986). In the Northern Territory, it has also been recorded from eucalypt tall open forests (Churchill 1998). In Queensland, it is known mainly from coastal lowlands, including eucalypt woodlands and rainforests (Duncan et al. 1999). It roosts in tree hollows and caves (Duncan et al. 1999).	-	Low	Species or species habitat likely to occur within Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.
<i>Trichosurus vulpecula arnhemensis</i> (T)	Northern Brushtail Possum	VU	EN	Two subspecies of common brushtail possum occur in the Northern Territory (NT). The subspecies <i>T. v. vulpecula</i>, occurs in isolated populations in the southern NT. It formerly had a much more extensive distribution in the NT that included most of the Tanami and Great Sandy Deserts across to the Western Australian border at Lake Mackay and Kintore, south to Charlotte Waters, east to the Todd and Hale River floodouts in the Simpson Desert, and as far north as the Murchinson Ranges. Outside the NT, this subspecies occurred across much of the continent, including South Australia, Victoria, New South Wales, southern and southwestern Queensland and much of Western Australia. It remains common in much of this area, including urban areas of most capital cities. The subspecies <i>T. v. arnhemensis</i> occurs in the monsoon tropics of the Top End of the NT and in the Kimberley, Western Australia. It remains locally common (notably in some Darwin suburbs), but is generally declining (Woinarski 2004) and is listed as Near Threatened in the NT. A range of sites is used as shelter including caves and rock holes, tree hollows and the tops of dense trees. The diet	-	Moderate	Species or species habitat known to occur in Study Area. Use specific habitats or resources present in the Project Area, but in a poor or modified condition. No previous records in Study Area.

				consists of the flowers, fruits and leaves of a wide range of non-eucalypt species (Evans 1986).			
<i>Xeromys myoides</i> (T)	Water Mouse, False Water Rat, Yirrkoo	VU	DD	In the Northern Territory, it is known from only 10 records at 6 sites (South Alligator River in 1903, Daly River floodplain in 1972, two sites on the Tomkinson River in 1975, Melville Island in 1975 and Glyde River floodplain in 1998 and 1999) (Redhead and McKean 1975; Magnusson et al. 1976; Woinarski et al. 2000). Beyond the Northern Territory, it is also known from several sites in coastal south-eastern Queensland and one site in New Guinea. The ecology of the species is reasonably well known from a detailed study on North Stradbroke Island, Queensland (Van Dyck 1996). The false water rat is a nocturnal predator eating mainly marine and freshwater invertebrates, especially including crabs, pulmonates and molluscs. It forages entirely on the ground, and is an adept swimmer. It builds and shelters in either burrows or substantial earthen mounds. Its habitats comprise mangrove forests, freshwater swamps and floodplain saline grasslands (Woinarski et al. 2000).	-	Low	Species or species habitat likely to occur in Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.
Insects							
<i>Attacus wardi</i>	Atlas Moth	-	VU	The Atlas Moth is a narrow-range endemic species restricted to high-rainfall coastal areas of the north-western Top End and northern Kimberley. In the Northern Territory (NT), the species has been recorded at several localities on Melville Island, Arau Point and Black Point on the Cobourg Peninsula, and at several coastal localities from Dundee Beach to Gunn Point in the Darwin region. Only a single record has been collected from the Kimberley in Western Australia: a specimen collected from Lesueur Island in December 1974. Although it has been suggested that the Atlas Moth might also occur further east in the Top End—given the distribution of the larval food plant and availability of suitable habitat —no evidence of its occurrence there has been obtained². Records from Cape York Peninsula in Queensland are considered to be erroneous. The preferred breeding habitat of the Atlas Moth is the edges of large patches of monsoon forests where the larval food plant <i>Croton habrophyllus</i> grows. Critical breeding habitat appears to be coastal semi-deciduous vine thickets. The species also breeds in wetter monsoon forests, such as Maxwell Creek, that have a substantial component of evergreen plants associated with permanent water.		Low	Species or species habitat likely to occur in Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.

Reptiles							
<i>Acanthophis hawkei</i> (T)	Plains Death Adder	VU	VU	The plains death adder has a disjointed distribution. It is known to occur on the cracking soils on floodplains of the Adelaide, Mary and Alligator Rivers as well as the cracking black soils of the Barkly Tableland on the Northern Territory (NT)/Queensland (QLD) border and the Mitchell Grass Downs of western QLD. It likely occurs on floodplains and cracking soil plains across mainland northern Australia. The plains death adder occurs on the flat, treeless cracking-soil plains of northern Australia, where it is a major predator on frogs, reptiles and rats.	-	Low	Species or species habitat known to occur in Study Area. Use specific habitats or resources not present in the Project Area. No previous records in Study Area.

* Information taken directly from the following sources (prioritised depending on availability):

- Threatened species of the Northern Territory Fact Sheets – Department of Environment, Parks and Water Security (NT Government):

<https://nt.gov.au/environment/animals/threatened-animals>

- Species Profile and Threats Database – Department of Agriculture, Water and the Environment (Australian Government): <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>