



# Crowley

## Project Caymus

### Northern Territory Environment Protection Referral

15 June 2021



## Project Caymus

Prepared for  
Crowley Government Services, Inc.

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## Acronyms and Abbreviations

Acronym	Definition
AAPA	Aboriginal Areas Protection Authority
AHD	Australian Height Datum
AS	Australian Standard
ASS	Acid Sulfate Soils
BFSF	Bulk Fuel Storage Facility
BOM	Bureau of Meteorology
CBD	Central Business District
CEMP	Contractor Environmental Management Plan
cm	Centimetre
CR	Critically Endangered
°C	Degrees Celsius
DAWE	Department of Agriculture, Water and Environment
DoD	Department of Defence
DENR	Department of Environment and Natural Resources
DEPWS	Department of Environment, Parks and Water Security
DIPL	Department of Infrastructure, Planning and Logistics
DoD	Department of Defence
DoH	Department of Health
EIA	Environmental Impact Assessment
EN	Endangered
EP Act	<i>Environment Protection Act 2019</i> (Northern Territory)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
Ha	hectare
HV	High Voltage
JFSF	Jet Fuel Storage Facility
km	Kilometre
km/hr	kilometre per hour
LDC	Land Development Corporation
m	Metre
mm	Millimetre
MCC	Motor Control Centres
MFL	Maximum Fill Level
MNES	Matters of National Environmental Significance

MOL	Minimum Operating Level
MPaG	Mega Pascal Gauge Reading
NFL	Normal Fill Level
NL	Not Listed
NOL	Normal Operating Level
NT	Northern Territory
NT EPA	NT Environment Protection Authority
NTG	Northern Territory Government
NTPS	Northern Territory Planning Scheme
NVIS	National Vegetation Information System
PWC	Power and Water Corporation
RL	Relative Level
RMU	Ring Main Unit
RWA	Restricted Work Area
SDS	Safety Data Sheet
SOCS	Site of Conservation Significance
TMP	Traffic Management Plan
TPWC Act	<i>Territory Parks and Wildlife Conservation Act 1976 (Northern Territory)</i>
TTP	TetraTech Proteus
UFC	Unified Facilities Criteria
US	United States
UXO	Unexploded Ordnance
VSD	Variable Speed Drives
VU	Vulnerable
WoNS	Weeds of National Significance
WV	Working Volume

## 1 Introduction

This Referral has been prepared by CDM Smith and Pritchard Francis on behalf of Crowley Government Services, Inc. (Crowley) to determine the environmental risks associated with the construction and operation phases of the bulk fuel terminal at East Arm (the project). The bulk fuel storage facility (BFSF) is made up of 300ML of Jet Fuel Storage. This referral is for the BFSF component of the project and the construction of the access road off Salloo Street East Arm.

The purpose of this referral is to provide adequate information to enable assessment of whether or not the proposed activity requires further assessment under the Northern Territory *Environment Protection Act 2019*. The structure and content of this document is based on the NT EPA's guidance for proponents Referring a proposal to the NT EPA (2019).

This referral also presents information relevant to assessing the potential for significant impact to Threatened species and Migratory species listed as matters of environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and whether the proposed action requires assessment and approval under the EPBC Act.

### 1.1 Proponent Details

The proponent details are outlined in Table 1.

**Table 1 Proponent details**

Proponent	Crowley Government Services, Inc.
Key contact person	Sean Thomas – Vice President
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### 1.2 Environment Consultant Details

The environment consultant nominated to prepare this NT EPA Referral is CDM Smith Australia Pty Ltd (CDM Smith). The key contact for CDM Smith is outlined below in Table 2.

**Table 2 Environment consultant details**

Company	CDM Smith Australia Pty Ltd
Key contact person	Jeni Young
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## 2 Site Description

The BFSF is proposed to be established upon Section 5720 (8.8 ha) along Berrimah Road in East Arm (Figure 1). The land parcel has been cleared and reclaimed in anticipation of industrial development for which it is zoned.

It is anticipated that the BFSF would require all to be cleared of any regrowth. It is proposed that Section 5720 would be used for bulk fuel storage.

**Table 3 Project area details**

Area	BFSF	Access Road
Current land use	Vacant land	
Tenure type	F - Freehold	F - Freehold
Title (Volume/folio)	808/379	787/370
Location code	055 Hundred of Bagot	055 Hundred of Bagot
Lot number	Section 5720	Section 5711
Street number	740 Berrimah Road	3 Salloo Street
Survey ID	S2003/201	L2003/078
Town planning zone	DV - Development	MZ -
Area (ha)	8.84	3.8

### 2.1 Land Use

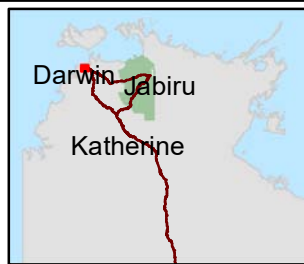
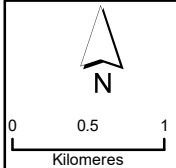
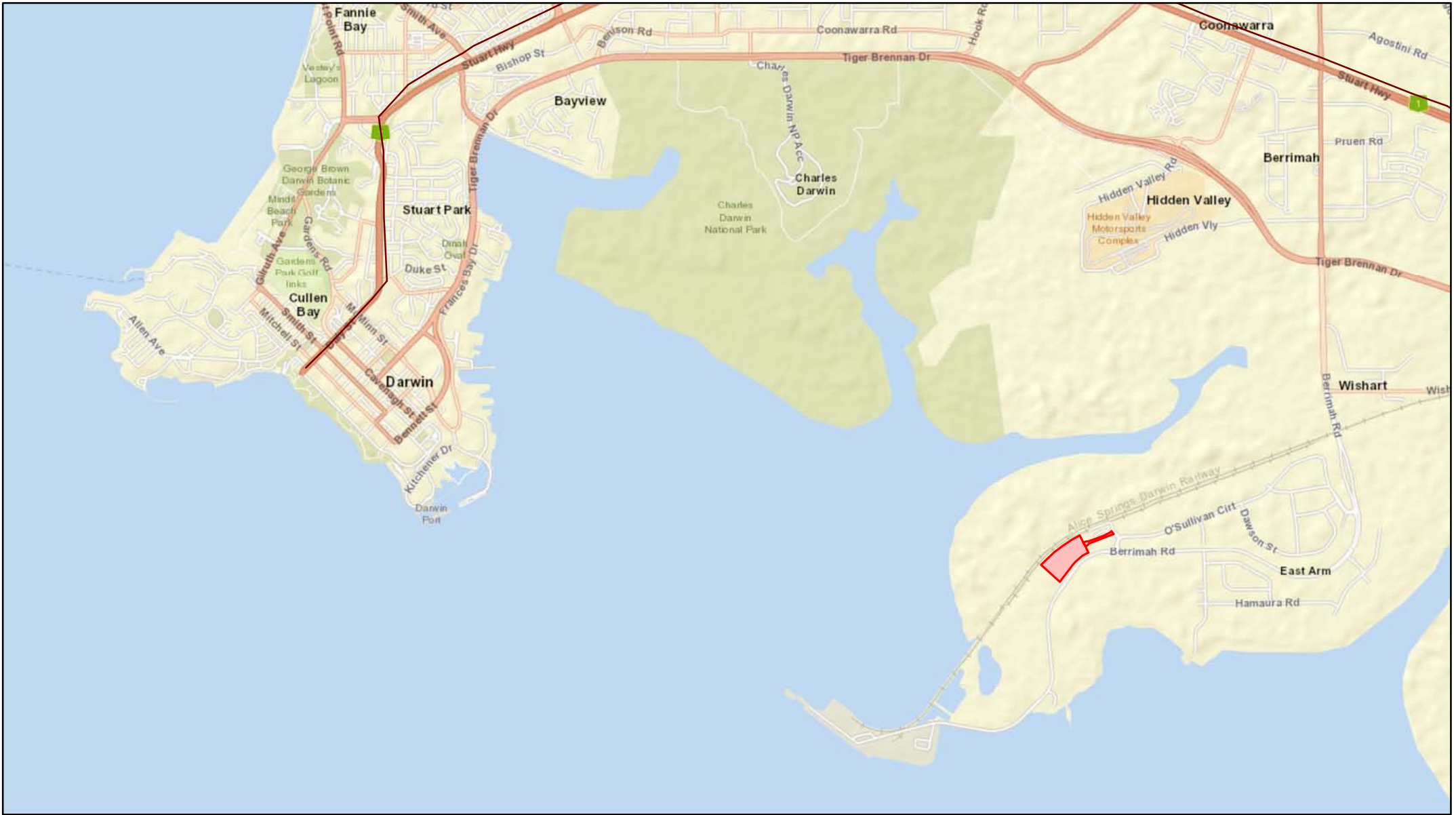
It is proposed that the Bulk Fuel Terminal be established over one land parcel, Section 5720 located immediately north of the Vopak Fuel Terminal. The majority of the land parcel comprises reclaimed land that was formerly the mangroves and salt flats that lay between Quarantine Island and the mainland.

The site and its vicinity are surrounded by mangroves, Darwin Harbour waters, the East Arm wharf and the Darwin Business Park industrial area.

The Northern Cement milling and distribution facility, Global Resource Recovery, Vopak fuel terminal all lie immediately west of the proposed site.

The passenger terminal for the Darwin-Adelaide Railway is located within the Darwin Business Park, a few hundred metres to the north-east of the site. There is generally a single passenger train service per week, doubling to two train services during the peak tourist season, with the terminal being essentially empty for the remaining period. Although the terminal has been established as a temporary facility, it may be some time before funds are available for its relocation and hence it could remain at the location for some years into the BFSF's operations.

The nearest residential premises are the residential quarters of Haileybury Rendell School, a private school located along Berrimah Road, roughly 4.5 km north-east of the site. The Shady Glen Caravan Park is located along Stuart Highway near the Defence Establishment Berrimah Naval Base, approximately 5 km north of the site. The nearest residential suburbs are Bayview Haven, Frances Bay and Stokes Hill, located approximately 5.5 km north-west to west of the site, whereas the nearest Palmerston suburbs (e.g., Durack) are over 7 km to the east (Figure 1).



**Legend**  
 Crowley Project Area

**Figure 1**  
 Project Locations and Regional Setting



### 3 Project Description

Crowley, are pursuing the development of a new greenfield BFSF at the East Arm District in Darwin Northern Territory, named Project Caymus.

Crowley engaged Tetra Tech Proteus (TTP) partnering with Pritchard Francis to undertake the Phase I Project Definition and Conceptual Design (10% design level) for the Bulk Fuel Storage Facility. Pritchard Francis has engaged with CDM Smith to undertake the environmental approvals.

#### 3.1 Bulk Fuel Storage Facility

The US Defence BFSF is to be located on Lot 5720 west of the Railway Terminal. Access to the BFSF is from the east via a proposed access road from Salloo Street.

The Jet Fuel Storage Facility functional requirements were identified as:

- Minimum storage of 300 ML Jet Fuel consisting of:
  - 700,000 barrels (111.3 ML) of F34 flammable jet fuel which is a military kerosene type aviation turbine fuel with Fuel System Icing Inhibitor (FSII) used by land based military gas turbine engine aircraft, and
  - 1,200,000 barrels (190.8 ML) F44 combustible jet fuel which is a military high flash point kerosene type aviation turbine fuel with FSII used by ship borne military gas turbine engine aircraft.
- Meet requirements of United States (US) Department of Defence (DoD)
- Designed to satisfy all relevant national and local safety, health and environmental requirements including:
  - Australian Standards
  - API Standards for tanks
  - ASME Codes for piping
  - AS1940 storage and handling of flammable and combustible liquids
  - API 1581 Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators
  - Unified Facilities Criteria (UFC) as a guide for US DoD facilities
- Issue and receipt of fuel by road via a triple road tanker load/unload gantry with a capacity of 2,500 litres/minute per truck
- Connection to existing diesel pipeline at Port of Darwin for marine issue and receipt at a pump rate of:
  - Tanker – 1,400 m<sup>3</sup>/hr
  - Barge – 320 m<sup>3</sup>/hr
- Facilities shall be as required for bulk fuel operations including:
  - Office/control room
  - Warehouse storage/space
  - Additive tank area
  - Pump house
- US grant scheduled for 1 October 2021 with a 2-year schedule from award to operation.

#### 3.2 Agreed Facility Layouts

The general layout of the facility is detailed below. The fuel will be pumped via existing pipeline to the East Arm Wharf where there will be an off-loading facility

The facility contains the following infrastructure:

- A series of flammable F34 jet fuel tanks compounds located on east side of Lot 5720.
  - Fixed or geodesic roof tanks.
  - Cooling water and foam injection to tanks required.
  - Cooling water – fixed piping on tanks with monitors on bund wall.

- External fire hydrant system required.
- A series of combustible F44 jet fuel tanks compound located on west side of Lot 5720.
  - Fixed or geodesic roof tanks.
  - External fire hydrant system required.
- All storage compounds have concrete retaining walls based on compound storage volume being based on 110% of largest storage tank volume.
- All storage compounds have flooring designed to contain spills and to allow access for equipment.
- Unsealed paved areas around all storage compounds to allow emergency vehicles and crane access
- Common facilities located on Lot 5720
  - A tanker loading gantry allowing loading of both fuels.
  - Additional park-up area required for triple road tankers during peak periods.
  - Combined warehouse and administration building.
  - Firewater tanks/pumps. The fire water tanks design based on:
    - Water supply from water mains may not be a guaranteed inflow rate.
    - Fire water storage tanks sized to provide the specified flows as listed below:
      - Cooling water – 1.5 hrs
      - 4 x hydrants – 4 hrs
      - Foam – 20 mins
    - Fire booster valve assembly is required after the fire water tanks, before fire water pumps.
  - Oily water separation.
  - Storage requirements based on AS1940:2017 The storage and handling of flammable and combustible liquids

Filtering capability for tank-to-tank transfer in accordance with API-1581.

### **3.3 Basis of Design**

#### **3.3.1 Mechanical**

##### **3.3.1.1 Ship unloading**

Fuel ships are to be unloaded at Wharf 4 at Darwin's East Arm port facility.

Fuel will be delivered via ship onboard pumps to the storage facility from the wharf to the BFSF along the pre-existing pipeline rack and easement.

After the initial terminal fill, the expectation is that the terminal will receive about 120 ML/annum (4 ships).

All piping and valves used in the piping system are to be designed in accordance with the ASME B31.3 and B31.4 design codes (ASME B31.3 is commensurate to AS 2885). The piping is carbon steel and joints are flanged. The pipe will have a sealed surface with a curb to contain any spills that may occur during maintenance activities, to contain any product while a spill kit is employed to soak up any product before being disposed of.

Operating procedures typically ensure that the pipelines are visually inspected before each use to ensure no anomalies.

##### **3.3.1.2 Ship Loading**

The ship loading rate will be 1,400 m<sup>3</sup>/hr from storage facility. Fuel will be delivered via shore pumps located at the storage facility.

### 3.3.1.3 Tank Truck On/Off-Loading Facility

The tank truck on/off-loading facility (TTOF) will be equipped with a safety overfill protection system capable of bottom loading all fuel shipped by truck. The TTOF has the necessary capacity to load two A-triple road trains at a rate of 36 kL per trailer per hour.

The loading arms are sized to deliver 2,500 L/min, equivalent to 150 kL/hr. The loading arms are capable of on and off-loading of road tankers.

The berth deck is to be designed to have a 200 mm high bund wall around the MLAs and manifold area. A topping slab is proposed to be installed with a 1:100 grade to an oily water drain. This then drains back to an underground 50 kL oily water tank, where it is then removed via road tanker.

The connectors are currently specified as the standard 100 mm API dry break coupler, designed for bottom loading applications.

### 3.3.1.4 Filtration

The terminal is to be capable of filtering all stored products during tank-to-tank transfers, when replacing dormant fuel in pipelines, or when repacking pipelines. The filtration system specified meets the requirements of the American Petroleum Institute (API) Publication 1581, "Specifications and Qualification Procedures – Aviation Jet Fuel Filter/Separator."

Category M type S filter/separators are specified.

### 3.3.2 Tankage

The following Australian and API standards shall be used in the structural design and be read in conjunction with the standards referred to in the following sections of this document.

**Table 4 Tankage design standards**

Standard	Title
AS 1940	The storage and handling of flammable and combustible liquids
API 650	Welded Steel Tanks for Oil Storage

The tank design is to incorporate API 650 and AS 1940 requirements. The tank is to have an external roof, with supported cone roof, internal columns, and rafters and no internal floating roof.

The proposed tanks are designed to achieve the required Working Volume (WV) between the tank Minimum Operating Level (MOL) and the tank Normal Operating Level (NOL).

Above the tank NOL an allowance has been made for the Maximum Fill Level (MFL).

A previous similar fuel farm project had allowed 7 minutes of inflow from NOL to High Level and a further 7 minutes from High Level (Alarm) to High-High Level, however AS1940:2017 requires the Normal Fill Level (NFL) to be not more than 95 % of the tank capacity which will exceed the 7 minutes plus 7 minutes criteria.

An allowance for 600 mm freeboard below the top of shell has been made to ensure the Maximum (overflow) level is below the internal roof framing.

### 3.3.3 Structural

#### 3.3.3.1 Codes and Standards

The following Australian standards shall be used in the structural design and be read in conjunction with the standards referred to in the following sections of this document.

**Table 5 Structural design standards**

Standard	Title
AS/NZS 1170.0	Structural design actions - Part 0: General principles
AS/NZS 1170.1	Structural design actions - Part 1: Permanent, imposed and other actions
AS/NZS 1170.2	Structural design actions - Part 1: Wind actions
AS/NZS 1170.4	Structural design actions - Part 1: Earthquake Actions in Australia
AS 1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation
AS 3600	Concrete Structures
AS 4100	Steel Structures

### 3.3.3.2 Design Parameters

**Table 6 Design parameters**

Standard	Parameter	Value
AS/NZS 1170.0	Importance Level	2
	Design Working Life	50 years
AS/NZS 1170.2	Annual probability of Exceedance	1:500 years
	Wind Region	Region C
	Terrain Category	2

### 3.3.4 Civil

Based on the geotechnical desktop study (Davies 2005) it is anticipated that relatively shallow rock occurs on the eastern portion of Lot 5720.

The west side of Lot 5720 consists of a tidal channel that was infilled with gravelly fill to connect the headland with a former island as part of the construction of the East Arm Wharf.

Access roads are designed in accordance with Austroads requirements and are suitable for A-triple road tankers. All internal roads are sealed asphalt roads.

All tank storage compound volumes are designed in accordance with AS 1940 to contain 110% of the largest tank volume. Storage compound walls are watertight sheet pile retaining walls and the floors designed to meet to permeability requirements.

Unsealed hardstand pavements are required around the external bund walls of the storage compounds to provide emergency vehicle and crane access. All surfaces are designed to allow stormwater runoff as sheet flow to external drains.

Security fencing is required around the perimeter of the required work site.

The finished earthworks design levels for the project area are all above the 100 ARI Storm Surge Level.

### 3.3.5 Electrical, Instrumentation and Communication

Power supply will be sourced from the adjacent grid. The exact tie in location will be selected once the layout has been confirmed.

A High Voltage (HV) ring main unit (RMU) will be used to distribute power to the Jet Fuel facility transformers, which will be placed adjacent to their respective pump skids.

The maximum demand has been calculated based on the Mechanical Equipment list (rev A) and has utilised the fuel loading strategy with highest rated pump power.

Motor Control Centres (MCC) and Variable Speed Drives (VSD) will be housed inside switch rooms and will be designed and specified as per Australian Standard. Transformers will be placed inside concrete bunds with 110% capacity as per AS 60076.

Electrical equipment inside Hazardous Areas and Dangerous Goods areas is designed as per AS-NZS 60079.

### 3.3.6 Piping

Piping is to be designed in accordance with the following standards.

**Table 7 Australian and Australia/New Zealand Standards**

Standard	Title
AS 1210	Pressure vessels
AS 1940	The storage and handling of flammable and combustible liquids
AS/NZS 2885	Pipelines - Gas and liquid petroleum - Design and construction
AS 4041	Pressure piping
B16.5	Pipe Flanges and Flanged Fittings
B31.3	Process Piping
B31.4	Pipeline Transportation Systems for Liquids and Slurries
B36.10	Welded and seamless wrought steel pipe
B36.19	Stainless Steel Pipe
5L	Seamless and Welded Pipe
6D	Pipeline and Piping Valves

### 3.3.7 Fire Systems

#### 3.3.7.1 Standards and Codes

The following codes and standards apply:

**Table 8 Fire System Standards and Codes**

Standard	Title
AS 1670 Series	Fire detection, warning, control and intercom systems - System design, installation and commissioning Part 1 – Fire Part 3 – Fire alarm monitoring Part 4 - Emergency warning and intercom systems Part 5 - Special hazards systems Part 6 - Smoke alarms
AS 1940	The storage and handling of flammable and combustible liquids
AS 2419.1	Fire hydrant installations – Part 1: System design, installation, and commissioning
AS 2941	Fixed fire protection installations – Pumpset systems
NFPA 11	Low- medium- and high-expansion foam systems
NFPA 15	Water spray fixed systems
NFPA 16	Foam water sprinkler and foam water spray systems

### 3.3.7.2 Fire System Design Criteria

**Table 9 Fire system design criteria**

Standard	Title
<b>Piping and pumping</b>	<ul style="list-style-type: none"> <li>Piping sized such that at maximum flow rate the water supply connection does not exceed 4 m/s</li> </ul>
<b>Water storage</b>	Sufficient water storage to accommodate the following: <ul style="list-style-type: none"> <li>Hydrant operation.</li> <li>Cooling water operation for tanks exposed to radiant heat from a “tank on fire” scenario.</li> <li>Water supply for foam addition applied to the flammable tanks only.</li> <li>No allowance to be made for inflow from mains water supply</li> </ul>
<b>Foam System</b>	Foam injection to F34 (flammable) tanks.
<b>Cooling water</b>	F34 (flammable) tanks, tank mounted manifolds with control valve sets

## 3.4 Project Timing

The project timing enables Crowley to deliver project Caymus within the required delivery timeline of the US Government. This will involve undertaking significant portions of design and construction activity simultaneously providing both the tightest construction timeframe as well as highest standard of engineering compliance. Timeline planning for the project has taken into account all long lead items, and is sensitive to local resourcing constraints, material supplies and labour.

## 3.5 Project Requirements and Activities

### 3.5.1 Gravel and Fill Resources

Gravel and fill resources required for construction works will be sourced from a local commercial supplier (with necessary licences and permits) and therefore is excluded from this assessment.

### 3.5.2 Water

Water is required for construction activities including:

- concreting
- construction of earthworks
- compaction of road base material
- dust suppression
- construction compound facilities.

Water will be required for dust suppression, earthworks in cut/fill and road pavement construction. Due to the Project being located in an urban area, water will be extracted from an existing Power and Water Corporation (PWC) watermain. A water meter and backflow prevention control device are to be placed on the water main to monitor the volume of water used.

Water will be required for irrigation of landscaped areas for temporary establishment and for permanent irrigation post construction. Water will be sourced from PWC watermains. No significant impact is anticipated due to drawing from PWC’s existing water supply.

The volume of water required for the Project is yet to be determined. The preferred locations for water extraction in urban areas are existing PWC standpipes. Groundwater extraction is not proposed for this Project.

### **3.5.3 Emergency Services**

Fire emergency services are located at Marrara, Darwin CBD, Berrimah and Palmerston. Police emergency services are located in Darwin CBD, Berrimah, Palmerston and Casuarina. Ambulance services are located in Winnellie (416 Stuart Highway) and Dripstone Road Casuarina.

The operation of, and access by, emergency services are not expected to be impacted by the Project works as alternate routes will be provided for works on existing road infrastructure in the event of any temporary road closures.

### **3.5.4 Traffic Management**

Minimising potential disruption to traffic and the road network will be critical given the urban, peri-urban and industrial areas surrounding the Project. Where possible, the proposed construction work would be programmed to minimise impact on traffic using Berrimah Road.

Construction of the Project will be under a Traffic Management Plan (TMP).

The TMP will include the traffic management measures to be employed to minimise the traffic impacts expected during construction and will detail how to minimise potential disruption to the road traffic network and traffic flow, minimise impact on commuters, minimise impact on businesses, identify detours, and identify works that will be constructed during peak periods and non-peak periods and any night works.

### **3.5.5 Clearing Requirements**

Clearing of regenerated vegetation will be required for the construction of the road, whole site and construction compound. Currently the site surface conditions consist of fill which is derived from mudstone/ phyllite, with some outcropping on the eastern section of the site. The majority of the site is unvegetated, with some clusters of shrubs and small trees (TTC, 2021).

The maximum area of clearing that would potentially be required during construction is approximately 9 ha incorporating the regrowth on section 5720 and the regrowth over Section 5711.

### **3.5.6 Surrounding Environmental Conservation Areas**

The Project is located within the NT Darwin Harbour Site of Conservation Significance (SOCS). Darwin Harbour SOCS is of importance for ecological values including estuarine, freshwater and terrestrial environments, extensive areas of tidal mudflats and one of the largest and diverse areas of mangroves in the NT. A map and information sheet of the SOCS is included in Appendix A.

No Project works are proposed in the Harbour itself however, stormwater will ultimately flow into Darwin Harbour. No works are proposed within or adjacent to any National Parks. The proposed works are not expected to have any significant impacts on Darwin Harbour. Areas of importance and/or significance in the surrounding area are discussed in the following Sections.

## **3.6 Construction Environmental Management Plan**

The Project will be constructed under a Construction Environmental Management Plan (CEMP). The CEMP will cover the environmental protection practices, resources and sequence of activities required to comply with relevant environmental legislation, conditions of any applicable licence, approval and permit and all the requirements of this impact assessment.

The CEMP requirements will identify potential adverse environmental effects, applicable regulatory requirements and/or compliance limits for the physical, human and biological environment with a particular emphasis on a risk-based approach to identifying and managing risks associated with work methods to be used. Appropriate environmental protection measures will be documented to keep environmental effects within compliance limits and show the responsibility for implementation in each case.

The CEMP will include all supplementary plans for environmental protection and operational control including plans for erosion and sedimentation control, weed management, waste management and site establishment.

### ***3.7 Approach to Environmental Assessment***

To determine the environmental characteristics and risk associated with the proposed works, CDM Smith conducted the following:

- a desktop assessment
- an on-site inspection
- a literature review

Proposed management and mitigation measures that will be implemented during construction of the Project are anticipated to reduce the risk of these impacts to low.

## 4 Legislative Context

### 4.1 Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) provides protection of the environment, heritage and biodiversity conservation. Under the EPBC Act, actions that are likely to cause a significant impact on MNES will require formal assessment by the Environment Minister through a referral process.

### 4.2 Environment Protection Act

The *Environment Protection Act* (EP Act) and associated regulations has recently replaced the *Environmental Assessment Act 1999* on 28 June 2020. The 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. This initial step is undertaken through a referral in which the NT EPA then determines if further assessment is required. Further environmental assessment would require the submission of an Environmental Impact Assessment (EIA) under a tiered assessment pathway.

### 4.3 Other Relevant Legislation and Policies

Table 10 lists other Federal and Territory legislation and regulation relevant to the project.

**Table 10 Relevant Commonwealth and Territory Legislation**

Act	Administered by	Description
<i>Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)</i>	Commonwealth Attorney-Generals, Prime Minister and Cabinet	The Act was established for granting Northern Territory lands to recognised traditional owners through Aboriginal Land Trusts. This Act also establishes aboriginal land councils.
<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)</i>	Commonwealth Attorney General's Agriculture, Water and the Environment	The Act protects and preserves areas and objects within Australia that are of particular importance to Aboriginals in accordance with Aboriginal traditions.
<i>Bushfires Management Act 2016 (NT)</i> and Bushfires Management (General) Regulations	NT Department of Environment, Parks and Water Security	The Act assists landowners to mitigate impacts of fire by implementing fire management strategies. Bushfires NT was established to carry out and guide landowners on best fire management practices.
<i>Electricity Reform Act 2000 (NT)</i> and associated Regulations	NT Department of Treasury and Finance; NT Department of Attorney General and Justice; NT Minister for Renewables, Energy and Essential Services	The Act regulates electricity supply industry, to make provisions for safety and technical standards for electrical installation.
<i>Heritage Act 2011 (NT)</i> and heritage regulations	Territory Families, Housing and Communities	The Act provides for the conservation of the NT's cultural and natural heritage. The Heritage Council established under the Act makes assessments and regulate work on heritage places. All sites on the NT Heritage Register and yet to be discovered sites are protected under this Act.
<i>National Greenhouse and Energy Reporting Act 2007 (Cth)</i>	Commonwealth Industry, Science, Energy and Resources	The Act introduces a national framework for the reporting of information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production.

Act	Administered by	Description
<i>Northern Territory Aboriginal Sacred Sites Act 1989 (NT)</i> and regulations	Aboriginal Areas Protection Authority	The Act depicts the need to preserve and promote Aboriginal tradition in relation to land in the NT. This Act establishes procedures for the protection and registration of sacred sites. The Act establishes offences for entry onto, work on or, desecration of, sacred sites without appropriate certification or in contravention of the certification.
<i>Planning Act 1999 (NT)</i> and regulations	NT Department of Infrastructure, Planning and Logistics	The Act provides framework of controls for the orderly use and development of land.
<i>Territory Parks and Wildlife Conservation Act 1976 (NT)</i> and Territory Parks and Wildlife Conservation Regulations	NT Department of Industry Tourism and Trade	The Act forms a framework for the establishment and management of parks and reserves. It also aims to manage the protection, study, conservation and sustainable utilisation of wildlife.
<i>Traffic Act 1987 (NT)</i> and regulations	NT Department of Planning, Infrastructure and Logistics	The Act regulates traffic and for other purposes. A permit is required where construction will occur within an NT road reserve.  A permit is required to work within a road reserve.
<i>Waste Management and Pollution Control Act 1998 (NT)</i>	NT Department of Environment Parks and Water Security	The Act protects the environment through the encouragement of effective waste management and prevention and control practices of pollution.  Applicable to this project common contaminants and waste that may be generated from site without any mitigation measures may include and not limited to spills, soil erosion, sedimentation, construction waste, light pollution and dust emissions.
<i>Water Act 2016 (NT)</i>	NT Department of Environment Parks and Water Security	The Water Act provides for the investigation, use, control, protection, management and administration of water resources within the Northern Territory.  The Water Act legislates the extent to which both surface and ground water can be used and for what purpose. Waste discharge to natural waters is prohibited unless licensed under the Act.
<i>Weeds Management Act 2001 (NT)</i>	NT Department of Environment Parks and Water Security	An Act to prevent the spread of weeds in and out of the Territory and to ensure that the management of weeds is an integral part of land management.  Using the NR Maps tool, there were several declared statutory weeds that could potentially occur within the project area.

## 5 Existing Environment

### 5.1 Existing Road Network

Berrimah Road currently services East Arm Port and access to the Haileybury Rendall School. In the vicinity of Haileybury Rendall School, school zone speed restrictions (40 km/h) apply between 7am and 5pm on school days.

Berrimah Road south of the Wishart Road turnoff caters for all traffic entering and exiting East Arm Port, for passenger collection and delivery service to The Ghan, and industrial traffic servicing a number of local businesses in the Industrial Park. Berrimah Road consists of two traffic lanes, one in each direction.

Salloo Street is a connection road from O'Sullivan Circuit to the East Arm Rail Terminal. O'Sullivan Circuit is the main thoroughfare through the East Arm Business Precinct and Transport Hub.

### 5.2 Existing Infrastructure and Services

The location of the site is suitable for the proposed BFSF due to the proximity of established infrastructure, including the existing East Arm Wharf, bulk liquids berth and associated pipelines to the adjacent Vopak Fuel Terminal, as well as arterial road access, power and water supplies. Lot 5720 had been identified by Land Development Corporation as a site for Bulk Fuels.

Road access to the BFSF would be via an access road to be constructed off O'Sullivan Circuit which will give the site good connectivity to the Stuart Highway and the road network of Darwin via O'Sullivan Circuit or Berrimah Road.

There is significant potable water infrastructure (DN600 main) and high voltage (11 kV) aerial and underground distribution mains along Berrimah Road adjacent to the BFSF. Negotiation will be undertaken with the Power and Water Corporation regarding connection to their water and power networks.

The nearest sewerage infrastructure is located along O'Sullivan Circuit to the northeast, with a pump station at the Passenger Rail Terminal (Section 5673). As such, all sewage and process wastewater would most likely be managed on site rather than discharged to sewer.

The existing pipe rack from the wharf to the Vopak/Biofuels/Bulk Fuels precinct will be utilised, as will the existing manifold distribution area on the wharf, currently utilised by Vopak and previously used by the Biofuels project and for acid transfer and storage. The BFSF will transfer fuel through either then existing pipe network or through two new purpose-built pipelines placed on the existing pipe rack which has capacity for the additional pipes. An extension of the pipe rack and pipelines to the BFSF from the Vopak site termination point will be required.

There is an existing pipeline easement from the wharf to the north west corner of the Vopak storage terminal. It is proposed to install a new DN400 carbon steel fully welded pipeline along this same pipe route utilising the existing pipe supports and road crossing culverts as the existing pipelines. The pipeline and associated pipe supports will then be extended to the northwest corner of Lot 5270 where it will feed the new storage facility. This pipeline will be used to load and unload fuel shipping tankers.

The existing easement contains five pipelines, two of which are not currently used and owned by the NT Government. If these lines are found to be of a suitable size there is an opportunity to lease one of these lines and extend it east to the northwest corner of Lot 5270 and avoid installation of a new pipeline.

### 5.3 Bioregion

Bioregions are geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities.

The proposed works are located in the Darwin Coastal Bioregion (DoEE 2021). The Bioregion includes:

- a total area of 27,800 km<sup>2</sup>
- the western coastline of the NT
- a landscape that is generally flat, low lying and drained by several large rivers
- vegetation communities including eucalypt forest and woodlands with tussock and hummock grass understorey
- mixed land use with urban development
- major population centres Darwin and Palmerston
- a tropical monsoonal climate
- numerous threatened species
- more than 15% of the bioregion is protected
- several weeds.

### 5.4 Climate

The climate of Darwin is characterised by a tropical monsoonal climate with a distinct Dry Season (May to September) and Wet Season (October to April). The Dry Season is dominated by dry, cool weather with little rain, low humidity and wide-ranging temperatures. The onset and duration of the Wet Season varies between years, however most rainfall in the Northern Territory is associated with monsoonal troughs and/or from isolated convective storms (BoM 2021). High precipitation rates are commonly experienced during storm events in the wet season.

The Darwin Airport Bureau of Meteorology station is located approximately 7.5 km northwest of the Project area. The average annual rainfall for Darwin is 1,731.2 mm. Most of the annual rainfall occurs between November and March. The mean minimum temperature is 23.2°C and the mean maximum temperature is 32.1°C (BoM 2021) (Appendix B).

Synoptic winds during the dry season tend to be dominated by the southeast trade winds, while light west to north-westerlies predominate during the wet season. Sea breezes from the northwest occur on most afternoons throughout the year.

Tropical cyclones occur in the Darwin region on average about once per year.

### 5.5 Topography, Geology and Soils

#### 5.5.1 Land Units

The Darwin Coastal bioregion is generally flat, low-lying country, drained by several large rivers. Based on local Darwin Topography maps, the Project area ranges in level from about relative level (RL) 3m Australian Height Datum (AHD) to approximately RL 9m AHD. The majority of the project area is mapped as having a slope greater than 2%.

Land unit mapping for the Darwin area provides an overview of the expected land units in the Project area. Noting that the majority of the peninsula is a built and modified site, the land unit information will concentrate on the fringing environments that have not been disturbed.

Consistent with the site's topography, Land Unit Mapping indicates the terrain in the Project includes rises and marine. Soil groups across the area also vary with the varying land units and generally include Kandosols in the higher landscapes and Hydrosols in the lower landscapes. Additional details of the Land Units across the Project area, exported from NR Maps, are provided in Table 11 and shown on Figure 2. A summary of Land Systems, exported from NR Maps, for the Project area is also provided in Table 12 and Figure 3.

According to land unit mapping (DEPAWS, 2021), the north-eastern corners of Section 5720 comprise gentle slopes (2 to 5%) with rapid drainage and shallow gravely soils, as well as low scarps and short steep slopes (10-15%) with shallow gravely lithosols.

The Littoral land system covers the remainder of the two land parcels, and previously formed a fringe of tidal mudflats around Quarantine Island (Acer Vaughan, 1993). The Littoral land system has negligible relief and slope and is subject to tidal inundation, with mangroves and salt flats lying over muddy soils formed by sedimentary progradation (Acer Vaughan, 1993). The mangrove muds comprise clays and silts that would likely have a low bearing capacity and a possibly a high acid sulphate potential, which would have implications for construction of large structures.

### 5.5.2 Geology

The regional geology is shown on the 1:100 000 scale geological map of Darwin (Pietsch, 1983). The Peninsula is underlain by Quaternary intertidal marine alluvium consisting of clay and mud, and colluvial sediments deposited by unconcentrated surface runoff consisting of sand, silt and clay. The former Quarantine Island area comprised the Bustard and Littoral land systems, which were underlain by Proterozoic rocks of the Burrell Creek formation, comprising fine grained siltstones and sandstones to coarser quartz conglomerates (Acer-Vaughan, 1993).

Unconsolidated and concretionary lateritic soils of Cainozoic age have been mapped in the area. Early Proterozoic metamorphic Burrell Creek Formation form isolated outcrops on the Peninsula.

The Peninsula landform comprises a combination of:

- lower intertidal areas of marine alluvium consisting of wet soft silt and clay with variable amounts of sand.
- upper intertidal areas of mixed marine colluvium and alluvium consisting of soft/loose silty sand and gravely sand.

According to locally available geotechnical information and the geology of the area, the site subsurface conditions are likely to comprise of fill, marine sediments overlaying Mudstone of the Burrell Creek Formation. It has been assumed that the fill has originated from the East Arm area and is possibly from excavation on or in the vicinity of the site.

**Table 11 Land Units of the Project Area**

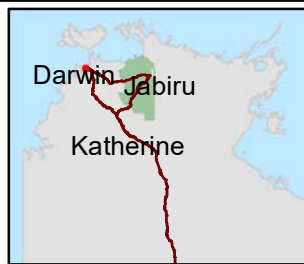
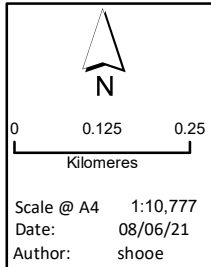
Location	Land Unit	Landform Class	Soil	Veg Sys	Veg Structure	Sp 1*	Sp 2*	Landform Description	Soil Description	Veg Description*
<b>Section 5720 and Section 5711</b>	2b2	Rises	Kandosols	SPECHT	Low open woodland	<i>Eucalyptus miniata</i>	<i>Eucalyptus tetradonta</i>	Side slopes	Brown kandosols	Low open to open woodland of missed species sparse grasses
<b>Section 5720 and Section 5711</b>	9b	Marine	Hydrosols	SPECHT	Low closed forest	<i>Avicennia marina</i>	<i>Ceriops tagal</i>	Estuarine fringe	Intertidal hydrosols	Low closed forest of Mangrove spp, intertidal inundation
<b>Section 5720</b>	9a	Marine	Hydrosols	SPECHT	Bare	<i>Arthrocnemum sp.</i>	<i>Sporobolus virginicus</i>	Estuarine fringes	Supertidal hydrosols	
<b>Section 5711</b>	6b	Drainage	Hydrosols	SPECHT	Tall shrubland	<i>Grevillea pteridifolia</i>	<i>Grevillea decurrens</i>	Broad lowland plans	Tenosolic Redoxic Hydrosols	Tall Shrubland to Low Open Woodland of Grevillea spp. Melaleuca spp. Lophostemon lactiflorus over annual Sorghum sp. Heteropogon triticeus

\*Noted that this data is from desktop database

**Table 12 Land Systems of the Project Area**

Location	Comp ID	Land system	Map unit	Class	Class description	Landform	Soil origin	Soil Asc	Vegetation*	ASS
<b>Section 5720 and Section 5711</b>	NORTH_250	Krans	Km	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Steep, dissected terrain forming the edge of deeply weathered plateau	Shallow lithosols and gravely yellow earths	Leptic rudosols and gravely yellow kandosols	Mid-high woodland of <i>E. tetradonta</i> , <i>E. miniate</i> , <i>C. bleeseri</i> , <i>Erythrophleum chlorostachys</i> , <i>E. tectifera</i> over tropical tall grass ( <i>Heteropogon triticus</i> , <i>Chrysopogon fallax</i> , <i>Sorghum spp</i> )	No occurrence of acid sulphate soils
<b>Section 5720 and Section 5711</b>		Littoral 1	Lit1	Tidal flats	Tidal mudflats and coastal floodplains with channels and estuaries; subject to tidal inundation; poorly drained clays and muds	Level tidal flats with channels and estuaries and minor dunes	Saline muds and grey cracking clays	Supratidal and intertidal hydrosols	Samphire, sedgeland, or mangrove low closed forest	Common occurrence of acid sulphate soils on tidal flats, coastal floodplains and some coastal sandplains

\*Noted that this data is from desktop database

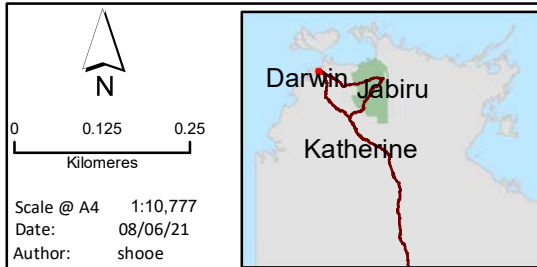


**Legend**

- Crowley Project Area
- 4c
- Land Unit 25k 6b
- 1c
- 2b1
- 9a
- 2b2
- 9b
- 9c

**Figure 2 Land Units 25k**





- Legend**
- Crowley Project Area
  - Land Systems**
  - Kay
  - Krans
  - Littoral

**Figure 3**  
 NT Land Systems



### **5.5.3 Soil Erosion and Sedimentation**

All soils in the Darwin region are susceptible to erosion because of the intense monsoonal rainfall and the structureless and sodic nature of the soils. Even very gentle slopes are prone to erosion if disturbed. Heavy wet season rains and the associated high volumes and velocities of surface water runoff that the project area receives makes disturbed areas more prone to accelerated soil erosion.

Construction activities such as earthworks at the end of the dry season or during the wet season could potentially result in areas of accelerated soil erosion along the road corridor where vegetation clearance and soil disturbance has occurred. Heavy rains could also result in the loss of fill material before it is completely compacted and stabilised.

Potential impacts associated with accelerated soil erosion include (Alt et al 2009):

- Loss of topsoil
- Accelerated erosion and deposition of soil into unwanted areas

Earthworks and clearing of vegetation will expose soil surfaces to water and wind elements. Wind erosion is possible particularly during the dry season. Water erosion is possible particularly during the wet season.

It is expected that some dirt may be deposited onto roads from truck tyres at the points where the road trains exit the site onto the existing road network.

### **5.5.4 Acid Sulphate Soils**

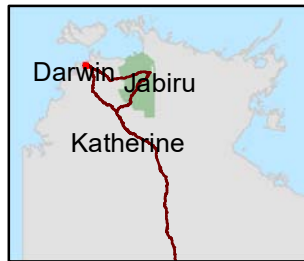
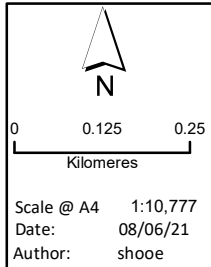
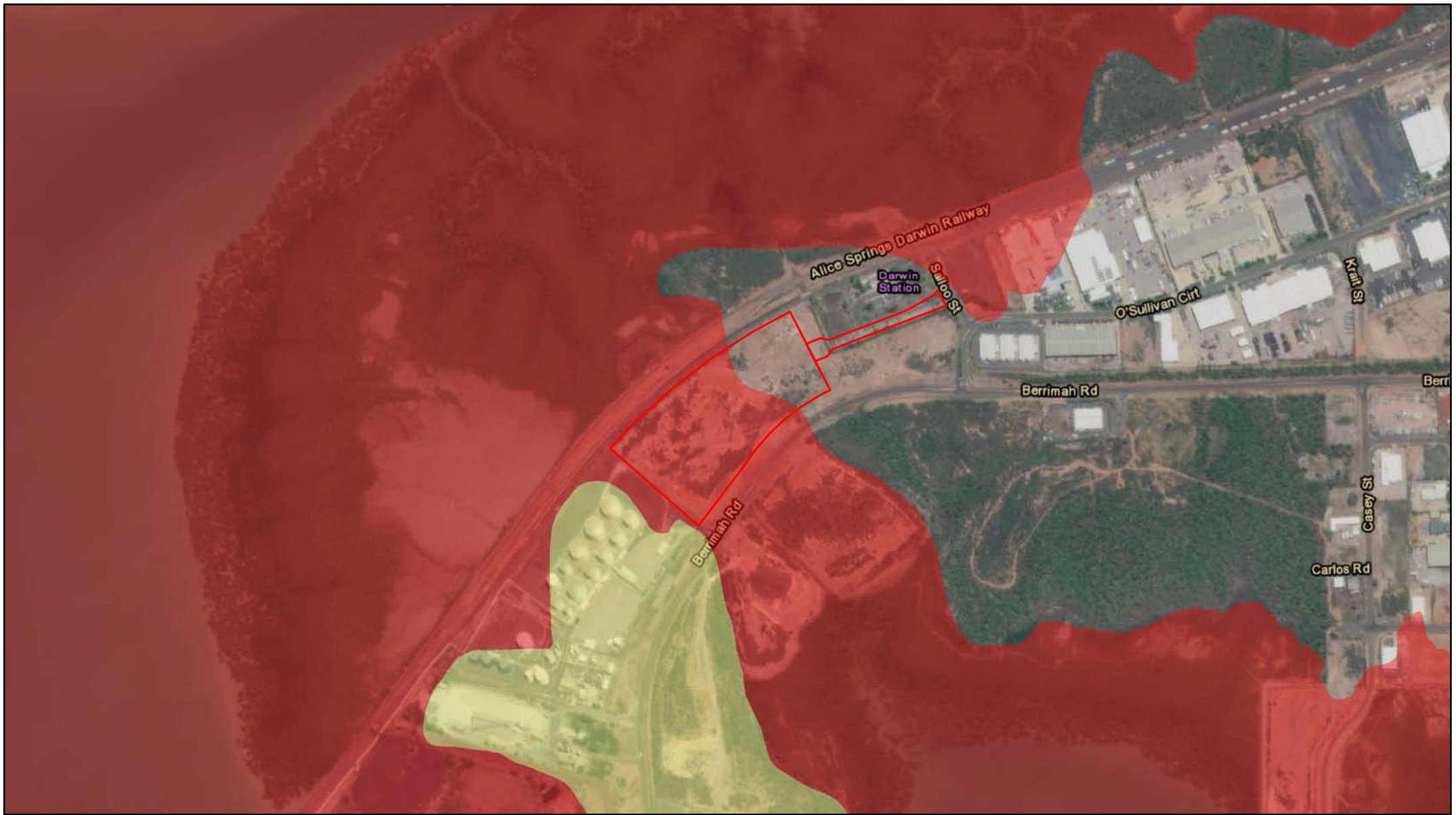
The western portion of Section 5720 overlies marine sediments that have the potential to be acid forming, which could pose an environmental issue should the sediments be excavated, dewatered or otherwise be exposed to air.

Review of the Australian Soil Resource Information System (ASRIS) National Acid Sulfate Soil probability mapping indicates a high probability of occurrence on the southwest side of the project area. The Project area is between 3 and 9 AHD and there is potential for acid sulfate soils to be encountered during excavation works (Figure 4).

### **5.5.5 Contaminated Soils**

Contaminated soil is soil that contains chemicals at levels that potentially pose a hazardous risk to human health and/or the environment. The chemicals are usually present in the land due to human activities, such as heavy industry or chemically intensive activities. As such, although contaminated land can occur anywhere, it is typically clustered in areas where humans undertake these activities. It is unlikely to encounter contaminated soils at this location.

The potential for unexploded ordnance (UXO) to be present in soil within the site is considered to be low given the site has previously been cleared, disturbed, excavated and filled for road construction and commercial development, therefore no UXO clearance survey is proposed to be undertaken prior to commencement of works.



**Legend**

- Crowley Project Area
- Acid Sulfate Soil Risk - Darwin Region 50k
- High Probability of Occurrence of Acid Sulfate Soils
- No Known Occurrence of ASS or PASS

**Figure 3**  
Acid Sulfate Soil Risk  
- Darwin Region 50k



## 5.6 Vegetation

Vegetation within the site includes grass, trees and native regeneration areas. The Project area has been previously cleared (pre-2005).

Whilst the Project area is located within the Darwin Harbour Site of Conservation Significance, there are no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the project area are mangroves which are located approximately 70m from the northern boundary of the Project area. This distance ensures an appropriate buffer is maintained.

Currently the site surface conditions consist of fill which is derived from mudstone/ phyllite, with some outcropping on the eastern section of the site. The majority of the site is unvegetated, with some clusters of shrubs and small trees (TTC 2021).

Review of the National Vegetation Information System (NVIS) indicates the majority of the site is mapped as Urban/Roads (Figure 5).

## 5.7 Fire

Northern Australia Fire Mapping indicates that the Project area has not been burnt in over 20 years. Fire is a natural and human induced occurrence in the area, and risk is prevalent during the drier months of the year (May to September). It is an integral component of much of the NT's ecosystems, as several species and vegetation communities have evolved and adapted to bushfire regimes.

Bushfires continue to occur throughout the NT, as controlled burns for fuel reduction and habitat management, Aboriginal land management practices, as deliberately lit fires, or as fires started by natural means (e.g., lightning strikes).

## 5.8 Hydrology

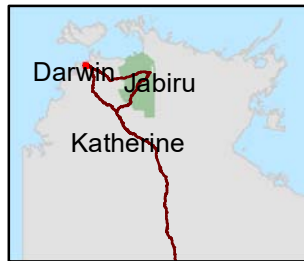
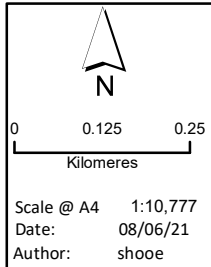
Section 5720 is a fully earth-worked site and has been designed to drain via overland flow to a sediment basin located adjacent to Berrimah Road, which discharges to an open drain flowing south-east through Part Section 5633 and discharging to the tidal creek adjacent to Section 5633.

No major rivers or creeks traverse the Project site. The proposed works are in the river basin areas of the Finniss, Howard and Elizabeth Rivers (DEPWS 2021). Due to the urban and peri-urban setting, a series of stormwater drainage systems and catchments are located in the Project area. There is a drainage line (stream) that is mapped to transect the site. Darwin Harbour is located to the northeast of the Project area.

Changes to the stormwater drainage of the site will be required to complete the project.

Whilst groundwater is not anticipated to be encountered during the works associated with the project, it should be noted that groundwater levels in Darwin fluctuate significantly throughout the seasons, generally due to soil permeability and seasonal rainfall patterns. It is possible for groundwater levels to rise to within a few metres of the ground surface during the wet season months.

Section 5720 and Section 5711 will be appropriately earth-worked and engineered to ensure that adequate stormwater drainage is provided, and any erosion and sedimentation minimised.



**Legend**

- Crowley Project Area
- Sparse samphire shrubland
- Closed forest
- Woodland
- Mid closed forest
- Urban/Roads

**Figure 5**  
 NIVIS 2007 Level 2



## **6 Project Site Selection Options and Alternatives**

### **6.1 Options for the project**

This Project is contingent upon several constraints including:

- The design and construction remaining within available funding
- Environmental clearances
- The proponent being awarded the contract to construct the facility
- The continued need by U.S. Department of Defence for a jet fuel storage facility in the Northern Territory.

The risk of these constraints holding up or stopping the project are considered to be low.

### **6.2 Alternatives for the project**

The area for this project at East Arm already is home to a bulk fuel storage facility. The Land Development Corporation (LDC) has several sections of land which have been reclaimed, earth-worked and flagged as fuel storage sections.

There is no other section of land as suitable for this project as the above assessed Section 5720 with access road on Section 5711.

## 7 Stakeholder Communication

Stakeholders are parties with an interest in the project who can potentially influence, or are influenced by, its development.

Potential stakeholders for the proposal are listed in Table 13.

**Table 13 Relevant Stakeholders**

Interest Group	Stakeholder
<b>Local / Northern Territory / Commonwealth Government</b>	<ul style="list-style-type: none"> <li>• City of Darwin Council</li> <li>• Palmerston City Council</li> <li>• Local electoral candidates</li> <li>• AAPA</li> <li>• NT Planning Commission</li> <li>• NT Environment Protection Authority (NT EPA)</li> <li>• DIPL Transport, Infrastructure and Planning</li> <li>• NT Police, Fire and Emergency Services (NT PFES)</li> <li>• NT Department of Health (DoH)</li> <li>• Power and Water Corporation (PWC)</li> <li>• NT Department of Environment, Parks and Water Security (DEPWS)</li> <li>• NT Heritage Council (Department of Tourism Sport and Culture)</li> <li>• Commonwealth Department of Defence</li> </ul>
<b>Nearby organisations and tenants</b>	<ul style="list-style-type: none"> <li>• Vopak Fuel Terminals (Darwin)</li> <li>• Global Resource Recovery</li> <li>• Northern Cement Darwin</li> <li>• Port of Darwin</li> <li>• RailOne</li> </ul>
<b>Indigenous Groups or Representation</b>	<ul style="list-style-type: none"> <li>• Aboriginal Areas Protection Authority</li> <li>• Northern Land Council</li> <li>• Larrakia Nation Aboriginal Corporation</li> </ul>
<b>Local Community</b>	<ul style="list-style-type: none"> <li>• Public / tourists</li> <li>• Adjacent Residences</li> <li>• Darwin and Palmerston Community</li> </ul>
<b>Media</b>	<ul style="list-style-type: none"> <li>• Local, regional and NT media sources</li> </ul>

## 8 Environmental Impact Assessment

The Northern Territory Environment Protection Authority (NT EPA) is currently responsible for administering proposed actions with the potential to have a significant effect on the environment under the *Environmental Protection Act 2019* (EP Act). The NT EPA's jurisdiction extends across the terrestrial and marine components of the project.

The EP act sets out referral triggers, which require the proponent of a project to refer the project to the NT EPA for assessment. Referral can also be triggered if the project is likely to result in a significant impact. This is informed by the environmental objectives, declared by the NT Minister.

### 8.1 Australian Government - Environment Protection and Biodiversity Conservation Act 1999 (Cwth)

The *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) is Australia's national environment law. The EPBC Act requires the assessment and approval of projects that are likely to have a significant impact on one or more of the defined MNES.

Should AWE advise that a referral would be prudent, the referral process is as follows:

Once the referral is submitted, via the Department of the Agriculture, Water and the Environment, it is exhibited for 10 business days. The Minister (or her delegate) then has 10 business days to make a decision on whether the project is:

- A controlled action, requiring further assessment.
- Not a controlled action, with no further assessment required.
- Not a controlled action in a particular manner, with no further assessment required as long as the project is undertaken in accordance with conditions.
- Clearly unacceptable.

If the project is deemed to be a controlled action, the Minister or her delegate will also determine which assessment approach is required. It is unlikely that this project will be determined to impact on MNES, however to de-risk all aspects of the referral process, it is recommended that referral to AWE be considered or at a minimum thorough discussions held with AWE to gauge their likely interest.

### 8.2 Environmental Factors and Objectives

#### 8.2.1 Presence/absence of environmental values

The NT EPA has developed a framework for the assessment of environmental impact. This approach uses 13 environmental factors to provide a systematic approach to organising environmental information and to establish clear benchmarks based on values.

The NT EPA has produced a guideline on environmental factors and objectives, which is designed to provide a systematic way to characterise information about the environment to enable effective environmental impact assessment and reporting.

Environmental factors are aspects of the environment that may be impacted by a proposed action. Table 15 includes a preliminary assessment on whether or not the environmental factors may be impacted by the proposed works.

There is potential for the project to result in impacts to a number of the NT EPA's environmental factors, as outlined in Table 14.

**Table 14 Summary of NT EPA environmental factors with potential to be impacted by the proposed action**

Theme	NT EPA Factor	Potential to have a significant impact?
<b>LAND</b>	Landforms	No
	Terrestrial environmental quality	No
	Terrestrial ecosystems	No
<b>WATER</b>	Hydrological processes	No
	Inland water environmental quality	No
	Aquatic ecosystems	No
<b>SEA</b>	Coastal processes	No
	Marine environmental quality	No
	Marine ecosystems	No
<b>AIR</b>	Air quality	No
	Atmospheric processes	No
<b>PEOPLE</b>	Community and economy	No
	Culture and heritage	No
	Human health	No

**Table 15 Environmental Factors, Objectives and Indicative Environmental Values and Sensitivities Potentially Relevant to the Proposed Action**

Environmental factor and objective	Does the proposed action have the potential to significantly impact on environmental values or sensitivities?			
	Construction	Construction comments	Operations	Operations Comments
<b>LAND</b>				
<b>Landforms</b>				
Objective: Conserve the variety and integrity of distinctive physical landforms so that environmental values are protected.	No	Construction of the Project will not cause significant impact on the variety of integrity of distinctive physical landforms	No	Ongoing operation of the Project will not cause significant impact on the variety of integrity of distinctive physical landforms
<b>Terrestrial environmental quality</b>				
Objective: Protect the quality and integrity of land and soils so that environmental values are supported and maintained	No	<p>All soils in the Darwin region are susceptible to erosion because of the monsoonal rainfall and the structureless and sodic nature of the soils. Even very gentle slopes are prone to erosion if disturbed. Heavy Wet Season rains and the associated high volumes and velocities of surface water runoff that the Project area receives makes disturbed areas more prone to accelerated soil erosion.</p> <p>Due to the nature of the Project, topsoils and subsoils will be disturbed during construction. Construction activities such as earthworks at the end of the Dry Season or during the Wet Season could potentially result in areas of accelerated soil erosion along the road corridor where vegetation clearance and soil disturbance has occurred. Heavy rains could also result in the loss of fill material before it is completely compacted and stabilised.</p> <p>Construction activities will be managed to minimise the size, extent, duration and likelihood of erosion. If possible, the bulk of the earthworks activities will be programmed during the Dry Season to eliminate the potential for accelerated soil erosion from storm events. Stabilisation, rehabilitation, treatment of ASS and revegetation of disturbed areas will be undertaken progressively to ensure that erosion events are also minimised in the Wet Seasons as far as practicable.</p>	No	<p>Permanent erosion controls form part of the design of the Project and will remain in place during operation.</p> <p>There will be no significant impact to the biological processes that depend on soil quality during operation of the project.</p>
<b>Terrestrial ecosystems</b>				
Objective: Protect the NT's flora and fauna so that environmental values including biological diversity, ecological integrity ecological functioning.	No	<p>Whilst the Project area is located within the Darwin Harbour Site of Conservation Significance, there are no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the project area are mangroves which are located approximately 70m from the northern boundary of the Project area. This distance ensures an appropriate buffer is maintained.</p> <p>Construction of the Project will not disturb or cause significant impacts to sensitive or significant vegetation or buffers.</p> <p>No locally endemic species or species with restricted habitat have been identified within the Project area as part of the desktop assessment. A restricted flora species, <i>Cleome insolata</i>, has been recorded within a 5km radius of the Project area, however, is unlikely to be present on site due to restricted habitat requirements. As such, it is unlikely for any locally endemic species or species with restricted habitat to be significantly impacted by the construction of the Project.</p> <p>A number of weed species, including Declared weeds (under the WM Act) and Weeds of National Significance (WoNS) are present on site and may be spread by machinery and equipment. Weeds may also be introduced into the Project site during construction and subsequently colonise disturbed ground and/or spread into areas that were previously weed free. Weeds compete with regenerating native plants.</p> <p>During construction, weed management within the Project area will be actively managed by the Construction Contractor.</p> <p>The introduction and movement of pest species resulting from construction activities is not anticipated to be a significant issue.</p> <p>As such, there will not be a significant impact associated with introduced and/or invasive species of flora or fauna.</p> <p>No species of social, cultural, livelihood and/or economic significance have been identified within the Project area as part of the desktop assessment, as such it is unlikely for these to be significantly impacted by the construction of the Project.</p>	No	<p>Ongoing operation of the Project will not result in significant impact to 'sensitive or significant' vegetation or buffers.</p> <p>The integrity of terrestrial ecosystems and the ecological services they provide will not be significantly impacted by the operation of the Project.</p> <p>The biological and functional diversity of terrestrial ecosystems in the Project area will not be significantly impacted by the operation of the Project.</p> <p>Following completion of construction, ongoing operation of the Project will not result in significant impact to the food supply of native fauna species.</p>
<b>WATER</b>				
<b>Hydrological processes</b>				
Objective: Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	No	<p>There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area.</p> <p>Changes to the natural catchment from the creation of hardstand surfaces through construction and operation of the Project. This may result in a minor increase in the volume of water entering waterways during the wet season.</p> <p>The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives of Surface Water. There will be no extraction of water from Darwin Harbour for construction of the Project. Construction activities associated with the Project will not cause significant impacts to the declared beneficial uses of the area.</p> <p>The Project will not interact with groundwater including regional scale aquifers during construction. The Project will not cause significant impacts to current or potential water supplies during construction.</p>	No	<p>Changes to the natural catchment from the creation of hardstand surfaces may result in a minor increase in the volume of water entering waterways during the wet season during operation of the project.</p> <p>Operation of the Project will not cause significant impacts to the declared beneficial uses of the area.</p> <p>The Project will not interact with groundwater including regional scale aquifers during operation. The Project will not cause significant impacts to</p>

Environmental factor and objective	Does the proposed action have the potential to significantly impact on environmental values or sensitivities?			
	Construction	Construction comments	Operations	Operations Comments
		There are no culturally important water features or other features affected by water level within or in the vicinity of the Project area that will be significantly impacted by the construction of the Project.		current or potential water supplies during operation. There are no culturally important water features or other features affected by water level within or in the vicinity of the Project area that will be significantly impacted by the operation of the Project.
<b>Inland water environmental quality</b>				
Objective: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	No	There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. Changes to the local catchment from the creation of additional hardstand surfaces through construction of the Project may occur. This is unlikely to impact on water quality. A number of management and mitigation measures (i.e., spill kits, appropriately bunded chemical storage areas, etc.) will be in place throughout construction to minimise the likelihood of impacts to the quality of surface water on and surrounding the Project area. With the proposed management and mitigation measures implemented during construction, the likelihood of a significant impact on inland environmental surface water quality is considered to be low. There are no water supply reservoirs nor is the Project located within a catchment used for water supply. The Project will not interact with groundwater including regional scale aquifers. There are no drinking water reservoirs nor is the Project located within a catchment used for drinking water. The Project will not interact with groundwater. There are no culturally important water features located within or in the immediate vicinity to the Project area.	No	Ongoing operation of the Project will not cause additional impacts to the quality of water in surface water features when compared to the current use of the area. The potability/drinkability of water will not be significantly impacted by the operation of the Project. No culturally important water features will be significantly impacted by the operation of the Project. Operation of the project will not cause significant impact to the present and/or future uses and users of water.
<b>Aquatic ecosystems</b>				
Objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	No	There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. No aquatic threatened species have been identified within the Project area as part of the desktop assessment. The construction of the Project will not cause a significant impact on aquatic threatened species. There are no groundwater dependent ecosystem/s within or surrounding the Project area. There are no RAMSAR wetlands within or neighbouring the Project area. No aquatic species of social, cultural, livelihood and/or economic significance have been identified within the Project area as part of the desktop assessment, as such it is unlikely for these to be significantly impacted by the construction of the Project. There are no significant aquatic ecosystems within the project area. There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. The integrity of aquatic ecosystems and the ecological services they provide will not be significantly impacted by the construction of the Project.	No	Operation of the Project will not have a significant impact on threatened aquatic species. Ongoing operation of the Project will not result in significant impacts to the biological and/or functional diversity of aquatic ecosystems.
<b>SEA</b>				
<b>Coastal processes</b>				
Objective: Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	No	Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	No	Operation of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.
<b>Marine environmental quality</b>				
Objective: Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.	No	Accidental release of contaminants including hydrocarbons and/or ore from collisions, malfunctions, general operations causing spills and leaks during loading, unloading and shipping and impacting marine environmental quality. Soil loss from land clearing causing sedimentation to marine environment. Disturbance of PASS soils during construction works. All buildings to be built according to Australian Standards. Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	No	Increased turbidity from vessel motors
<b>Marine ecosystems</b>				
Objective: Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning	No	Dust deposition within coastal zones to marine ecosystems Loss of marine habitat from increased sedimentation from coastal erosion. Acid sulphate soils exposed during construction.	No	The tanks are to be bunded and built to Australia Standards in accordance with any measures to contain leaks, spills or failure to tank containers.

Environmental factor and objective	Does the proposed action have the potential to significantly impact on environmental values or sensitivities?			
	Construction	Construction comments	Operations	Operations Comments
		The impacts from construction are short term and minimal on marine ecosystems.		Pipeline delivery is via existing NTG owned pipe rack between the wharf and the BFSF, designated for fuel and acid transfer. On and offloading facility on wharf is built to Australian Standard and is designed to eliminate the risk of spills. Connection points are on the delivery or receiving ship. Oil spill response management sits with Darwin Port. The following link takes you to the Darwin Port Oil Spill Contingency Plan SOP:  <a href="http://darwinport.com.au">DP OSCP (darwinport.com.au)</a>
<b>AIR</b>				
<b>Air quality</b>				
Objective: Protect air quality and minimise emissions and their impact so that environmental values are maintained.	No	The only anticipated emissions to air are in the form of dust during the construction phase of the Project. Dust caused via the movement of vehicles and transport of material to and from the site can result in a reduction in air quality. Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. A number of management and mitigation measures will be implemented during the construction phase to ensure that the impact to air quality is minimised.	No	Operation of the Project will not cause the chemical, physical and biological characteristics of air to be impacted significantly.
<b>Atmospheric processes</b>				
Objective: Minimise greenhouse gas emissions so as to contribute to the NT Government's aspirational target of achieving net zero greenhouse gas emissions by 2050.	No	Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction. Onsite conditions that may affect the amount of impact caused by carbon dioxide emissions include the machinery involved, the time and length of works, and the location of resources. The impact of these exhaust emissions during construction is negligible and unmeasurable and will not cause a significant increase in contribution to the NT's greenhouse gas emissions.	No	Operation of the Project will not cause a significant increase in traffic and as such will not cause a significant increase in contribution to the NT's greenhouse gas emissions.
<b>PEOPLE</b>				
<b>Community and economy</b>				
Objective: Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	No	There will be no significant impact to dwellings, homelands, communities, towns and suburbs where people live as the result of construction of the Project. There will be no significant impact to healthy lifestyles associated with construction of the Project. Existing industries such as agriculture, pastoralism, tourism, fisheries will not be significantly impacted by the construction of the Project.	No	There will be no significant impact to dwellings, homelands, communities, towns and suburbs where people live associated with operation of the Project. Ongoing operation of the Project will not cause significant impact to community.
<b>Culture and heritage</b>				
Objective: Protect sacred sites, culture and heritage.	No	AAPA certificates cover the project site registered by other companies for previous works. No registered sacred sites or restricted work areas (RWA) are located within the proposed construction footprint of the Project, or within close proximity to the Project boundary. The NT Heritage Branch confirmed no heritage places or Aboriginal archaeological sites are located within the Project area. Due to large parts of the proposed Project area having been subject to previous clearing, the archaeological potential of the area is greatly reduced. Works will not occur within, or cause significant impact to, a world heritage area.	No	Ongoing operation of the Project will not cause significant impact on sacred sites, or heritage
<b>Human health</b>				
Objective: Protect the health of the Northern Territory population.	No	There are no drinking water reservoirs nor is the Project located within a catchment used for drinking water. There will be no significant impacts to drinking water associated with the construction of the Project. Dust caused via the movement of vehicles and transport of material to and from the site during construction may result in a reduction in air quality. Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. A number of management and mitigation measures will be implemented during the construction phase to ensure that the impact to air quality is minimised.	No	There are no drinking water reservoirs nor is the Project located within a catchment used for drinking water. There will be no significant impacts to drinking water associated with the ongoing operation of the Project. There will be no significant impacts to air quality that will impact on the health of the Northern Territory Population that will result from the ongoing operation of the Project.

Environmental factor and objective	Does the proposed action have the potential to significantly impact on environmental values or sensitivities?			
	Construction	Construction comments	Operations	Operations Comments
		<p>The works will involve bitumen spray sealing and line marking. Sealing works involves the mixing of a number of chemicals and aggregate at high temperatures, resulting in the release of strong-smelling chemical vapours, which may result in localised odours. These odours disburse in a short amount of time.</p> <p>Construction planning and methods will include consideration of use chemicals with less odour and application of bitumen and spray paint when wind direction is away from the nearest human sensitive receptors.</p> <p>The proposed works are located within close proximity to Darwin Harbour and areas of mangrove habitat which can often be a haven for biting insects. Depressions and irregularities in the surface created as a result of works can potentially create the ponding on water onsite. This has the potential to create areas suitable for mosquito breeding sites.</p> <p>Appropriate biting insect management measures will be implemented during construction, consistent with Guidelines for Preventing Mosquito Breeding Associated with Construction Practice near Tidal Areas in the NT (DoH 2017), and as such no biting insect habitat is anticipated to be created.</p> <p>To minimise the impacts from biting midges, contractors will be encouraged to wear protective clothing, such as long sleeved, collared shirts and long pants and use repellents. Barrier insecticides may also be used to lower adult biting midge numbers around construction areas if considered required.</p>		<p>There will be no significant impacts to biting insects associated with the ongoing operation of the Project.</p>

## 9 Land

### 9.1 Matters of National Environmental Significance

Under the EPBC Act an action will require approval from the Federal Minister if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES).

The MNES are:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'RAMSAR' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013a) outline that an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population of a species
- reduce the area of occupancy of the species
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of the species
- disrupt the breeding cycle of a population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

A search of The EPBC Act Protected Matters Report (generated 19/02/2021), covering a 5km buffer for the site (Appendix C), highlighted some of the potential MNES (Table 16).

#### Areas of Environmental Significance

Darwin Harbour is a working harbour that is listed as a wetland of national significance in the Directory of Important Wetlands in Australia and has international significance rating due to there being 15 threatened species reported as being found at the Harbour. Conservation initiatives, such as a Regional Plan of Management and ecosystem monitoring, have been developed and established (Harrison et al., 2009).

**Table 16 Matters of National Environmental Significance (5km Buffer).**

Matters of National Environmental Significance	Quantity
World Heritage Properties	None
National Heritage Properties	None
Wetlands of International Importance	None
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Threatened Ecological Communities	None
Threatened Species	38
Migratory Species	63
Commonwealth Land	Australian Government Solicitor Defence – HMAS Coonawarra (Berrimah)
Commonwealth Heritage Places	None
Listed Marine Species	99
Whales and Other Cetaceans	12
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None
State and Territory Reserves	Charles Darwin National Park
Regional Forest Agreements	None
Nationally Important Wetlands	Port Darwin
Key Ecological Features (Marine)	None

## 9.2 Likelihood of Occurrence

A number of threatened flora and fauna and/or weed and pest species have been identified as potentially occurring on-site or previously recorded within 5 km of the proposed works. Each species likelihood of occurrence has been rated based on known species requirements, habitat preference etc.

**Table 17 Level of Likelihood**

Descriptor	Likelihood of Occurrence
Almost Certain	> 90% chance of occurring on-site
Likely	60-90% chance of occurring on-site
Possible	30-60% chance of occurring on-site
Unlikely	10-30% chance of occurring on-site
Rare	< 10% chance of occurring on-site

Abbreviations under the *Territory Parks and Wildlife Conservation (TPWC) Act 1976* and the EPBC Act include:

- NT = Near Threatened
- VU = Vulnerable
- EN = Endangered
- CR = Critically Endangered

## 9.3 Flora

### 9.3.1 Threatened Flora Species

A desktop assessment was undertaken reviewing the EPBC Act Protected Matters Report and DEPWS NR Maps Database, listed species in Darwin Harbour SoCS Factsheet for threatened flora species within a 5 km radius of the Project area. A summary of threatened flora species with the potential to occur within the Project area are listed in Table 18.

The EPBC Act Report (Appendix C) indicates no threatened ecological communities or threatened flora species potentially occurring within 5 km of the Project site.

NR Maps identified two threatened flora species to occur within the Project Area, however neither of these was recorded within 1km of the Project site.

The NT Flora Atlas results (accessed 06/06/21) indicated:

- no records of threatened flora are within the construction footprint.
- no threatened flora species recorded within 1 km of the Project area

**Table 18 Flora Species of Conservation Significance**

Common Name	Scientific Name	Status		Description	Likelihood
		TPWC Act	EPBC Act		
Armstrong's Cycad	<i>Cycas armstrongii</i>	Not listed	VU	Medium-sized Cycad growing up to 6m tall with a slender trunk that is approximately 6-12cm in diameter. It is endemic to the NT. Whilst this species is locally abundant less than 1% of the population occurs in conservation reserves. The classification status as "vulnerable" has been applied as a precautionary measure (Kerrigan et. al. 2006).	Unlikely
Cleome	<i>Cleome insolata</i>	Not listed	VU	An annual herb with ascending to weakly erect branches to c. 40 cm long. Has been recorded growing in inundated sedgeland on silty loam with an overlay of laterite gravel, but also on the adjoining roadside verge.	Unlikely

### 9.3.2 Sensitive and/or significant vegetation

Whilst the Project area is located within the Darwin Harbour Site of Conservation Significance, there is no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the project area are mangroves which are located approximately 70 m from the southwestern boundary of the Project area. This distance ensures an appropriate buffer is maintained.

Construction of the Project will not disturb or cause significant impacts to sensitive or significant vegetation or buffers.

### 9.3.3 Weeds

There are three main categories of noxious weeds defined under the *Weeds Management Act 2001* (WMA), which include:

- Class A – To be eradicated;
- Class B – Growth and spread to be controlled; and
- Class C – Not to be introduced to the Northern Territory. All Class A and B weeds are also considered to be Class C weeds.

In addition to this, thirty-two Weeds of National Significance (WoNS) have been agreed by Australian Governments based on an assessment process that prioritized these weeds based on their invasiveness, potential for spread and environmental, social and economic impacts. Consideration was also given to their ability to be successfully managed.

A desktop assessment was undertaken reviewing the EPBC Act Protected Matters Report (Appendix C) and DEPWS NR Maps which indicated 84 weed species declared under the WM Act occur or have the potential to occur within 5km of the works. Of these, 14 have the potential to occur within 1 km of the works and where three are WM Act declared and one is WoNS declared, WoNS are listed in Table 19.

**Table 19 Potential Weed Species**

Common Name	Scientific Name	Status		DEPWS	EPBC Act Report
		Declared under NT WM Act	WoNS		
Gamba Grass	<i>Andropogon gayanus</i>	A/B (zoned)	Yes	Recorded within project area	Species or species habitat likely to occur within area

#### 9.4 Fauna

Results of the EPBC Act Protected Matters Report (Appendix C), the DEPWS NR Maps database and the Darwin Harbour SoCS Factsheet for threatened species records within 5km of the works area are listed in Table 20.

A total of 35 species listed as threatened under the TPWC Act and/or EPBC Act may potentially occur within 5 km of the Project. The 35 threatened species includes three reptiles, 11 mammals, 15 birds, and six aquatic species. Threatened sharks/fish, whales and crustaceans have not been included in the summary due to the lack of water bodies within the project area.

It should be noted that the results of these searches may not fully characterise the potential diversity of the proposed work area, due to the area being either under-surveyed historically or difficult to detect. Records covering the proposal area may include species (particularly bird species) that are migratory or present in the general area but do not present in the study area due to lack of suitable habitat.

No important migratory species population, or habitat for an important population, is known to be present in the Project area.

Of the 35 species listed only five may potentially occur within 1km of the Project.

**Table 20 Potential Threatened Species**

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood
<b>Reptiles</b>					
<b>Mitchell's Water Monitor</b>	<i>Varanus mitchelli</i>	Not listed	VU	This species is widespread across the Top End of the NT, generally in the vicinity of permanent freshwater.	Unlikely – There have been no records of this species within 5km of project area. The species may occur adjacent to waterways in the leases and may use suitable habitat in the project area from time to time. There will be a lack of suitable habitat during the dry season when all of the waterways in the area are completely dry.
<b>Plains Death Adder</b>	<i>Acanthophsis hawkei</i>	VU	VU	Prefers flat, treeless, crackingsoil riverine floodplains	Unlikely – Whilst the species has historically been recorded within 5km of project area, no cracking black soil plains or coastal plains habitat is present in the Project area.
<b>Yellow-spotted monitor*</b>	<i>Varanus panoptes</i>	Not listed	VU	This species has been recorded across most of the Top End and the Gulf Region in a variety of habitats, including coastal	Unlikely – The species has been recorded within 5km of project area. The species may use suitable habitat in the project area from time to time. There will be a lack of suitable habitat during the dry season when all of the waterways in the area are completely dry.
<b>Mammals</b>					
<b>Bare-rumped Sheath-tailed Bat</b>	<i>Saccolaimus saccolaimus</i>	VU	Not listed	Open Pandanus woodland fringing the and eucalypt tall open forests. It roosts in tree hollows and caves.	Unlikely - no suitable habitat within the project area
<b>Black-footed Tree-rat</b>	<i>Mesembriomys gouldii</i>	EN	VU	Occurs in the Top End of the NT in tropical woodlands and open forests in coastal areas.	Unlikely - no suitable habitat within the project area
<b>Brush-tailed Rabbit-rat</b>	<i>Conilurus penicillatus</i>	VU	EN	The preferred habitat is eucalypt tall open forest, has been known to also occur on coastal grasslands with scattered large Casuarina equisetifolia trees, beaches, and stunted eucalypt woodlands on stony slopes. It shelters in tree hollows, hollow logs and, less frequently, in the crowns of pandanus or sandpalms.	Unlikely – Suitable habitat may be available; however, this species appears to be restricted to the Coburg Peninsula and some islands.
<b>Fawn Antechinus</b>	<i>Antechinus bellus</i>	VU	EN	Occurs in savannah woodland and tall open forest of the Top End of the NT, shelters in tree hollows and fallen logs, shows a	Possible - the species may use suitable habitat in the project area from time to time

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood
				preference for areas exposed to cooler and less frequent fires.	
<b>Ghost Bat</b>	<i>Macroderma gigas</i>	VU	Not listed	The distribution of this species is influenced by the availability of suitable caves and mines for roost sites. Daytime roosts may change seasonally. One of the largest known colonies occurs in a series of gold mine workings at Pine Creek in the Northern Territory.	Unlikely - no suitable habitat within the project area
<b>Nabarlek (Top End)</b>	<i>Petrogale concinna</i>	EN	VU	Nabarleks are restricted to rocky areas, especially on steep slopes, with large boulders, caves and crevices. They may move from these to forage in adjacent flat areas.	Unlikely - no suitable habitat within the project area
<b>Northern Brush-tailed Phascogale</b>	<i>Phascogale pirata</i>	VU	EN	Most records are from tall open forests dominated by <i>Eucalyptus miniata</i> and <i>E. tetrodonta</i> .	Unlikely – the species is unlikely to be present in light of recent reductions in range
<b>Northern Brush-tailed Possum</b>	<i>Trichosurus vulpecula arnhemensis</i>	Not listed	VU	Most records are from tall open forests dominated by <i>Eucalyptus miniata</i> and <i>E. tetrodonta</i> .	Unlikely – the species is unlikely to be present in light of recent reductions in range
<b>Northern Quoll</b>	<i>Dasyurus hallucatus</i>	EN	CE	This species formerly occurred across much of northern Australia, from south-eastern Queensland to the south-west Kimberley, with a disjunct population in the Pilbara. The most suitable habitats appear to be rocky areas.	Unlikely – whilst the species has historically been recorded within 5km of project area the species is unlikely to be present in light of recent reductions in range
<b>Pale Field Rate</b>	<i>Rattus tunneyi</i>	Not listed	VU	Found in the higher rainfall areas of northern Australia, extending from the Kimberley to south-eastern Queensland. Including the Top End of the NT. It was once widespread and found in dense vegetation along creeks.	Possible – The species has been recorded within 5km of project area and suitable habitat may occur.
<b>Water Mouse / False Water Rat</b>	<i>Xeromys myoides</i>	VU	Not listed	Mangrove forests, freshwater swamps and floodplain saline grasslands.	Unlikely – the species has not been recorded within 5km of the Project area and there is no suitable habitat on the leases.
<b>Birds</b>					

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood
<b>Asian Dowitcher</b>	<i>Limnodromus semipalmatus</i>	Not listed	VU	Migratory species. In the NT they are generally solitary or in small flocks and seek out sheltered coasts. They feed on intertidal mudflats.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Australian Painted Snipe</b>	<i>Rostratula australis</i>	VU	VU	Shallow, vegetated, freshwater swamps, claypans or inundated grassland	Unlikely – No suitable habitat within the project area
<b>Bar-tailed Godwit (baueri)*</b>	<i>Limosa lapponica</i>	VU	VU	Migratory species. In the NT they are rarely found far from the coast. They forage on intertidal mudflats or in shallow water	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Curlew Sandpiper*</b>	<i>Calidris ferruginea</i>	CE	VU	Fresh and brackish water, can include ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Eastern Curlew*</b>	<i>Numenius madagascariensis</i>	CE	VU	They are most common in mangrove areas but will also forage on intertidal flats and saltmarshes.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Gouldian Finch</b>	<i>Erythrura gouldiae</i>	EN	VU	The species forages in open woodland with groundcover of <i>Sorghum</i> and other annual and perennial grasses. Nests in hollows in <i>Eucalyptus tintinnans</i> .	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Great Knot</b>	<i>Calidris tenuirostris</i>	CR	VU	Migratory species. In the NT birds settle on large sheltered intertidal mudflats and sandflats, especially in mangrove areas.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Greater Sand Plover*</b>	<i>Charadrius leschenaultii</i>	VU	VU	In the NT, Greater Sand Plovers have been recorded from most of the coastline. In the NT they forage along sandy beaches and sheltered mudflats and have been reported them occasionally also using inland saline wetlands but always close to the coast.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Grey Falcon</b>	<i>Falco hypoleucos</i>	VU	VU	Occurs in lightly timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500mm.	Unlikely – Has not been recorded within 5km of the project area and suitable habitat does not occur within the Project area.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood
<b>Lesser Sand Plover</b>	<i>Charadrius mongolus</i>	EN	VU	Migratory species. In the NT the birds forage on sheltered mudflats, sandy beaches, estuaries and mangroves. They have also been reported to use inland saline wetlands occasionally but always close to the coast.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Masked Owl (mainland Top End)</b>	<i>Tyto novaehollandiae kimberli</i>	VU	VU	Occurs mainly in eucalypt tall open forests (especially those dominated by Darwin woollybutt <i>Eucalyptus miniata</i> and Darwin stringybark <i>E. tetradonta</i> ), but also roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands. Although it may roost in dense foliage, it more typically roosts, and nests, in tree hollows.	Unlikely - no suitable habitat within the project area
<b>Partridge Pigeon</b>	<i>Geophaps smithii</i>	VU	VU	Occurs in open forest and woodland dominated by <i>Eucalyptus tetradonta</i> and <i>E. miniata</i> with a structurally diverse understorey.	Possible - The species has been recorded within 5km of project area and may use suitable habitat in the project area from time to time
<b>Red Gosshawk</b>	<i>Erythrotriorchis radiatus</i>	VU	VU	Forest and woodland with a mosaic of vegetation types, including eucalypt woodland, open forest, gallery rainforest, swamp sclerophyll forest and rainforest margins.	Unlikely - no suitable habitat within the project area
<b>Red Knot</b>	<i>Calidris canutus</i>	EN	VU	Migratory species. In the NT birds settle on large sheltered intertidal mudflats and sandflats and are rarely encountered far from the coast.	Unlikely – Whilst the species has been recorded within 5km of project area, no suitable habitat within the project area
<b>Yellow Chat (Alligator Rivers)</b>	<i>Epthianura crocea tunneyi</i>	EN	EN	Alluvial coastal and sub coastal grassy floodplains, primarily near floodplain depressions and channels. Reported on tall grasslands and samphire shrublands (on coastal salt pans).	Unlikely - no suitable habitat within the project area
<b>Aquatic</b>					
<b>Flatback Turtle</b>	<i>Natator depressus</i>	VU	DD	Flatback Turtles frequent the waters of Darwin Harbour but the lack of sandy	Recorded within 5km of project area, however no appropriate habitat within the project area.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood
				beaches within the Harbour inhibits nesting activity.	
<b>Green Turtle</b>	<i>Chelonia mydas</i>	VU	NT	Green Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	Recorded within 5km of project area, however no appropriate habitat within the project area.
<b>Hawksbill Turtle</b>	<i>Eretmochelys imbricata</i>	VU	VU	Hawksbill Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	Recorded within 5km of project area, however no appropriate habitat within the project area.
<b>Loggerhead Turtle</b>	<i>Caretta Caretta</i>	VU	EN	Loggerhead Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	Recorded within 5km of project area, however no appropriate habitat within the project area.
<b>Leatherback Turtle</b>	<i>Dermochelys coriacea</i>	CE	EN	Leatherback Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	Recorded within 5km of project area, however no appropriate habitat within the project area.
<b>Olive Ridley Turtle</b>	<i>Lepidochelys olivacea</i>	VU	EN	Olive Ridley Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	Recorded within 5km of project area, however no appropriate habitat within the project area.

\*May potentially occur within 1km of the Project.

## 9.5 Pest Species

Results of the desktop searches of EPBC Act Protected Matters Report (Appendix C), DEPWS NR Map and SoCS Factsheets indicate that several pest species are likely to occur within 5 km of the location of the works, as listed in Table 21.

**Table 21 Potential Pest Species**

Common Name	Scientific Name
<b>Asian House Gecko</b>	<i>Hemidactylus frenatus</i>
<b>Black Rat</b>	<i>Rattus rattus</i>
<b>Cane Toad</b>	<i>Rhinella marina</i>
<b>Cat</b>	<i>Felis catus</i>
<b>Cow</b>	<i>Bos taurus</i>
<b>Common Starling</b>	<i>Sturnus vulgaris</i>
<b>Dog</b>	<i>Canis lupus familiaris</i>
<b>Eurasian Tree Sparrow</b>	<i>Passer montanus</i>
<b>Flowerpot Blind Snake</b>	<i>Ramphotyphlops braminus</i>
<b>Horse</b>	<i>Equus caballus</i>
<b>House Mouse</b>	<i>Mus musculus</i>
<b>House Sparrow</b>	<i>Passer domesticus</i>
<b>Mourning Gecko</b>	<i>Lepidodactylus lugubris</i>
<b>Pig</b>	<i>Sus scrofa</i>
<b>Rock Pigeon, Rock Dove</b>	<i>Columba livia</i>
<b>Spotted Dove</b>	<i>Spilophelia chinensis</i>
<b>Water Buffalo</b>	<i>Bubalus bubalis</i>

## 10 Water

### 10.1 Surface water

There are no rivers, lakes, wetlands (including RAMSAR wetlands), swamps, creeks, billabongs, floodplains or mangroves located within the Project area. Intermittent streams and drainage lines do transect parts of the Project area. These ultimately drain towards and into Darwin Harbour to the southwest of the project area.

The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives of Surface Water. There will be no extraction of water from Darwin Harbour for construction of the Project.

Post-construction, the local water flow will be altered slightly from existing stormwater drainage. Changes to the natural catchment of the Project area may occur from the creation of hardstand surfaces through construction and operation of the Project.

Drainage design of the road such as table drains and swales will collect stormwater and may aid in reducing the flow of the water to allow sediment and other materials to settle out from the water flow.

During construction bunded chemical containment and fuel/oil storage areas, and appropriate minor maintenance area for plant and equipment will be established.

A spill response kit will be available at the construction area the contractor is to ensure that appropriately trained personnel will be on site.

### 10.2 Stormwater

The BFSF will involve the storage and processing of significant quantities of petroleum compounds, which could potentially contaminate soil and water resources should any spills occur either through gradual leaks or through sudden accidents. To mitigate the risk of these impacts, the BFSF will have sufficient containment systems to retain petroleum spills as well as accumulated rainfall during peak storm events. The depth of rainfall to be contained will be determined through an assessment of spill risk, rainfall conditions and response timeframe. The system will include the release of onsite water to an oil-water separate before release into the drainage system.

The containment systems will be provided for all areas at risk of spills of petroleum or other hazardous materials, including all process areas, pipelines, any loading and unloading areas, and all storage tanks for feedstock, intermediate products, products, wastes and process chemicals (e.g., acids or caustics). These areas will be contained within bunded compounds with impervious pavements to prevent any spills infiltrating into underlying soils.

### 10.3 Ground water

Groundwater information is limited within the region and what is available indicates that groundwater is encountered within both the Quaternary and Proterozoic lithologies. Aquifers are low yielding, with flows reported at less than 0.5 litres/second. Higher yields with low storage may be available from sand lenses within the Quaternary sediments and fractures within sandstone.

Groundwater depths are likely to be shallow, particularly given the proximity to the ocean. The quality of groundwater within the shallow sediments is typically saline to hypersaline and not suitable for drinking or irrigation. The high salinity has likely resulted from landward salt-water intrusion and the dissolution of salts derived from marine sediments. The groundwater aquifers and marine environments are likely to be hydraulically connected.

Deeper groundwater resources may be available from fractured shales, siltstone and sandstones. Groundwater quality is variable within the deeper aquifers and typically brackish to saline. The hydraulic connectivity between the aquifers will depend upon the degree of structures such as fracturing within the shales.

No existing groundwater users are reported within the vicinity of the site.

The Project will not interact with groundwater (including regional scale aquifers) or groundwater features (including aquifers, aquitards and water tables) during construction. There are no groundwater dependent ecosystem/s within or immediately surrounding the Project area.

## 11 Sea

### 11.1 Darwin Harbour Values

Darwin Harbour is subject to a tidal range of 8 m and is bounded by extensive tidal flats. It has a relatively small catchment of 2,417 km<sup>2</sup> compared to its extensive estuary at 810 km<sup>2</sup> (DHAC, 2003). The harbour's tidal flats are estimated to support over 20,000 ha of mangroves in a relatively pristine condition (URS, 2002). Mangroves have been identified as a key component of the Darwin marine environment, providing primary production for the food web, as well as a nursery for vertebrate and invertebrate fauna (URS, 2002). In recognition of their status, the mangroves were recently rezoned for conservation under the NT Planning Scheme. The harbour is listed (Port Darwin NT029) in the Directory of Important Wetlands in Australia, with 25 species of migratory birds listed for protection under international treaties (JAMBA, CAMBA, Bonn).

Darwin Harbour has semidiurnal macro-tides with a strong diurnal inequality. The highest astronomical tide is eight metres. The tides spread into the harbour as a progressive wave with a lag of approximately 1.5 hours between the mouth of the harbour and its upper reaches. The ebb tide within the upper reaches persists for approximately one hour longer than the flood tide. Modelling shows that the circulation near the headlands and embayments is complex and different at flood and ebb tides, including jets, eddies, separation points and stagnation zones (Williams et al., 2006).

The salinity of the harbour varies in different areas and is influenced by the tides and tropical climatic seasons. Salinity at the mouth of the harbour remains almost constant, indicating that most of the mixing of river/creek freshwater runoff and ocean saltwater occurs within the harbour, although mixing is inhibited between the arms and the harbour (Williams et al., 2006).

The waters of the harbour are moderately turbid and there is a distinct fluctuation of suspended sediment concentration values with tidal frequency and season. Freshwater runoff along channel banks and mangrove zones is the main contributor for the majority of the fine sediments dispersed into the upper arms of the harbour (Williams et al., 2006). This contribution of sediments varies greatly between seasons with maximum turbidity resulting from increased runoff during heavy wet season storms.

Pipeline delivery is via existing NTG owned pipe rack between the wharf and the BFSF, designated for fuel and acid transfer. On and offloading facility on wharf is built to Australian Standard and is designed to eliminate the risk of spills. Connection points are on the delivery or receiving ship and spills managed on these vessels in accordance with national law. Oil spill response management sits with Darwin Port in the case of spills and control of spills in the wharf precinct. Given this activity is routine and risks well known and managed for the Darwin Port, the addition of the BFSF transfer and delivery system will not create any significant impact on the marine environment.

Darwin Port Oil Spill Contingency Plan SOP: [DP OSCP \(darwinport.com.au\)](http://darwinport.com.au)

## 12 Air

Current operation of the East Arm Wharf generates dust from areas such as the wharf, conveyers, gravel surfaces, rail and road transport, open stockpiles, drying sediment ponds, bottom dump station, ship and cattle loading.

Construction practices for the new Project elements, such as earthworks, vehicle use, vegetation clearing, and wind erosion will contribute to the overall dust plumes. This has the potential to cause:

- Increased contaminated turbidity and sedimentation of Darwin Harbour and surrounding intertidal creeks and mangrove forests.
- Further reduction in air quality.
- Further reduction in visibility.

The Northern Territory participates in monitoring for ambient air in the Darwin Region following NEPM Ambient Air Quality. It reports annually to NEPC (NTG, 2007). Results show that emissions of most air pollutants are low in the Northern Territory, with fine particles from bushfire smoke the exception.

Current activities at the East Arm Wharf and adjacent industry areas generate noise levels and night lighting. Construction and increased operation activities will increase these levels, with the potential to cause:

- Disturbance to the community amenities of Darwin City and Palmerston.
- Disruption to wildlife behaviour.

### 12.1 Greenhouse Gas Emissions

Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction, and to a lesser extent during operations. Modelling has been undertaken in accordance with the National Greenhouse Account Factors guidance produced by the Australian Government Department of Agriculture Water and Environment. Both Scope 1 and Scope 2 emissions were considered for the construction phase and the operational phase of the project. Highly conservative site activities were used assuming peak site activity for a full 365 days per year during construction, and similarly peak activity used for operations.

Peak emissions calculations for the construction period indicate 6019 tpa CO<sub>2</sub> equivalent. As the modelling is highly conservative the actual figure is likely to be significantly lower. All emissions during construction are Scope 1 emissions as power on site will be provided via diesel powered generators which are accounted for in Scope 1.

Operations modelling includes trucking of fuel assumed to be a conservative delivery of 1 triple to Tindal return, (600km). There are no other scope 1 emissions as there is no specific GHG emitting machinery other than fuel transport. Scope 2 emissions have been calculated based on peak power usage. Modelling indicates operational GHG emission of 600tpa, for the 1 MV supply required for the site and 20 days of consecutive pumping based on an assume maximum rate (480000 kwh) and the fuel transport combined. Modelling is attached in Appendix D.

Construction and operational emissions will not cause a significant increase in contribution to the NT's greenhouse gas emissions.

The environmental objective for any development should be to minimise greenhouse gas emissions to the greatest extent practicable. The planning for this Project and its elements should also accommodate predicted sea level rises over the assessed life of the Wharf, ensuring design and construction provides a level of structural safety, longevity and modification options if rises do occur.

The design (and during construction and operation) is to assess the risks from natural disasters, such as cyclone, storm surge, earthquake and wildfire.

## **12.2 VOC Emissions**

The fuels proposed for the Bulk Fuel terminal are both distillates and have high low vapor pressures at ambient Darwin temperatures. Crowley have undertaken a calculation assessment of the two distillates for the total inventory expected at the fuel site and the emissions are orders of magnitude lower than international reporting standards.

Based on VOC emissions of the preliminary design, the BFSF will emit a total of approximately 1 ktpa of VOCs as such this is considered of negligible impact to the environment.

## **12.3 Air (dust)**

Dust caused via the movement of vehicles and transport of material to and from the site, as well as excavation works can result in a reduction in air quality. Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health.

Air pollution may also be initiated by the emission of smoke caused by wildfire, deliberate and accidental burning of materials and from discarded cigarette butts. Fire can potentially occur from combustion of fuels, inappropriate storage of fuels and chemicals, inappropriate disposal of cigarettes, high local temperatures and campfires.

Operation of construction equipment and vehicles using the extended road will generate exhaust fumes. This will result in a reduction of air quality in the immediate area of the source. It is anticipated this will be of negligible impact.

## **12.4 Noise**

Construction of the BFSF facilities will require the use of a range of heavy vehicles and equipment that may generate significant noise. Earthworks and construction activities will generally be restricted to day-light hours, will be carried out in accordance with Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" and the equipment used will be the quietest reasonably available. Therefore, noise impacts are expected to be localised and not be detectable in residential areas.

Investigation and appropriate improvement plans will be initiated in response to noise complaints from any residents.

## 13 People

There is potential for both positive and negative impacts to stakeholders and the community regarding the Project. The works will give an employment boost to the local economy, however having another fuel facility on the harbour can be perceived as a negative from locals and environmental groups.

### 13.1 Archaeology and Heritage

Much of the proposed BFSF site has been reclaimed and earth worked and hence does not have heritage sites present.

A search was conducted of the Archaeological Resource Database and NT Heritage Register (publicly accessible) maintained by Heritage Conservation Services. The search indicated that there are no recorded sites within the proposed BFSF site.

Within the Darwin Region archaeological sites are located sparsely across the landscape and are concentrated where there are topographic features, transitions in habitat and in the coastal regions.

The Project elements include disturbance and construction between the Harbours water's edge to mangroves and mudflats and limited woodland. The majority of the area onshore under the proposal is built or disturbed.

The Peninsula was occupied during WWII with the presence of Z Force on Catalina Island the impact is low as no part of the project is in close vicinity to named heritage areas.

#### 13.1.1 Native Title

All Native Title claims over the project area (land and water) were extinguished (Risk vs Northern Territory of Australia, Federal Court NTD6033/01). It is unlikely that any future claims will be made over the same area and if so, it is unlikely that the claim will be successful.

### 13.2 Sacred Sites

A search of the register maintained by the Aboriginal Areas Protection Authority indicated no recorded or registered sacred sites within the proposed BFSF site or its immediate vicinity.

Two flaked stone points were found near the higher sections of Quarantine Island during the archaeological survey for the Darwin Port Expansion – East Arm Environmental Impact Statement (Acer Vaughan 1993). During the EIS process and subconsultant surveys, sites of cultural significance to Aboriginal people were identified on Catalina Island and the associated sandbar. No sites of cultural significance were identified near the proposed location.

### 13.3 Public Health and Safety

There are some potential risks to public health and safety during construction including noise, dust and construction traffic. All temporary arrangements to maintain traffic flow on the road network and manage construction vehicles will be made in accordance with traffic management standards. Some inconvenience to road network users can be expected due to increased slower moving construction traffic, but this impact is unavoidable.

#### 13.3.1 Unexploded Ordnance

An Unexploded Ordnance (UXO) is any sort of military or commercial ammunition or explosive which has failed to detonate as intended. During World War Two (WWII), thousands of Australian and Allied personnel trained in the Darwin region. Numerous bases were established in the Darwin region to support military operations and strikes against the Japanese. Camp sites and training areas were located throughout the NT with firing ranges established for artillery, tank, infantry and aircraft live firing and bombing practices. With such a large number of military personnel present within Darwin during WWII there is ongoing potential for UXO to be located in the vicinity of these areas.

The Department of Defence (DoD) Where is Unexploded Ordnance (UXO)? register does not indicate that UXO are likely to be uncovered in the Project area (DoD 2021).

### **13.3.2 Biting Insects**

Although the Quarantine Island area has a high density of biting midges, which has been identified as a perennial problem at the nearby Northern Cement milling facility, there are no large mosquito breeding sites in the immediate vicinity of the site (Acer Vaughan, 1993). Minor mosquito breeding areas were previously identified near the Trade Development Zone and East Arm Leprosarium (Acer Vaughan, 1993).

### **13.3.3 Sewage**

Sewage from facility offices and ablutions, during operations, would be disposed of either to an on-site sewage treatment plant or to the Power and Water Corporation's sewerage system. If an on-site system is used, the sewage will be treated prior to disposal/reuse on site via subsurface or drip irrigation, in accordance with the requirements of the Department of Health and Community Services. During construction portals will be used and effluent pumped out by a suitable contractor for disposal.

### **13.3.4 Process Wastewater**

Process wastewater would be generated from the BFSF process units as well as any washdown facilities. The wastewaters generated by the BFSF process units and washdown area will vary in their characteristics, however as a combined stream they may contain a range of range of contaminants.

The process wastewater will be treated prior to discharge into the harbour, or else reused on site (e.g., as process, washdown or cooling water). Reuse at the BFSF would be desirable from an environmental perspective, however its feasibility will depend on several factors including risk to the BFSF process units and pipelines, and the need for segregated treatment or reticulation systems for different wastewater streams. Any discharge of treated process wastewater into Darwin Harbour will be in accordance with a licence under the Northern Territory *Water Act 1992*.

### **13.3.5 Solid Waste**

The BFSF will generate general rubbish from office and maintenance areas, inert wastes (e.g., rubble, construction materials), as well as potentially hazardous wastes including spent process materials (e.g., catalysts), sludges from tanks, process vessels and wastewater treatment facilities, and contaminated soils.

Rubbish and inert wastes would be collected by local waste contractors and disposed of at licensed landfill sites. Spent catalysts may be recycled due to their high value (e.g., platinum catalyst), otherwise they would be disposed of as a hazardous waste. There are a number of possible options for disposal of hazardous wastes from the BFSF:

- Disposal at the Shoal Bay Waste Facility owned by the Darwin City Council limited to authorised Listed Wastes.
- Transport of wastes for disposal at dedicated hazardous waste facilities elsewhere in Australia. Sludges may be dewatered in Darwin to reduce the transport costs.

## **13.4 Social and Economic Impacts and Benefits**

### **13.4.1 Visual Amenity**

The BFSF would comprise a number of large processing and storage structures that have the potential to affect the visual amenity of the area. At present, the East Arm wharf, Northern Cement, Vopak terminal and Wickham Point LNG facilities have significantly large structures that are all clearly visible from populated areas near Darwin, including Bayview Haven, Frances Bay and Stokes Hill. It is therefore likely that the BFSF structures on Section 5720 would be also visible from these areas.

Given the presence of other industrial structures in the vicinity, the considerable distance (5 km +) to residential and commercial areas, the movement of large marine vessels and the general industrial nature of the East Arm area, the risk of the BFSF causing a significant impact to the visual amenity of Darwin would probably be low.

## 14 Potential Environmental Impacts and Proposed Environmental Management

### 14.1 Environmental Risk Analysis

#### 14.1.1 Purpose of the Environmental Risk Assessment

An environmental risk assessment was undertaken to identify the key potential environmental impacts from activities. Mitigation measures for each of the environmental aspects are general in nature and provide a broad approach to impact management.

#### 14.1.2 Methodology of the Environmental Risk Analysis

The methodology for this assessment is based on the requirements of AS/NZS 4360:2004 (Risk Management).

The environmental risk analysis was undertaken to:

- establish a risk framework that defined boundaries of risk likelihoods and consequences.
- identify the type of risks associated with the project.
- analyse the identified risks.
- evaluate the risks by ranking them according to the likelihood of the risk and its consequence.
- outline management measures to mitigate risks to an acceptable level.
- determine the residual level of risk after application of management measures.

The first step involves the identification of the consequence levels should a particular risk result in a negative impact and these are summarised in Table 22.

**Table 22 Risk Consequence Levels**

Risk		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Environment and Heritage	<b>Ecosystem Function (need to consider resilience and resistance)</b>	Alteration or disturbance to ecosystem within natural variability. Ecosystem interactions may have changed but it is unlikely that there would be any detectable change outside natural variation or occurrence	Measurable changes to the ecosystem components without a major change in function (no loss of components or introduction of new species that affects ecosystem function). Recovery in less than 1 year.	Measurable changes to the ecosystem components without major change in function (not loss of components or introduction of new species that affects ecosystem function). Recovery in 1 to 2 years following completion of Project construction.	Measurable changes to the ecosystem components with a major change in function. Recovery (i.e., within historic natural variability) in 3 to 10 years following completion of Project Construction.	Long term and possibly irreversible damage to one or more ecosystem functions. Recovery, if at all, greater than 10 years following completion of Project Construction.
	<b>Habitat, communities and/or assemblages</b>	Alteration or disturbance to habitat within natural variability. Less	1 to 5% of the area of habitat affected in a major way or	5 to 30% of the area of habitat affected in a major way or	3 to 90% of the area of habitat affected in a major way or	Greater than 90% of the area of habitat affected in a major way or

		than 1% of the area of habitat affected or removed	removed. Reestablishment in less than 1 year (relative to component seasonality) following completion of Project construction.	removed. Reestablishment in 1 to 2 years following completion of Project construction	removed. Reestablishment in 3 to 10 years following completion of Project construction.	removed. Reestablishment, if at all, greater than 10 years following completion of Project construction.
	<b>Species and/or groups of species (including protected species)</b>	Population size or behaviour may have changed but it is unlikely that there would be any detectable change outside natural variation/occurrence.	Detectable change to population size and/or behaviour, with no detectable impact on population viability (recruitment, breeding, recovery) or dynamics. Recovery in less than 1 year (relative to species lifecycle) following completion of Project Construction.	Detectable change to population size and/or behaviour, with no detectable impact on population viability (recruitment, breeding, recovery) or dynamics. Recovery in 1 to 2 years following completion of Project Construction.	Detectable change to population size and/or behaviour, with no detectable impact on population viability, or dynamics. Recovery (i.e., within historic natural variability) in 3 to 10 years following completion of Project Construction.	Local extinctions are imminent/immediate or population no longer viable. Recovery, if at all, greater than 10 years following completion of Project Construction.

The second step involves defining the risk categories. This considered the frequency of activities that may cause the impact and likelihood (probability) of the impact occurring during the activity. The level of likelihood that a risk would occur is summarised in Table 23.

**Table 23 Level of Likelihood**

Level	Descriptor	Likelihood of Occurrence
1	Rare	May happen in exceptional circumstances
2	Unlikely	Could occur at some time
3	Possible	Might occur at some time
4	Likely	Will probably occur in some circumstances
5	Almost Certain	Expected to occur in most circumstances

The risk rating categories that were adopted for this Project are outlined in Table 24.

**Table 24 Risk Rating Categories**

Descriptor	Likelihood of Occurrence
<b>Low</b>	Potential impacts either require no specific management measures or can be directly managed through design measures, general mitigation measures and safety controls.
<b>Moderate</b>	Management responsibility required. Potential impacts can be mitigated through the application of relatively standard environmental management measures.
<b>High</b>	Management attention needed. Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts associated with the risk.
<b>Catastrophic</b>	Immediate action required. Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts associated with the risk.

The risk rating category of each potential impact was then determined by combining the likelihood with the consequence of the risk according to the matrix shown in Table 25.

**Table 25 Risk Rating Matrix**

Likelihood rating	Consequence rating				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Almost certain A	Moderate (1)	Moderate (3)	High (2)	Catastrophic (1)	Catastrophic (3)
Likely B	Low (4)	Moderate (2)	High (1)	High (4)	Catastrophic (2)
Possible C	Low (3)	Low (7)	Moderate (4)	High (3)	High (6)
Unlikely D	Low (2)	Low (6)	Low (9)	Moderate (6)	High (5)
Rare E	Low (1)	Low (5)	Low (8)	Moderate (5)	Moderate (7)

### 14.1.3 Result of Environmental Risk Analysis

The completed environmental risk assessment is provided in Table 26.

**Table 26 Environmental Risk Assessment Considering the NT EPA Factors and Objectives**

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
LAND	<b>Landforms</b> - Conserve the variety and integrity of distinctive physical landforms	It should be noted that there are no distinctive physical landforms within or in the immediate vicinity of the Project area.	Landform degradation by soil erosion.	Low 6	Where construction activities are scheduled to occur over the wet season (1 October - 30 April), an ESCP (including accepted International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008 (or higher standard) where relevant) will be prepared by a suitably qualified and experienced professional.  Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season.	Low 2
	<b>Terrestrial environmental quality</b> - Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Soils in the Darwin region are susceptible to erosion because of the monsoonal rainfall and the structureless and sodic nature of the soils. Even very gentle slopes are prone to erosion if disturbed. Heavy Wet Season rains and the associated high volumes and velocities of surface water runoff that the Project area receives makes disturbed areas more prone to accelerated soil erosion.  Due to the nature of the Project, topsoils and subsoils will be disturbed during construction. Construction activities such as earthworks at the end of the Dry Season or during the Wet Season could potentially result in areas of accelerated soil erosion along the road corridor where vegetation clearance and soil disturbance has occurred. Heavy rains could also result in the loss of fill material before it is completely compacted and stabilised.  Works that have the potential to cause sedimentation include: <ul style="list-style-type: none"> <li>• Clearing;</li> <li>• Excavation and transportation of gravel and fill material;</li> <li>• Grading and rolling of road material; and</li> <li>• Excavations required for the construction of new culverts and extension of the existing ones.</li> </ul> <b>Acid Sulfate Soils:</b> Review of the Australian Soil Resource Information System (ASRIS) National Acid Sulfate Soil probability mapping indicates a medium to low probability of occurrence. Generally potential acid sulfate soils are located in areas at or below 5m AHD (Dear et. al 2014). The Project area is between 9 and 10m AHD and acid sulfate soils are unlikely to be encountered during excavation works. A detailed Site Investigation has been undertaken on the site and can be made available.	Direct disturbance of landforms and soils from earthworks during construction.  Indirect disturbance from project construction, such as erosion/topsoil migration.  Soil contamination (e.g., surface soils) by oil, fuels and lubricant spills during refuelling and hydraulic line rupture.	Medium 6	Clearing to be restricted to the construction footprint only.  Where construction activities are scheduled to occur over the wet season (1 October - 30 April), an ESCP (including accepted International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008 (or higher standard) where relevant) will be prepared by a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing.  Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season.  If possible, the bulk of the earthworks activities will be programmed during the Dry Season to eliminate the potential for accelerated soil erosion from storm events.  Stabilisation, rehabilitation and revegetation of disturbed areas will be undertaken progressively to ensure that areas and duration of soil exposure and therefore potential for erosion events are minimised in the Wet Seasons, as far as practicable. Disturbed areas will be sealed or landscaped and stabilised post construction.  The design of the road and associated infrastructure will include drainage and compaction in accordance with Australian Standards.  Permanent erosion controls will form part of the design of the Project and will remain in place during operation. Maintenance of the landscaped areas and drainage infrastructure is anticipated to result in negligible land degradation.  An appropriately bunded chemical storage area in the construction laydown area.  Refuelling carts must be self-bunded and contain spill kits.	Low 6
	<b>Terrestrial ecosystems</b> - Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	The Project area is located within the Darwin Harbour Site of Conservation Significance. No significant impact on the values contributing to the values of the SOCS is anticipated with the provision effective implementation, management, and monitoring of mitigation measures. With maintenance of drains, landscaping and roads infrastructure such as batters, no significant impact on the values contributing to the values of the SOCS is anticipated.  There are no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the project area are mangroves which are located approximately 7m from the southwestern boundary of the Project area. This distance ensures an appropriate buffer is maintained.  Loss or disturbance of plant species or communities and therefore loss of habitats can take place through clearing of vegetation. A maximum of	Impacting on Darwin Harbour SOCS.  Loss or disturbance of vegetation and potential foraging, sheltering and breeding habitat for threatened fauna.  Direct loss of flora/ecological communities from vegetation clearing.  Direct disturbance of fauna and fauna habitat as a result of clearing.  Indirect impacts to fauna as a result of reduced habitat availability or fragmentation.  Direct impacts to fauna as a result of collision with vehicles or equipment.	Moderate 4	Clear delineation of construction areas.  Minimise clearing to the construction footprint only (subject to detailed design and construction method).  No littering.  No pets to be brought on site.  Pest species sited to be reported.  Ongoing weed management for the duration of construction, wash down of vehicles.	Low 3

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
		<p>9ha of regrowth vegetation clearing is required for construction of the Project.</p> <p>A number of weed species, including Declared weeds (under the WM Act) and Weeds of National Significance (WoNS) are present on site. Several pest species are likely to occur within the project area.</p>	<p>Construction noise, dust and vibration has the potential to impact fauna species in the area.</p> <p>Introduction or increase of weed species.</p> <p>Introduction or increase of pest species.</p> <p>Land degradation from inappropriate disposal of waste.</p> <p>Works may cause an increase in the population of existing pest species, native species with pest potential and/or facilitate the introduction of other species by creating thoroughfares for their movement</p>			
WATER	<p><b>Hydrological processes</b> – Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.</p>	<p>The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives of Surface Water. There will be no extraction of water from Darwin Harbour for construction of the Project.</p> <p>There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area.</p> <p>Post-construction, the local water flow will be altered slightly from existing stormwater drainage. Changes to the natural catchment of the Project area may occur from the creation of hardstand surfaces through construction and operation of the Project. The Project will not interact with groundwater (including regional scale aquifers) or groundwater features (including aquifers, aquitards and water tables) during construction.</p> <p>Water will be required for dust suppression, earthworks in cut/fill and road pavement construction. Due to the Project being located in an urban area, water will be extracted from an existing PWC watermain.</p>	<p>Localised erosion from ground disturbance and surface water flow changes.</p> <p>Changes to the natural catchment from the creation of hardstand surfaces through construction and operation of the project.</p> <p>Sedimentation of waterways.</p>	Moderate 4	<p>Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a CPESC, CPSS or a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing.</p> <p>Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product.</p> <p>Works are not to be conducted in waterways or drainage lines if rainfall is expected.</p> <p>Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season.</p> <p>Emergency Response Plan prepared and implemented.</p> <p>No water extraction from Darwin Harbour.</p>	Low 3
	<p><b>Inland water environmental quality</b> - Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.</p>	<p>The sedimentation of adjacent waterways can have a potential negative effect on aquatic communities downstream from site and vegetated areas. This in turn could potentially decrease water quality potentially resulting in an adverse impact on the aquatic environment and impact on human health (in the event the downstream water or aquatic foods are consumed). Activities that can contribute to sedimentation and suspended solids in the water column include clearing of vegetation, earthworks, and construction of culverts/stormwater infrastructure.</p> <p>The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives of Surface Water.</p> <p>There is no water supply or drinking water reservoirs nor is the Project located within a catchment used for water supply or drinking water.</p> <p>The Project will not interact with groundwater.</p> <p>There are no culturally important water features located within or in the immediate vicinity to the Project area.</p>	<p>Excavation works, stockpiling and grading works that disturb soil material have potential to cause discharge of sediment laden water to downstream water ways through run off during rainfall events or excessive irrigation/dust suppression.</p> <p>Sedimentation may result in an increased volume of suspended solids entering surrounding stormwater drains which may discharge to Darwin Harbour via the existing stormwater system.</p> <p>Accidental release of hydrocarbon or other hazardous chemical spills on site entering adjacent waterways.</p> <p>Contamination of soil by oil, fuels and lubricant spills during refuelling and hydraulic line rupture that could cause secondary pollution of waterways following rainfall.</p> <p>Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of</p>	Moderate 4	<p>Minimise clearing to the construction footprint only.</p> <p>Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a CPESC, CPSS or a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing.</p> <p>Works are not to be conducted in waterways or drainage lines if rainfall is expected.</p> <p>Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product.</p> <p>Emergency Response Plan prepared and implemented.</p> <p>An appropriately bunded chemical storage area in the construction laydown area.</p> <p>Refuelling carts must be self-bunded and contain spill kits.</p>	Low 3

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
			potential contaminants that are likely to be found on site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls.			
	<b>Aquatic ecosystems</b> – Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. No aquatic threatened species or species of social, cultural, livelihood and/or economic significance have been identified within the Project area as part of the desktop assessment. There are no groundwater dependent ecosystem/s, RAMSAR wetlands within or immediately surrounding the Project area.	Sedimentation of waterways. Hydrocarbon or chemical spill entering waterway. Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of potential contaminants that are likely to be found on site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls which could result in negative effects on aquatic communities downstream from the site.	High 3	Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Works are not to be conducted in waterways or drainage lines if rainfall is expected. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Emergency Response Plan prepared and implemented. An appropriately bunded chemical storage area in the construction laydown area. Refuelling carts must be self-bunded and contain spill kits.	Moderate 2
SEA	<b>Coastal processes</b> - Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained	The project does not involve activities on the coastline or in the marine environment that could impact on coastal morphology. No clearing of mangrove or coastal vegetation is required for the project. No impacts on the geophysical or hydrological coastal processes are predicted.	Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	Low 2	Establish measures to minimise/control chemical spills from construction and/or operation. Silt curtains or similar to be used during construction to manage turbidity movements.	Low 1
	<b>Marine environmental quality</b> - protect the quality and productivity of water, sediment and biota so that environmental values are maintained	The project does not involve activities on the coastline or in the marine environment that could impact on marine water quality.	Accidental release of contaminants including hydrocarbons and/or ore from collisions, malfunctions, general operations causing spills and leaks during loading, unloading and shipping and impacting marine environmental quality. Soil loss from land clearing causing sedimentation to marine environment. Disturbance of PASS soils during construction works. All buildings to be built according to Australian Standards. Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	Moderate 4	Establish measures to minimise/control chemical spills from construction and/or operation. Silt curtains or similar to be used during construction to manage turbidity movements. Silt fencing, barricading on land to coast areas to minimise sedimentation from surface water runoff caused by clearing and disturbances. An appropriately bunded chemical storage area in the construction laydown area.	Low 9

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
	<b>Marine ecosystems</b> – protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning	The project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	Dust deposition within coastal zones to marine ecosystems Loss of marine habitat from increased sedimentation from coastal erosion. Acid sulphate soils exposed during construction. The impacts from construction are short term and minimal on marine ecosystems.	Moderate 6	Implement a monitoring program for the receiving environment that includes marine habitat monitoring, marine fauna monitoring and development and implementation of management measures if required. Controls will be in place for all visiting vessels in accordance with the national bio fouling management guidelines for commercial vessels and ballast water management requirements.	Low 9
AIR	<b>Air quality</b> - Protect air quality and minimise emissions and their impact so that environmental values are maintained	Anticipated emissions to air are in the form of dust during the construction phase of the Project. Dust caused via the movement of vehicles and transport of material to and from the site, as well as excavation works can result in a reduction in air quality. Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Activities likely to cause dust include: <ul style="list-style-type: none"> <li>transportation and deposition of gravel and fill</li> <li>excavation</li> <li>grading and compaction works</li> <li>stockpiling of fill</li> <li>clearing vegetation</li> <li>recovery of windrows</li> <li>movement of equipment and personnel.</li> </ul> Carbon dioxide from use of machinery will be generated during construction and contribute to a localised reduction in air quality. The likelihood of exhaust emissions is almost certain; however, the consequence rating and impact is negligible and unmeasurable. The residual risk associated with emissions from works is considered to be low due to the expected standard of vehicles and ongoing maintenance, the minimal distance travelled to and from the construction site (minimised by construction laydown area), and the temporary requirement of works. Air pollution can be initiated by the emission of smoke caused by wildfire, deliberate and accidental burning of materials and from discarded cigarette butts.	Reduction in local air quality due to the emission of dust, smoke (from fires), spraying of chemicals, bitumen and/or spray paint, and/or petrol/diesel exhaust during construction and/or operation of the project. Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Localised air quality impacts associated with dust and emissions from mobile plant. Emissions of airborne particulate matter associated with excavation/backfilling, movement of soil and rock, and movement of vehicles on unsealed areas. Fire causing negative effects on local biodiversity, destroying potential habitat and resulting in flora and fauna kills. Fire/smoke impacting on human health.	High 1	Project specific Contractor CEMP prepared and implemented. The CEMP will include a sub-plan to include mitigation measures to minimise potential dust emissions. To minimise generation of dust during the dry season and early wet season of the construction phase, water carts will suppress dust as necessary. Communications plan including complaints procedure. Ensure all vehicles and machinery are well maintained. Use of on-site laydown area to reduce travel distance of construction vehicles and machinery. Emergency planning in accordance with legislation and appropriate controls. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Appropriate disposal containers for cigarettes made available. Where there is a perceived high risk (e.g., total fire ban days) no hot works are to be conducted. No campfires are permitted.	Moderate 2
	<b>Atmospheric processes</b> - Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction. Onsite conditions that may affect the amount of impact caused by carbon dioxide emissions include the machinery involved, the time and length of works, and the location of resources. The impact of these exhaust emissions during construction is orders of magnitude below national and international thresholds and will not cause a significant increase in contribution to the NT's greenhouse gas emissions.	<ul style="list-style-type: none"> <li>Increased vehicle exhaust emissions from the transportation of people and machinery to and from the site.</li> <li>Air pollution by the emission of greenhouse gases from the clearing of native vegetation.</li> <li>Air pollution by the emission of greenhouse gases from the grading, rolling and sealing of the site, and construction activity.</li> </ul>	Low 6	<ul style="list-style-type: none"> <li>Ensure all machinery is well maintained.</li> <li>Use of on-site laydown area to reduce travel distance of construction vehicles and machinery.</li> </ul>	Low 2
PEOPLE	<b>Communities and economy</b> - Enhance communities and the economy for the welfare, amenity and benefit of current	Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction. Onsite conditions that may affect the amount of impact caused by carbon dioxide emissions include the machinery involved, the time and length of works, and the location of resources. The impact of these exhaust emissions during	<ul style="list-style-type: none"> <li>Increased vehicle exhaust emissions from the transportation of people and machinery to and from the site.</li> </ul>	Low 7	<ul style="list-style-type: none"> <li>Ensure all machinery is well maintained.</li> <li>Use of on-site laydown area to reduce travel distance of construction vehicles and machinery.</li> </ul>	Low 5

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
	and future generations of Territorians.	construction is negligible and unmeasurable and will not cause a significant increase in contribution to the NT's greenhouse gas emissions.	<ul style="list-style-type: none"> <li>Air pollution by the emission of greenhouse gases from the clearing of native vegetation.</li> <li>Air pollution by the emission of greenhouse gases from the grading, rolling and sealing of the site.</li> </ul>			
	<b>Culture and heritage -</b> Protect sacred sites, culture and heritage.	<p>No registered sacred sites or restricted work areas (RWA) are located within the proposed construction footprint of the Project, or within close proximity to the Project boundary.</p> <p>The NT Heritage Branch confirmed no heritage places or Aboriginal archaeological sites are located within the Project area. No nominated, provisional or declared heritage places, nor any previously recorded Aboriginal archaeological sites are located within the Project area. Due to large parts of the proposed Project area having been subject to previous clearing, the archaeological potential of the area is greatly reduced.</p> <p>Works will not occur within, or cause significant impact to, a world heritage area. Any visual amenity impacts will be short term and primarily be associated with passing motorists and are therefore unlikely to cause significant impacts or complaints.</p> <p>No impact on cultural heritage values is anticipated.</p>	<ul style="list-style-type: none"> <li>Direct and indirect disturbance to significant Aboriginal cultural heritage sites and values (e.g., artefact scatters, shell middens, earth mounds, quarries, stone arrangements, petroglyphs, rock shelters, rock art, etc.) during project construction, operation, and maintenance activities including vegetation clearance, topsoil stripping and subsoil excavation.</li> <li>Direct and indirect disturbance to traditional and/or contemporary values and traditional and/or contemporary Aboriginal uses of land (e.g., hunting and ceremonial use) due to construction, operation or maintenance activities.</li> <li>Direct and indirect disturbance to non-Aboriginal cultural heritage sites and values during project construction, operation, and maintenance activities including vegetation clearance, topsoil stripping and subsoil excavation.</li> <li>Tangible and intangible impacts to cultural values and landscapes due to potential disturbance to flora and fauna, ecosystems, landscapes and landforms from construction, operation or maintenance activities.</li> </ul>	Medium 8	<ul style="list-style-type: none"> <li>As the NTG holds valid Aboriginal Areas Protection Authority (AAPA) certificates for the proposed works it is unlikely that there would be any breach of the Northern Territory Aboriginal Sacred Sites Act.</li> <li>Contractors and Subcontractors to comply with AAPA Certificates including their conditions, location of any RWAs and their responsibilities regarding cultural heritage.</li> <li>Should a site or object of cultural or heritage significance be uncovered during construction, works will cease immediately, and the appropriate regulatory body contacted for advice (i.e., AAPA, Heritage Branch).</li> </ul>	Low 4
	<b>Human health –</b> Protect the health of the Northern Territory population.	<p>There are no drinking water reservoirs or recreational water bodies within or neighbouring the Project area nor is the Project located within a catchment used for drinking water.</p> <p>Dust from the movement of vehicles and transport of material to and from the site during construction. Spraying of bitumen and spray paint is required for construction of road surfaces.</p> <p>During construction, machinery will generate Noise during operation.</p> <p>The proposed works are located within close proximity to Darwin Harbour and areas of mangrove habitat which can often be a haven for biting insects. Depressions and irregularities in the surface created as a result of works can potentially create the ponding on water onsite. This has the potential to create areas suitable for mosquito breeding sites.</p>	<ul style="list-style-type: none"> <li>Dust impairing the visual amenity for road users, making driving hazardous.</li> <li>Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health.</li> <li>Noise emissions from construction works.</li> <li>Disruption to neighbouring receptors and businesses from construction noise.</li> </ul>	Moderate 2	<ul style="list-style-type: none"> <li>CEMP will include a sub-plan to include mitigation measures to minimise potential noise and dust emissions.</li> <li>Ensure all machinery is well maintained.</li> <li>Works will be undertaken generally in accordance with the requirements outlined in Noise Guidelines for Development Sites in the Northern Territory (NT EPA 2014).</li> <li>Communication Plan including a complaints procedure for community members and notification of works.</li> <li>Stakeholder engagement to be undertaken to inform communities of project, key construction milestones, possible impacts, etc.</li> <li>Biting insect management measures consistent with DoH Guidelines for Preventing Mosquito Breeding Associated with Construction Practice near Tidal Areas in the NT</li> </ul>	Low 7

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood / consequence)	Management	Residual Risk (likelihood / consequence)
			<ul style="list-style-type: none"> <li>• Construction noise, dust and vibration has the potential to impact fauna species in the area.</li> <li>• Construction workers affected by biting insects.</li> <li>• Creation of mosquito or biting insect breeding habitats.</li> </ul>		<ul style="list-style-type: none"> <li>• To minimise the impacts from biting midges, contractors will be encouraged to wear protective clothing, such as long sleeved, collared shirts and long pants and use repellents. Barrier insecticides may also be used to lower adult biting midge numbers around construction areas.</li> <li>• Traffic Management Plan prepared and implemented</li> <li>• Qualified traffic control personnel.</li> </ul>	

## 15 Consideration of Ecologically Sustainable Development

The EP Act is clear in its purpose of promoting the ecologically sustainable development of the NT. The EP Act defines ecologically sustainable development as:

- development that improves the total quality of human life, both now and in the future, in a way that:
  - maintains the ecological processes on which all life depends; and
  - recognises the need for development to be equitable between current and future generations.

The principles of ecologically sustainable development, as set out in Part 2 Division 1 of the EP Act, are provided in Table 27.

**Table 27 Principles of Ecologically Sustainable Development**

Principle name	Principle	Phase	Theme	Environmental Factors Considered	How have ESD principles been considered
<b>Decision making Principle</b>	Decision-making processes should effectively integrate both long-term and short-term environmental and equitable (unbiased) considerations.	Project Planning / Approvals / Procurement. Construction Phase Operation Phase	Air	Atmospheric processes	<p>In April 2021, Crowley announced our ambition to be the most sustainable and innovative maritime logistics solutions provider in the Americas by 2025.<sup>1</sup> This ambition from our senior-most executives is driving the transformation of our business towards becoming an increasingly more just and sustainable company that embeds sustainability into everything we do. To date, Crowley has reduced well-to-wake carbon emissions by up to 21% with their two LNG-powered ConRo ships compared to vessels powered by conventional marine fuels, is piloting biofuels in a number of assets on the West Coast of the U.S., and recently announced the completion of the design of the United States' first battery electric tugboat.<sup>2</sup></p> <p><sup>1</sup>Retrieved from: <a href="https://youtu.be/Yyli5OQUWNo">https://youtu.be/Yyli5OQUWNo</a> <sup>2</sup>Retrieved from: <a href="https://www.crowley.com/news-and-media/press-releases/crowley-completes-first-u-s-design-fully-electric-tug/">https://www.crowley.com/news-and-media/press-releases/crowley-completes-first-u-s-design-fully-electric-tug/</a></p>
<b>Decision making Principle</b>	Decision-making process should provide for community involvement in relation to decisions and actions that affect the community.	Project Planning / Approvals / Procurement. Construction Phase Operation Phase	People	Communities and economy	<p>Crowley has a long history of operating in the most environmentally sensitive, and socially progressive ports in the USA. By partnering with port communities in California, Crowley has completed the design of the U.S.'s first e-Tug, a fully battery electric tugboat that will completely eliminate air emissions during operation.<sup>1</sup></p> <p>Further, Crowley solicits input from, and systematically engages with key stakeholders external to the organization through a variety of means to ensure that we are strong stewards of our communities and corporate citizens. In February 2021, Crowley hired a new Director of Global Sustainability and Corporate Citizenship, tasked with driving forward an inclusive strategic process for the organization, and in May 2021, Crowley hired a Director of Sustainability, Stakeholder, and Regulatory Engagement to further assist in driving community participation in the planning of our operations.</p> <p><sup>1</sup>Retrieved from: Sustainability at Crowley Slide Deck</p>
<b>Decision making Principle</b>	Decision-making processes should effectively integrate both long-term and short-term	Project Planning / Approvals / Procurement	All	Where relevant	<p>Crowley has many partnerships with organizations pursuing environmental sustainability. To name a few: World Shipping Council, Washington Maritime Blue, Trident Alliance, CCWG, The American Waterways Operators, The Society for Gas as a Marine Fuel, American Maritime Partnership, SmartWay Transport Partnership, and the Environmental</p>

Principle name	Principle	Phase	Theme	Environmental Factors Considered	How have ESD principles been considered
	environmental and equitable (unbiased) considerations.				<p>Defence Fund; Climate Corps. These external fora, alongside engagement with our internal, community, and academic stakeholders are key to helping us drive towards our ambition of being the most sustainable and innovative maritime logistics solutions provider in the Americas by 2025.</p> <p><sup>1</sup>Retrieved from: Sustainability at Crowley Slide Deck</p>
<b>Principle of improved valuation, pricing and incentive mechanisms</b>	Established environmental goals should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems	Project Planning / Approvals / Procurement. Construction Phase Operation Phase	People	Terrestrial environmental quality	<p>Crowley's Puerto Rico Liner Services group has joined the SmartWay Transport Partnership. SmartWay is an innovative collaboration between U.S. Environmental Protection Agency and industry that provides a framework to assess the environmental and energy efficiency of moving goods through supply chains. Crowley's participation will help contribute to the partnership's savings of 170.3 million barrels of oil, \$24.9 billion in fuel costs, 72.8 MMT of carbon dioxide, 1.5 million tons of nitrogen oxides, and 59,500 tons of particulate matter. This is equivalent to eliminating annual energy use in more than 6 million homes.<sup>1</sup></p> <p>In addition, Crowley is a member of the Clean Cargo Working Group (CCWG), and internationally recognized non-profit organization that enables the use of a standardized methodology for the allocation of emissions from container ships to customers, allowing for the easy inclusion of climate impacts alongside price and service-level during tender.</p> <p><sup>1</sup>Retrieved from: Crowley Sustainability 2016 Slide Deck</p>
			Land		
<b>Principle of improved valuation, pricing and incentive mechanisms</b>	Environmental factors should be included in the valuation of assets and services.	Operations	People	Infrastructure and services	<p>Crowley is committed to being the most sustainable and innovative maritime and logistics solutions provider in the Americas. An example being the transformation of their digital systems to leverage technology to make the terminals more efficient for the trucks and equipment.<sup>1</sup></p> <p>Further, Crowley has completed the design of the U.S.' first e-Tug, citing the decreased maintenance and operating cost as core drivers alongside the unparalleled environmental performance of the vessel in the decision to move forward.</p> <p><sup>1</sup>Retrieved from: <a href="https://crowley365.sharepoint.com/sites/c-link/pages/news.aspx?ID=777&amp;List=447524a4-254c-4ac5-a25b-ac60646d36b5">https://crowley365.sharepoint.com/sites/c-link/pages/news.aspx?ID=777&amp;List=447524a4-254c-4ac5-a25b-ac60646d36b5</a></p>

Principle name	Principle	Phase	Theme	Environmental Factors Considered	How have ESD principles been considered
<b>Principle of sustainable use</b>	Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate	Operations	Air	Atmospheric process	<p>Crowley is a member of the Trident Alliance, a coalition of shipping owners and operators that share a common interest in robust enforcement of existing maritime sulfur regulations. The Trident Alliance is committed to improving the enforcement of these regulations to hold every operator accountable.<sup>1</sup></p> <p>In addition, Crowley leverages a multitude of technologies and process efficiencies to continue to drive down resource use across our operations. Specifically, Crowley works directly with our customers to minimize the use of “drop lots” for afterhours deliveries, reducing the unnecessary repositioning of containers and therefore reducing carbon emissions.</p> <p><sup>1</sup>Retrieved from: <a href="http://www.crowley.com/news-and-media/press-releases/crowley-announces-membership-in-the-trident-alliance-and-its-support-for-robust-enforcement-of-maritime-sulfur-regulations/">http://www.crowley.com/news-and-media/press-releases/crowley-announces-membership-in-the-trident-alliance-and-its-support-for-robust-enforcement-of-maritime-sulfur-regulations/</a></p>

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## **Appendix A - Darwin Harbour – Site of Conservation Significance**

## 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



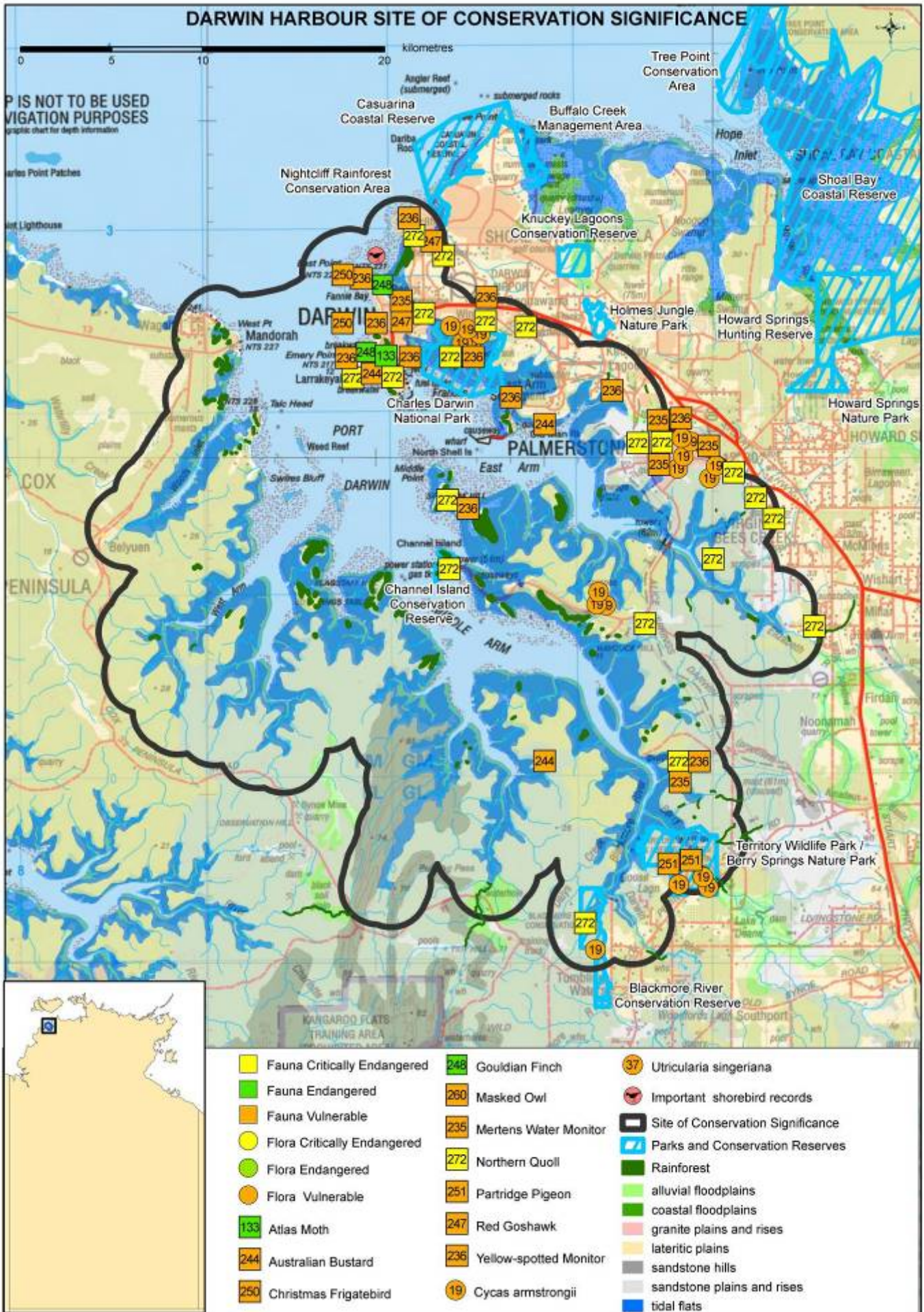
being considered. Water pollution from run-off and industry and sea-level rise will also potentially affect the Harbour environment.

### 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	<b>SOCS Number</b>	6 (NT Parks and Conservation Masterplan Map Number 12)
	<b>Latitude/Longitude</b>	12° 34' South, 130° 52' East (at centre)
	<b>Bioregion</b>	Darwin Coastal (98%), Pine Creek (2%)
	<b>Description</b>	<p>The site includes the tidal flats (222 km<sup>2</sup>) 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 km<sup>2</sup>). Sub-tidal waters of the Harbour are not included in this assessment.</p> <p>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).</p> <p>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.</p>
THREATENED SPECIES	<b>Significance Rating</b>	<b>International Significance</b>
	<b>Threatened plants and animals</b> (Listings at National/NT level <b>CR</b> - Critically Endangered, <b>EN</b> - Endangered, <b>VU</b> - Vulnerable, <b>NT</b> - Near Threatened, <b>LC</b> - Least Concern, <b>DD</b> - Data Deficient)	15 threatened species are reported from this site. <b>Plants</b> <ul style="list-style-type: none"> <li>▪ <i>Cycas armstrongii</i> (-/VU)</li> <li>▪ <i>Utricularia singeriana</i> (-/VU)</li> </ul> <b>Vertebrates</b> <ul style="list-style-type: none"> <li>▪ Australian Bustard <i>Ardeotis australis</i> (-/VU)</li> <li>▪ Christmas Frigatebird <i>Fregata andrewsi</i> (VU/-)</li> <li>▪ Gouldian Finch <i>Erythrura gouldiae</i> (EN/EN)</li> <li>▪ Masked Owl <i>Tyto novaehollandiae kimberli</i> (VU/VU)</li> <li>▪ Partridge Pigeon <i>Geophaps smithii</i> (VU/VU)</li> <li>▪ Red Goshawk <i>Erythrotriorchis radiatus</i> (VU/VU)</li> <li>▪ Northern Quoll <i>Dasyurus hallucatus</i> (EN/CR)</li> <li>▪ Merten's Water Monitor <i>Varanus mertensi</i> (-/VU)</li> <li>▪ Yellow-spotted Monitor <i>Varanus panoptes</i> (-/VU)</li> <li>▪ Flatback Turtle <i>Natator depressus</i> (VU/DD)</li> <li>▪ Green Turtle <i>Chelonia mydas</i> (VU/LC)</li> <li>▪ Hawksbill Turtle <i>Eretmochelys imbricata</i> (VU/-)</li> </ul> <b>Invertebrates</b> <ul style="list-style-type: none"> <li>▪ Atlas Moth <i>Attacus wardi</i> (-/EN)</li> </ul> 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	<b>Significance Rating</b>	<b>Not Significant</b>
	<b>Notes</b>	<p><b>Endemic to the bioregion:</b> One vertebrate (<i>Ramphotyphlops nema</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.</p> <p><b>Endemic to the NT:</b> 77 plant and 12 vertebrate species recorded in the site are only known from the NT.</p> <p><b>Other:</b> 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.</p>
WILDLIFE AGGREGATIONS	<b>Significance Rating</b>	<b>Not Significant</b>
	<b>Marine turtles</b>	Flatback, Hawksbill, and Green Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.
	<b>Seabirds</b>	Significant aggregations of seabirds are not known from this site (Chatto 2001).
	<b>Waterbirds</b>	This site lacks a large area of freshwater wetland and supports relatively low numbers of waterbirds (Chatto 2006).
	<b>Shorebirds</b>	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).
WETLANDS	<b>Other aggregations</b>	None known
	<b>Significance Rating</b>	<b>National Significance</b>
	<b>Ramsar criteria met</b>	Not assessed
	<b>DIWA criteria met</b>	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.
<b>Notes</b>	<p>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).</p> <p>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.).</p>	

DARWIN HARBOUR - SITE OF CONSERVATION SIGNIFICANCE

	<b>Rivers</b>	The Darwin, Blackmore and Elizabeth Rivers and Berry Creek flow into Darwin Harbour. All are relatively small Top End rivers.
<b>FLORA</b>	<b>Significance Rating</b>	<b>National Significance</b>
	<b>Notes</b>	<p><b>Rainforest:</b> 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 &gt;100 ha but most patches are small (&lt;10 ha) (Russell-Smith 1991).</p> <p>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.</p> <p><b>Other:</b> 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).</p>
<b>OTHER ENVIRONMENTAL VALUES</b>		<p>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).</p> <p>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.</p> <p>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).</p> <p>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).</p> <p>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).</p> <p>80 species recorded from this site are listed under international conventions or bilateral agreements protecting migratory animals.</p> <p>Dugongs are common in the Harbour (Whiting 2004).</p> <p>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.).</p>
<b>MANAGEMENT ISSUES</b>		<p><b>Fire:</b> 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.</p> <p><b>Feral animals:</b> 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).</p> <p><b>Weeds:</b> 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).</p> <p><b>Other:</b> 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.</p> <p>Nutrient enrichment from sewerage discharge and storm water run-off may affect mangrove communities in the Harbour (Dames and Moore 1984 in Wightman 2006).</p> <p>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.</p> <p>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.</p> <p>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).</p>

DARWIN HARBOUR - SITE OF CONSERVATION SIGNIFICANCE

<b>MANAGEMENT INFORMATION</b>	<b>NRM groups</b>	Belyuen Land Management Group (Belyuen), Larrakia Rangers (Darwin) (Northern Land Council 2006).
	<b>Protected areas</b>	Blackmore River Conservation Reserve (4 km <sup>2</sup> / 0.6% of site), Channel Island Conservation Reserve (1 km <sup>2</sup> / 0.1% of site), Charles Darwin National Park (10 km <sup>2</sup> / 1% of site), Territory Wildlife Park/Berry Springs Nature Park (11 km <sup>2</sup> / 1% of site).
	<b>Current management plans</b>	<p><b>Site-specific plans:</b> Charles Darwin National Park Plan of Management (PWCNT undated); Darwin Harbour Regional Plan of Management (Darwin Harbour Advisory Committee 2003).</p> <p><b>National recovery plans for threatened species:</b> 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.).</p> <p><b>Other management plans:</b> Australian Weeds Strategy (NRMCC 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.).</p>
<b>KEY REFERENCES</b>	<b>Monitoring programs and research projects</b>	<p>Fire in the tropical savannas is mapped continuously under the North Australia Fire Information Project <a href="http://www.firenorth.org.au/nafi/app/init.jsp">http://www.firenorth.org.au/nafi/app/init.jsp</a></p> <p>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).</p> <p>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).</p> <p>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.</p> <p>There is an ongoing program of monitoring and removal of Saltwater Crocodiles from within Darwin Harbour and Shoal Bay (Nichols and Letnic in press).</p> <p>Dolphins are surveyed monthly along transects within Darwin Harbour and Shoal Bay (C. Palmer, NRETAS unpubl.).</p> <p>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.</p> <p>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 3<sup>rd</sup> year by DIPE.</p> <p>Recommended methodology for monitoring of flora and soils in mangrove habitats of Darwin Harbour was developed by DIPE (Moritz-Zimmeman <i>et al.</i> 2002), developed further in a research framework (Comley 2002) and later applied at the Darwin LNG plant (McHugh 2004).</p> <p>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.</p> <p>Research on the distribution and role of Dambo wetland systems in the Darwin Harbour catchment (R. Wasson, Charles Darwin University, pers. comm.).</p> <p>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).</p> <p>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).</p>
	<b>Management recommendations</b>	<p>Continue to implement the Darwin Harbour Regional Plan of Management (NRETA 2005).</p> <p>Develop a fire management strategy for the Darwin region that identifies clear objectives, roles and responsibilities (Price and Baker 2007).</p> <p>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).</p> <p>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.).</p> <p>Consider expanding the boundary of the site to the catchment boundary to incorporate Dambo wetland systems (R. Wasson, Charles Darwin University, pers. comm.).</p>
<b>KEY REFERENCES</b>	<b>Papers and reports</b>	<p>Darwin Harbour Advisory Committee (2003). <i>Darwin Harbour Regional Plan of Management</i>. Department of Infrastructure, Planning and Environment, Darwin.</p> <p>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.</p> <p>DIWA (A Directory of Important Wetlands in Australia). <i>Australian Wetlands Database</i>. Department of Environment, Water, Heritage &amp; the Arts, Canberra ACT (accessed November 2007).</p> <p>Metcalf, K. (2007). <i>The biological diversity, recovery from disturbance and rehabilitation of mangroves in Darwin Harbour</i>. PhD thesis. Charles Darwin University, Darwin.</p>
	<b>Contributors</b>	Kristin Metcalfe, Consultant Environmental Scientist, Darwin

## **Appendix B - Darwin Airport ID14015 BoM Data**

# Monthly Rainfall (millimetres)

## DARWIN AIRPORT

Station Number: 014015 · State: NT · Opened: 1941 · Status: Open · Latitude: 12.42°S · Longitude: 130.89°E · Elevation: 30 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1941	508.4	371.9	304.3	27.1	8.9	8.1	0.0	0.0	0.0	0.3	250.1	68.6	1547.7
1942	550.9	361.4	143.2	48.4	4.6	0.0	0.0	0.0	108.1	24.7	202.1	243.4	1686.8
1943	241.9	467.4	250.6	196.8	0.0	0.0	0.0	0.0	12.2	78.3	191.6	127.2	1566.0
1944	333.8	192.1	334.9	79.7	0.0	0.0	0.0	0.0	5.3	82.3	229.4	301.8	1559.3
1945	239.6	377.4	474.2	125.8	0.0	0.0	0.5	0.3	0.0	99.4	198.9	199.9	1716.0
1946	287.3	303.8	128.0	1.0	0.0	0.8	1.6	15.2	13.0	9.9	60.2	203.9	1024.7
1947	233.3	375.0	466.1	53.1	0.0	0.8	0.0	83.8	64.3	99.6	97.6	198.6	1672.2
1948	171.2	205.5	306.4	245.4	0.0	0.0	0.0	0.0	6.9	2.3	157.6	208.6	1303.9
1949	208.8	553.4	397.7	77.7	0.0	0.0	0.0	0.0	0.5	21.4	70.8	350.3	1680.6
1950	593.0	319.8	230.9	4.1	1.3	2.8	0.0	0.8	18.3	128.9	151.2	357.9	1809.0
1951	198.6	341.6	171.5	43.8	0.0	0.0	0.0	0.5	6.6	111.3	109.4	168.9	1152.2
1952	317.2	158.5	171.7	27.6	0.0	0.0	3.3	0.3	10.0	45.8	199.1	170.9	1104.4
1953	465.5	325.0	203.5	357.0	0.0	0.0	0.0	0.0	0.5	0.0	115.1	231.7	1698.3
1954	460.3	229.2	225.7	168.6	0.0	0.0	0.0	3.8	23.4	338.7	186.3	257.1	1893.1
1955	205.5	654.0	310.0	186.6	31.5	4.0	9.7	0.0	0.0	1.4	219.3	113.5	1735.5
1956	344.7	629.5	220.2	218.4	96.8	0.0	6.1	0.8	18.6	150.2	215.2	406.5	2307.0
1957	564.0	355.3	360.3	30.5	12.9	4.6	5.3	0.0	3.8	21.4	113.6	412.2	1883.9
1958	173.1	221.1	194.4	127.1	5.4	0.0	3.3	0.3	0.0	37.9	132.4	181.9	1076.9
1959	442.5	103.3	140.6	331.3	12.2	0.3	0.0	0.0	36.3	18.5	138.7	328.4	1552.1
1960	568.1	414.1	446.0	81.4	13.2	0.0	0.0	0.0	2.0	47.1	77.6	106.2	1755.7
1961	263.2	368.6	94.4	97.3	0.3	0.0	0.0	0.0	0.5	61.2	179.7	55.6	1120.8
1962	571.0	464.8	175.2	26.5	0.3	0.3	0.3	0.0	0.0	53.7	142.3	187.4	1621.8
1963	310.6	330.4	228.2	125.3	0.9	0.3	0.9	0.3	0.0	46.1	61.8	228.9	1333.7
1964	319.3	117.3	350.8	126.2	1.8	2.0	0.0	0.0	70.7	82.2	370.8	262.4	1703.5
1965	136.1	132.7	595.0	2.0	14.2	0.3	0.0	0.0	21.6	4.8	64.8	582.9	1554.4
1966	432.7	263.9	130.5	39.1	0.8	1.0	0.0	3.8	1.8	85.0	118.0	293.0	1369.6
1967	434.2	641.6	289.3	29.7	37.1	0.0	0.0	0.0	0.5	6.1	82.1	106.7	1627.3
1968	547.9	673.1	227.3	96.6	298.9	0.0	9.4	5.7	13.2	69.6	57.0	122.5	2121.2
1969	374.1	814.5	346.0	13.1	3.0	0.0	5.1	0.0	18.8	170.7	40.9	160.4	1946.6
1970	220.2	312.4	124.5	33.4	19.1	0.0	0.0	0.0	17.5	169.2	130.1	198.0	1224.4
1971	388.7	298.0	471.8	186.6	28.7	0.0	0.0	0.0	20.9	79.9	191.6	306.3	1972.5
1972	230.1	425.9	362.4	73.2	25.9	0.0	0.0	3.3	26.8	55.1	126.8	162.0	1491.5
1973	536.0	137.6	467.5	30.9	15.5	41.4	0.0	0.0	0.3	42.8	126.5	268.2	1666.7
1974	746.8	370.1	497.3	57.2	0.2	0.0	0.0	35.3	26.1	118.8	127.6	664.5	2643.9
1975	336.6	514.5	361.5	100.4	1.4	0.0	0.0	0.2	7.2	154.7	237.8	195.5	1909.8
1976	531.6	380.9	502.2	36.2	0.6	0.0	0.0	0.0	0.0	16.2	17.2	77.8	1562.7
1977	532.8	407.7	1013.6	147.6	28.8	0.0	0.0	0.0	3.2	18.8	38.6	194.0	2385.1
1978	508.4	278.4	88.0	66.2	5.0	0.4	6.8	0.0	22.4	245.2	268.8	244.8	1734.4
1979	444.2	142.6	228.3	37.6	64.4	0.0	0.0	0.0	2.6	75.6	37.4	164.4	1197.1
1980	694.0	361.4	235.6	38.8	0.0	0.0	0.0	31.6	0.0	61.8	159.4	262.2	1844.8
1981	905.8	214.2	419.8	51.6	7.2	0.0	1.4	36.6	129.8	29.4	142.8	225.8	2164.4
1982	644.0	224.6	278.2	51.2	0.0	0.0	0.0	7.8	15.6	1.2	184.0	88.0	1494.6
1983	216.0	272.0	676.0	209.4	14.0	0.0	0.0	0.0	18.0	146.0	157.4	177.4	1886.2
1984	418.6	586.2	358.6	150.8	0.0	0.0	0.0	45.4	66.6	33.0	162.2	127.4	1948.8
1985	281.4	299.8	229.2	189.6	0.0	0.0	0.0	0.0	1.0	82.0	58.4	92.4	1233.8
1986	660.4	267.2	282.8	100.2	14.6	2.8	5.2	11.0	5.6	169.8	103.2	115.0	1737.8
1987	607.2	381.4	93.0	82.8	145.8	0.0	0.2	0.0	21.8	2.4	104.0	539.2	1977.8
1988	233.4	277.8	334.6	19.6	74.8	0.0	0.2	51.2	48.8	161.8	248.0	402.8	1853.0

Quality control: 12.3 Done & acceptable, 12.3 Not completed or unknown



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# Monthly Rainfall (millimetres)

## DARWIN AIRPORT

Station Number: 014015 · State: NT · Opened: 1941 · Status: Open · Latitude: 12.42°S · Longitude: 130.89°E · Elevation: 30 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1989	267.8	161.8	573.8	184.6	4.0	1.8	0.0	0.0	0.0	25.0	40.2	221.4	1480.4
1990	305.0	152.8	219.4	151.0	59.6	1.2	0.0	0.0	0.0	6.0	158.8	289.6	1343.4
1991	922.2	578.2	185.0	77.6	0.8	0.0	0.2	0.0	0.2	15.6	177.0	18.8	1975.6
1992	318.6	129.8	162.6	215.8	1.2	0.2	0.0	0.2	5.4	148.4	185.0	240.2	1407.4
1993	494.8	271.2	168.4	8.8	16.8	0.0	0.0	3.0	14.2	32.4	90.6	468.8	1569.0
1994	277.6	435.0	368.0	19.8	17.8	0.4	0.0	0.0	0.0	34.6	66.2	361.2	1580.6
1995	940.4	249.4	600.8	129.0	44.6	0.6	0.0	7.2	5.8	59.4	219.8	198.4	2455.4
1996	292.4	274.0	272.0	137.4	0.0	0.0	0.0	1.0	0.6	130.0	108.6	587.6	1803.6
1997	670.0	404.0	474.0	0.6	116.6	0.0	0.0	4.6	0.0	52.0	180.4	380.6	2282.8
1998	788.6	397.8	625.0	75.0	0.0	0.0	0.4	2.2	13.2	119.4	156.6	598.4	2776.6
1999	360.2	524.6	375.0	194.8	0.0	0.4	0.4	0.0	7.8	102.2	76.6	250.0	1892.0
2000	441.2	667.4	363.6	307.6	8.6	0.2	0.0	0.0	0.4	77.4	68.8	205.6	2140.8
2001	262.8	429.4	293.4	47.2	7.4	0.0	26.6	0.0	0.0	30.4	164.6	182.0	1443.8
2002	147.6	407.4	247.4	55.8	44.2	0.0	0.0	0.2	26.6	9.0	181.4	94.8	1214.4
2003	466.2	727.2	121.2	12.2	0.0	5.8	0.2	0.0	6.4	51.2	200.6	377.2	1968.2
2004	460.8	350.4	413.8	60.4	54.0	50.6	0.0	0.8	2.8	42.6	105.2	236.8	1778.2
2005	408.0	265.4	202.2	68.6	0.6	0.0	0.0	1.6	1.4	77.0	184.4	151.0	1360.2
2006	410.0	227.6	455.0	396.2	22.4	0.0	0.0	0.0	6.4	1.8	43.6	240.0	1803.0
2007	206.8	422.6	689.8	18.0	18.8	4.2	0.0	0.4	43.6	13.2	143.2	247.8	1808.4
2008	515.2	670.0	264.7	10.2	0.0	0.0	0.0	0.0	5.2	117.0	54.6	325.8	1962.7
2009	411.0	495.8	115.6	63.6	0.4	0.0	0.0	0.0	34.4	33.4	131.0	457.2	1742.4
2010	630.2	428.8	198.4	136.6	66.2	0.0	0.2	0.0	40.4	157.8	208.2	390.4	2257.2
2011	627.2	1110.2	231.6	193.0	0.6	0.0	0.0	0.0	3.2	141.0	152.0	227.2	2686.0
2012	459.2	250.2	572.4	70.2	51.4	0.0	0.0	0.0	21.2	16.8	79.3	203.0	1723.7
2013	219.8	398.4	381.0	101.6	31.6	0.6	0.0	2.6	0.2	98.6	314.2	210.8	1759.4
2014	608.6	369.0	92.4	177.2	8.6	0.0	0.0	0.0	0.0	14.8	165.8	111.0	1547.4
2015	484.6	353.2	230.8	21.2	13.8	0.4	0.0	0.2	3.4	42.6	84.2	509.4	1743.8
2016	169.8	150.4	115.8	46.4	62.4	0.0	0.0	0.0	64.4	130.8	208.2	406.8	1355.0
2017	470.6	624.8	458.4	184.8	0.0	0.0	0.0	0.0	0.0	100.6	174.2	183.6	2197.0
2018	893.0	364.2	279.4	43.6	0.0	0.0	0.0	0.0	32.8	30.0	204.0	67.2	1914.2
2019	362.0	177.4	174.0	163.2	31.2	0.0	0.0	0.2	0.0	20.2	87.2	58.6	1074.0
2020	402.4	216.8	278.2	115.6	1.4	1.0	0.0	0.0	87.8	167.8	89.0	389.6	1749.6
2021	647.6	305.2	158.2	93.0	0.0								

Quality control: 12.3 Done & acceptable, 12.3 Not completed or unknown



## Monthly Rainfall (millimetres)

### DARWIN AIRPORT

Station Number: 014015 · State: NT · Opened: 1941 · Status: Open · Latitude: 12.42°S · Longitude: 130.89°E · Elevation: 30 m

#### Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	431.8	369.3	312.4	101.6	20.7	1.7	1.1	4.5	16.5	70.8	142.0	250.4	1723.1
<b>Lowest</b>	136.1	103.3	88.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	17.2	18.8	1024.7
<b>5th percentile</b>	173.1	137.6	115.6	8.8	0.0	0.0	0.0	0.0	0.0	1.8	40.9	68.5	1120.0
<b>10th percentile</b>	208.8	158.5	128.0	18.0	0.0	0.0	0.0	0.0	0.0	5.9	58.3	94.6	1223.4
<b>Median</b>	418.6	355.3	278.2	77.6	4.6	0.0	0.0	0.0	6.1	52.8	142.6	223.6	1729.1
<b>90th percentile</b>	660.4	629.5	502.2	196.8	59.6	2.8	3.5	8.1	44.1	155.0	219.4	416.7	2203.0
<b>95th percentile</b>	788.6	670.0	600.8	245.4	74.8	4.7	6.1	35.4	66.8	169.2	248.1	541.4	2388.6
<b>Highest</b>	940.4	1110.2	1013.6	396.2	298.9	50.6	26.6	83.8	129.8	338.7	370.8	664.5	2776.6

#### Statistics calculated over the period 1961-1990

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	436.6	342.5	341.8	85.2	28.9	1.7	1.0	7.7	18.7	75.8	131.3	233.9	1705.1
<b>Lowest</b>	136.1	117.3	88.0	2.0	0.0	0.0	0.0	0.0	0.0	1.2	17.2	55.6	1120.8
<b>5th Percentile</b>	217.9	134.9	93.6	16.0	0.0	0.0	0.0	0.0	0.0	3.5	37.9	82.4	1209.4
<b>10th percentile</b>	229.1	142.1	121.5	25.8	0.0	0.0	0.0	0.0	0.0	5.9	40.0	92.0	1232.9
<b>Median</b>	425.6	306.1	312.0	69.7	6.1	0.0	0.0	0.0	10.2	61.5	127.2	196.8	1685.1
<b>90th percentile</b>	663.8	591.7	575.9	184.8	65.4	1.8	5.1	35.4	50.6	169.3	238.8	416.4	2125.5
<b>95th percentile</b>	723.0	658.9	639.5	188.2	113.8	2.4	6.1	41.4	68.9	170.3	259.4	563.2	2285.8
<b>Highest</b>	905.8	814.5	1013.6	209.4	298.9	41.4	9.4	51.2	129.8	245.2	370.8	664.5	2643.9

#### 1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

#### 2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

#### 3) Further information

<http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml>.

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## **Appendix C – EPBC Protected Maters**



# 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](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	38
<a href="#">Listed Migratory Species:</a>	63

## 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.

<a href="#">Commonwealth Land:</a>	2
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	99
<a href="#">Whales and Other Cetaceans:</a>	12
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	31
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

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

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

Name	Status	Type of Presence
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<b>Sharks</b>		
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
<a href="#">Glyphis garricki</a> Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
<a href="#">Pristis clavata</a> Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pristis pristis</a> Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pristis zijsron</a> Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhincodon typus</a> 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
<b>Migratory Marine Birds</b>		
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Calonectris leucomelas</a> Streaked Shearwater [1077]		Species or species habitat known to occur within area
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
<a href="#">Fregata minor</a> Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
<a href="#">Sternula albifrons</a> Little Tern [82849]		Species or species habitat may occur within area

#### Migratory Marine Species

<a href="#">Anoxypristis cuspidata</a> Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Carcharhinus longimanus</a> Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Crocodylus porosus</a> Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Dugong dugon</a> Dugong [28]		Species or species habitat known to occur within area
<a href="#">Eretmochelys imbricata</a> Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Manta alfredi</a> 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
<a href="#">Manta birostris</a> Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Orcaella heinsohni</a> Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Pristis clavata</a> Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pristis pristis</a> Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<a href="#">Pristis zijsron</a> Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
<a href="#">Sousa chinensis</a> Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
<a href="#">Tursiops aduncus (Arafura/Timor Sea populations)</a> Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Cecropis daurica</a> Red-rumped Swallow [80610]		Species or species habitat known to occur within area
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat likely to occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat known to occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Acrocephalus orientalis</a> Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Arenaria interpres</a> Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris alba</a> Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris tenuirostris</a> Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius mongolus</a> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour may occur within area
<a href="#">Gallinago megala</a> Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Gallinago stenura</a> Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Foraging, feeding or related behaviour may occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Numenius minutus</a> Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Numenius phaeopus</a> Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area
<a href="#">Pluvialis fulva</a> Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pluvialis squatarola</a> Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Tringa brevipes</a> Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Xenus cinereus</a> Terek Sandpiper [59300]		Foraging, feeding or

Name	Threatened	Type of Presence related behaviour known to occur within area
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## Other Matters Protected by the EPBC Act

### Commonwealth Land [\[ Resource Information \]](#)

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

Name
Commonwealth Land - Australian Government Solicitor Defence - HMAS COONAWARRA (Berrimah)

### Listed Marine Species [\[ Resource Information \]](#)

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

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Acrocephalus orientalis</a> Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Arenaria interpres</a> Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris alba</a> Sanderling [875]		Foraging, feeding or

Name	Threatened	Type of Presence
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	related behaviour known to occur within area Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris tenuirostris</a> Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Calonectris leucomelas</a> Streaked Shearwater [1077]		Species or species habitat known to occur within area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius mongolus</a> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour may occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
<a href="#">Fregata minor</a> Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
<a href="#">Gallinago megala</a> Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Gallinago stenura</a> Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Foraging, feeding or related behaviour may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Heteroscelus brevipes</a> Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Hirundo daurica</a> Red-rumped Swallow [59480]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat likely to occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat known to occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Numenius minutus</a> Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Numenius phaeopus</a> Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area
<a href="#">Pluvialis fulva</a> Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pluvialis squatarola</a> Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Sterna albifrons</a> Little Tern [813]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Xenus cinereus</a> Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
<b>Fish</b>		
<a href="#">Campichthys tricarinatus</a> Three-keel Pipefish [66192]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Choeroichthys brachysoma</a> Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
<a href="#">Choeroichthys suillus</a> Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
<a href="#">Corythoichthys amplexus</a> Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
<a href="#">Corythoichthys flavofasciatus</a> Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
<a href="#">Corythoichthys haematopterus</a> Reef-top Pipefish [66201]		Species or species habitat may occur within area
<a href="#">Doryrhamphus excisus</a> Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
<a href="#">Doryrhamphus janssi</a> Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
<a href="#">Festucalex cinctus</a> Girdled Pipefish [66214]		Species or species habitat may occur within area
<a href="#">Halicampus brocki</a> Brock's Pipefish [66219]		Species or species habitat may occur within area
<a href="#">Halicampus grayi</a> Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
<a href="#">Halicampus spinirostris</a> Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
<a href="#">Haliichthys taeniophorus</a> Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
<a href="#">Hippichthys cyanospilos</a> Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
<a href="#">Hippichthys parvicarinatus</a> Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
<a href="#">Hippichthys penicillus</a> Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
<a href="#">Hippocampus histrix</a> Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
<a href="#">Hippocampus kuda</a> Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
<a href="#">Hippocampus planifrons</a> Flat-face Seahorse [66238]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Hippocampus spinosissimus</a> Hedgehog Seahorse [66239]		Species or species habitat may occur within area
<a href="#">Micrognathus micronotopterus</a> Tidepool Pipefish [66255]		Species or species habitat may occur within area
<a href="#">Solegnathus hardwickii</a> Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
<a href="#">Solegnathus lettiensis</a> Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
<a href="#">Solenostomus cyanopterus</a> Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
<a href="#">Syngnathoides biaculeatus</a> Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
<a href="#">Trachyrhamphus bicoarctatus</a> Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
<a href="#">Trachyrhamphus longirostris</a> Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dugong dugon</a> Dugong [28]		Species or species habitat known to occur within area
<b>Reptiles</b>		
<a href="#">Acalyptophis peronii</a> Horned Seasnake [1114]		Species or species habitat may occur within area
<a href="#">Aipysurus duboisii</a> Dubois' Seasnake [1116]		Species or species habitat may occur within area
<a href="#">Aipysurus eydouxii</a> Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
<a href="#">Aipysurus laevis</a> Olive Seasnake [1120]		Species or species habitat may occur within area
<a href="#">Astrotia stokesii</a> Stokes' Seasnake [1122]		Species or species habitat may occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Crocodylus johnstoni</a> Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
<a href="#">Crocodylus porosus</a> Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Disteira kingii</a> Spectacled Seasnake [1123]		Species or species habitat may occur within area
<a href="#">Disteira major</a> Olive-headed Seasnake [1124]		Species or species habitat may occur within area
<a href="#">Enhydrina schistosa</a> Beaked Seasnake [1126]		Species or species habitat may occur within area
<a href="#">Eretmochelys imbricata</a> Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Hydrelaps darwiniensis</a> Black-ringed Seasnake [1100]		Species or species habitat may occur within area
<a href="#">Hydrophis atriceps</a> Black-headed Seasnake [1101]		Species or species habitat may occur within area
<a href="#">Hydrophis coggeri</a> Slender-necked Seasnake [25925]		Species or species habitat may occur within area
<a href="#">Hydrophis elegans</a> Elegant Seasnake [1104]		Species or species habitat may occur within area
<a href="#">Hydrophis inornatus</a> Plain Seasnake [1107]		Species or species habitat may occur within area
<a href="#">Hydrophis mcdowelli</a> null [25926]		Species or species habitat may occur within area
<a href="#">Hydrophis ornatus</a> Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
<a href="#">Hydrophis pacificus</a> Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
<a href="#">Lapemis hardwickii</a> Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Parahydrophis mertoni</a> Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
<a href="#">Pelamis platurus</a> Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

## Whales and other Cetaceans [\[ Resource Information \]](#)

Name	Status	Type of Presence
<b>Mammals</b>		
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Delphinus delphis</a> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
<a href="#">Orcaella brevirostris</a> Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Sousa chinensis</a> Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
<a href="#">Tursiops aduncus (Arafura/Timor Sea populations)</a> Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area

## Extra Information

### State and Territory Reserves [\[ Resource Information \]](#)

Name	State
Charles 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 Resources Audit, 2001.

Name	Status	Type of Presence
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Name	Status	Type of Presence
<b>Birds</b>		
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
<b>Frogs</b>		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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
<b>Plants</b>		
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]		Species or species habitat may occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
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]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, Thorny Sensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pennisetum polystachyon 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 likely to occur within area

## Nationally Important Wetlands

Name	State
<a href="#">Port Darwin</a>	NT

[ [Resource Information](#) ]

# 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

-12.47451 130.90222

# 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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