

PORT OF WEIPA

▶ APPENDIX H

Environmental values assessment





North Queensland Bulk Ports

Port of Weipa Environmental Values Assessment Report

February 2019

Acronyms

Acronym	
NQBP	North Queensland Bulk Ports
RT	Rio Tinto
EVA	Environmental Values Assessment
SSM	Sustainable Sediment Management
EVs	Environmental Values
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
RTA	Rio Tinto Alcan
MNES	Matter of National Environmental Significance
MSES	Matter of State Environmental Significance
DATSIP	Department of Aboriginal and Torres Strait Islander Partnerships
CHMP	Cultural Heritage Management Plan
NT Act	<i>Native Title Act 1993</i>
EP Act	<i>Environmental Protection Act 1994</i>
EMR	Environmental Management Register
CLR	Contaminated Land Register
VM Act	<i>Vegetation Management Act 1999</i>
NC Act	<i>Nature Conservation Act 1992</i>
TI Act	<i>Transport Infrastructure Act 1994</i>
ACH Act	<i>Aboriginal Cultural Heritage Act 2003</i>
SCR	State Controlled Road
MLES	Matter of Local Environmental Significance
EVNT	Endangered, Vulnerable and Near Threatened
LG Act	<i>Local Government Act 2009</i>
PAA	Priority Agricultural Area
PLA	Priority Living Area
SEA	Strategic Environmental Area
SCA	Strategic Cropping Area
RIDA	Regional Interests Development Approval
EIS	Environmental Impact Statement
PDR	Peninsula Development Road
STP	Sewage Treatment Plant
WCCC	Western Cape Chamber of Commerce
IMA	Intensive Monitoring Area
CMA	Core Monitoring Area
PMST	Protected Matters Search Tool
FHA	Fish Habitat Area
AquaBAMM	Aquatic Biodiversity Assessment and Mapping Method
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
DES	Department of Environment and Science
WHA	World Heritage Area
REMP	Receiving Environment Monitoring Program

Executive summary

The Port of Weipa is located within Albatross Bay in the Gulf of Carpentaria, on the North West coast of Cape York Peninsula. The facilities at the port principally support the export of bauxite (aluminium ore) from the nearby Rio Tinto Alcan (RTA) mine. Port infrastructure includes a main shipping channel in Albatross Bay (South Channel) and an Inner Harbour. RTA Weipa is currently proceeding with the Amrun Project, which will see expansion of its bauxite reserves south of the Embley River and new port facilities constructed at Boyd Point.

Weipa itself is a coastal town of approximately 3,500 people, making it the largest community on the Cape York Peninsula. The port is economically important to the Weipa township and broader region, and is a hub for various commercial and recreational activities. The landscape and aquatic environments within and adjacent Weipa support flora and fauna that are important across biodiversity, cultural and social criteria.

NQPB has commenced work on a strategic assessment for the ongoing management of marine sediments at the Port of Weipa and Amrun known as the 'Port of Weipa and Amrun – Sustainable Sediment Management (SSM) Project'. The SSM Project is made up of a number of technical and scientific studies, each building from the other. This study provides an important input to that SSM Project through provision of an Environmental Values Assessment (EVA) for the geographies of Weipa and Amrun. Findings will be used as a consistent resource in planning and decision-making at the port.

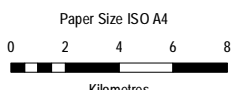
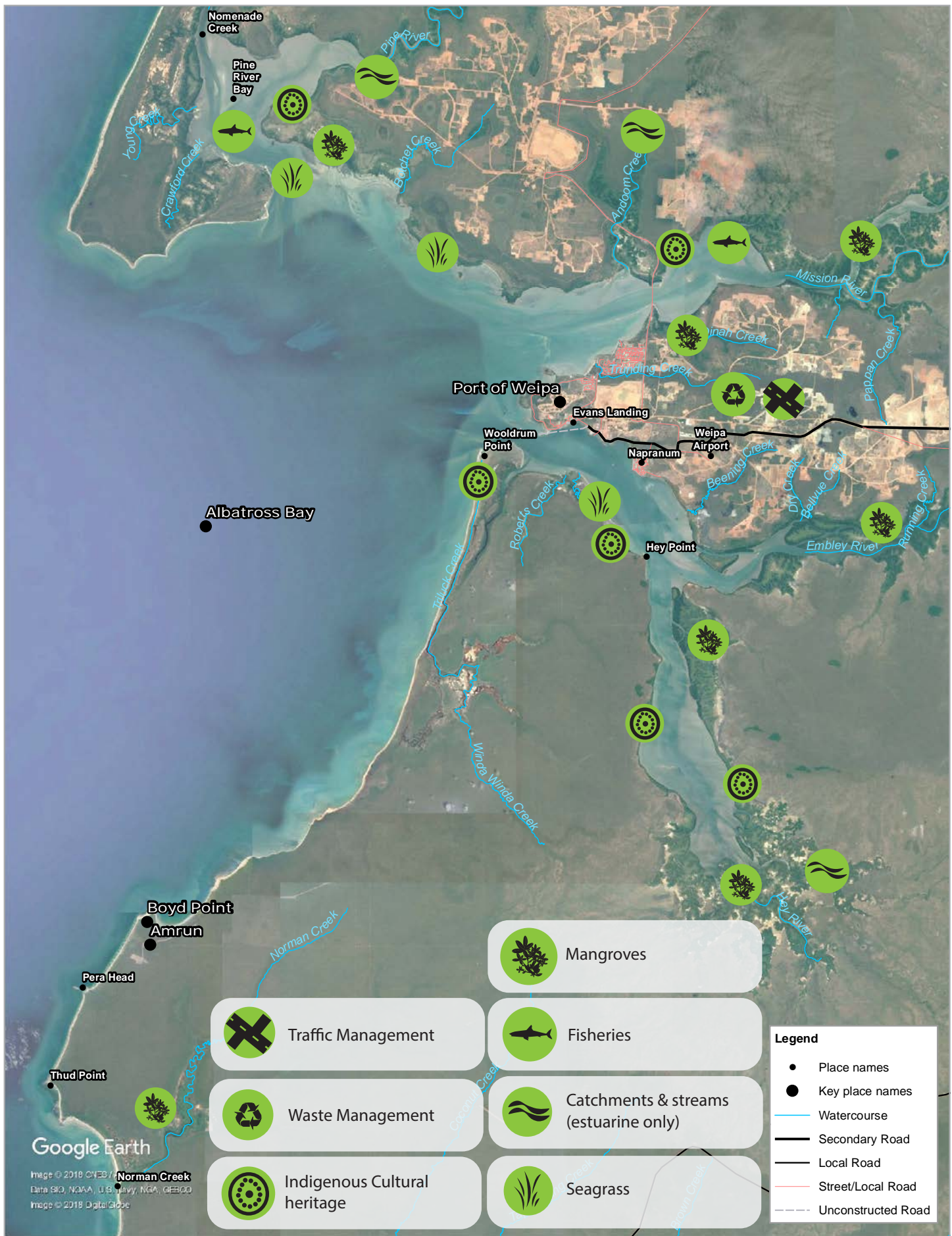
This EVA has identified, assessed and evaluated those values considered to be important for the Port of Weipa and Amrun across the headline categories of social, aquatic ecosystems, landform and biota and air quality. This has been completed using robust methodologies that considered how values considered important at a national, regional and local level were expressed within the Project area to determine those values that are considered significant for the Port of Weipa and Amrun. Assessment used desktop review of data collated and reported from field investigations in conjunction with data available through online portals, including government databases.

Assessment determined the significant values for the Project area to be:

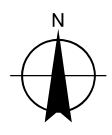
- Traffic management
- Fisheries
- Waste management
- Indigenous cultural heritage
- Seagrass
- Mangroves
- Catchments & streams (estuarine)

These values have been assessed as significant as they represent something that is regionally or locally unique. Some values, like corals and shorebirds, were recognised to be important for the region however were not found to be unique to the Project area when compared with other surrounding areas/regions.

A summary figure of the significant values can be found over page.



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

Project No. 41-31822
 Revision No. A
 Date 03/09/2018

Significant Environmental Values

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Appendices

Appendix A – Field Verified Regional Ecosystems for Amrun-Boyd Point study area

1. Introduction

1.1 Background

GHD has been commissioned by North Queensland Bulk Ports (NQBP) to prepare an Environmental Values Assessment (EVA) for the Port of Weipa and Amrun (Port of Weipa). The EVA is a key piece of work underpinning the overall Sustainable Sediment Management Project (SSM Project) for the Port of Weipa.

This EVA is one of many studies being undertaken as part of the Port of Weipa SSM Project. Other SSM studies, some of which will be informed by the EVA, include:

- Port operations and supply chain analysis
- Sediment dynamics
- Marine sediment properties
- Bathymetric modelling and analysis
- Navigational maintenance requirements
- Beneficial re-use options
- Reclamation (and potentially onshore) engineering

The EVA provides a review of available desktop information about the Environmental Values (EVs) at the Port of Weipa, as well as an assessment and evaluation on the importance of identified EVs, to be used as a consistent resource in planning and decision-making at the port.

Specific to the SSM Project, the EVA will assist in identifying environmental constraints and opportunities when considering and ultimately deciding sediment management options for the port.

1.2 Purpose of this report

This report provides a desktop review and assessment of the current state of the EVs present at the Port of Weipa.

The objective of the EVA is to compile available information about the EVs in the vicinity of the Port of Weipa to provide a compiled source of information on each EV to assist in decision-making. This information will also be used to raise general awareness of port activities in the context of surrounding values.

For the purposes of this review, important environmental values are defined as those that are:

- Matters of national environmental significance protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Matters of state environmental significance protected under Queensland environmental protection and management laws.
- Habitats or ecosystems that are considered 'important' or 'critical to the survival' of listed species or communities.
- Values recognised in Regional Plans and Marine Plans.

Important social and cultural values are those that are:

- Included in national or state registers.
- Identified by traditional owners or community members.
- Values that contribute to the appreciation of the culture and heritage in the region.
- Values that are considered locally important given the remoteness of the Weipa area
- Features that provide a connection to the landscape, history or previous or current use of the area.

The significance of each EV to the Project area has been assessed further, based on whether the value provides a key supporting function or is considered locally or regionally unique based on pre-determined criteria.

It is important to note that this report is not intended to be an impact assessment of any action or activity being undertaken at the Port of Weipa, nor does the report provide an assessment of an action against the Commonwealth 'Significant Impact Guidelines' or Queensland's Planning and Environmental State Codes or associated legislation. It is an assessment of environmental values based on defined criteria to identify i) those values considered important and ii) of those important values, those that are considered 'significant' based on their unique contribution to the Project area.

1.3 Scope and limitations

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

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

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

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

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

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

2. Methods

2.1 Study areas

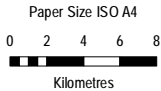
The Port of Weipa is located in the town of Weipa on the north-west coast of the Cape York Peninsula, approximately 800 km from Cairns and 200 km from the tip of Australia.

The '**Project area**' for the EVA extends from the lower reaches of Nomenade Creek including Pine River Bay, taking in Albatross Bay, and extending south to the northern reaches of the Ward River (Figure 2-1). The offshore area extends out into the Albatross Bay and the Gulf of Carpentaria.

The Project area has been separated into the **Port of Weipa study area** (Figure 2-2) and the **Amrun – Boyd Point study area** (Figure 2-3) to assist in reporting on site specific EVs supported by review and analysis of data available for the two study areas.

It should be acknowledged that the Port of Weipa study area extends north to Nomenade Creek and takes into account the wider Weipa Township and surrounding ML 7024 area down to Wooldrum Point. It also extends down the Embley River and Mission Rivers into Albatross Bay and takes in the potential areas where onshore reclamation or beneficial reuse may occur, noting possible reuse of material for a road north of the Mission River for boat ramp access further north.

The Amrun – Boyd Point study area takes in the majority of ML 7024 and extends north to Wooldrum Point on the southern bank of the Embley River and south to the Ward River just north of Aurukun.



North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

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Map Projection: Transverse Mercator
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 Grid: GDA 1994 MGA Zone 54

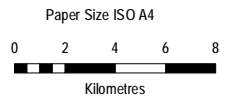
Project Area **FIGURE 2-1**

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 Data source: GHD: Study Area/2018; DNRME - Road/2018, GA: Mainland, Place names, Watercourse/2007. Image © Google, CNES/Airbus, Digital Globe (Date extracted - 20180627). Created by: mstanley



Google Earth

Image © 2010 CIES / Airbus
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Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54

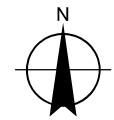
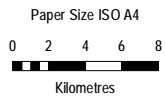
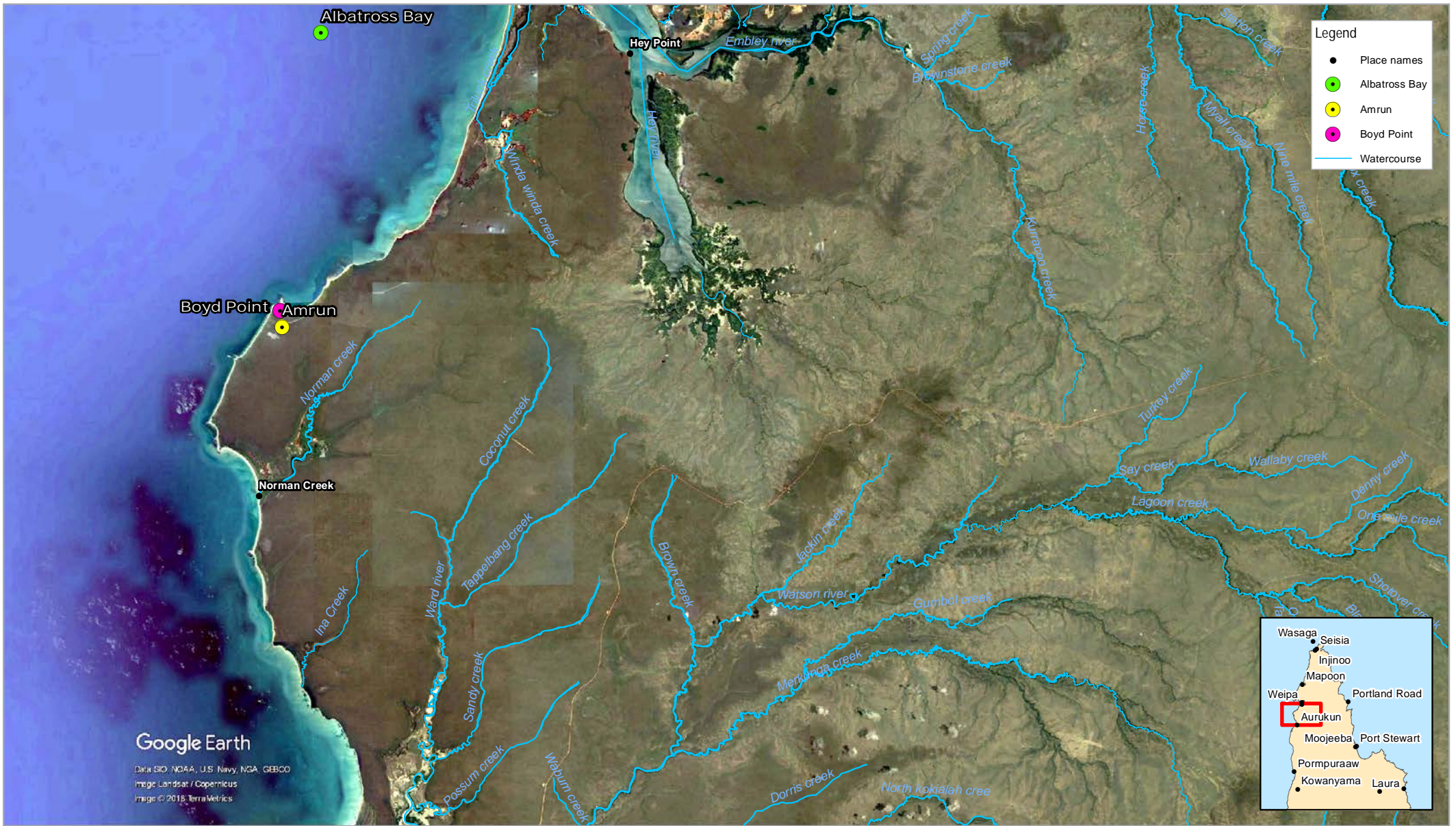


North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

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 Date 4/09/2018

Study area - Port of Weipa

FIGURE 2-2



Map Projection: Transverse Mercator
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North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

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Study area - Amrun Boyd Point

FIGURE 2-3

2.2 Environmental values categories

Numerous EVs have been identified as part of this EVA. The values have been defined according to headline themes, sub-themes and individual EVs based on key features considered to be important or notable at a national, regional or local level. These values were identified using a process of desktop review of available information and workshopping with NQBP to support inclusion of site-specific information not available through reports.

Information has been summarised for each value under the following headings:

- Overall definition of EV
- Description of each EV
- Location of each EV
- Regional context
- Threats/vulnerability/health
- Information gaps

The EVs and related headline themes and sub themes are listed in Table 2-1 below.

Table 2-1 Environmental values

Headline Theme	Sub-theme	EV
Social and other values	Tourism, recreation and public amenity	
	Traffic management	
	Fisheries	
	Waste management	
	Cultural Heritage	Non-indigenous cultural heritage Indigenous cultural heritage
Aquatic Ecosystems	Marine	Seagrass
		Coral Reefs
		Non-reefal benthic fauna and infauna
		Marine fauna
		Marine water quality
	Protected areas	
Coastal	Mangroves Wetlands	
Freshwater	Catchments and streams Surface water quality Groundwater quality Freshwater fish	
Landform and Biota	Topography, geology and soils	
	Land use/management	
	Terrestrial vegetation Communities	
	Terrestrial Flora	
	Terrestrial fauna	
	Protected areas	
Air Quality	Dust management	
	Noise management	
	Lighting management	

2.3 Information sources

2.3.1 Desktop review

An initial desktop review of publically available information was undertaken for each identified value (refer to section 2.2). The information reviewed is listed in the Reference section and has been sourced from impact assessments, investigations, and management plans undertaken in the Project area.

Information for the Amrun – Boyd Point study area was sourced from Rio Tinto Alcan's South of Embley Project, which included the Environmental Impact Statement, supporting technical reports and associated management plans.

A number of studies undertaken for the Port of Weipa study area, including but not limited to dredge management plans, sediment sampling, seagrass assessments and monitoring programs and shorebird investigations undertaken by NQBP were used to provide detail on EVs in the Port of Weipa study area.

To provide a regional context for each EV, reviews of local and regional plans/policy documents and environmental database searches were also undertaken.

It should be noted that no new studies or fieldwork was undertaken to inform this report.

2.3.2 Gap analysis

A gap analysis of the data reviewed was undertaken to identify whether the existing knowledge base adequately addressed all potential EVs for the Project area. This process supported identification of knowledge strengths, such as extensive time series data for seagrass and water quality, as well as any knowledge gaps for potentially important EVs. This process also supported the ability to identify confidence in data described further.

With the data review complete and key gaps understood, information was then synthesised into profile summaries for each EV and an assessment undertaken on the geographical 'significance' of the identified EVs.

2.4 Values Assessment

2.4.1 Measure of importance

Criteria that supported identification of EVs considered to be 'important' for the Project area are provided in Table 2-2. These include specific '**measures of importance**' to identify what is an important environmental, social and cultural value for the Project area.

The process considered whether values were of importance across national, regional and local spatial scales. Criteria were aligned with measures used by national and state legislation and from regional planning and policy documents.

A statement of importance has been provided for each EV, separated into study area, to provide further clarity around whether the EV's are considered important at either the Amrun – Boyd Point study area, Port of Weipa study area or both. This has been highlighted in the table with a tick or cross as follows:

✓ Measure is applicable and/or located in the study area

X Measure not identified and/or applicable in the study area

Table 2-2 Criteria – measures of importance

Criteria	Source	Measures
Matter of National Environmental Significance (MNES)	EPBC Act	Listed as a matter of national environmental significance and is 'known or likely to occur' in the Project area: <ul style="list-style-type: none"> • listed threatened species and ecological communities • migratory species protected under international agreements • Commonwealth marine areas
Matter of State Environmental Significance (MSES)	State Planning Policy <i>Environmental Offsets Regulation 2014</i>	MSES includes certain environmental values that are protected under Queensland legislation including the: <ul style="list-style-type: none"> • <i>Nature Conservation Act 1992</i> • <i>Marine Parks Act 2004</i> • <i>Fisheries Act 1994</i> • <i>Environmental Protection Act 1994</i> • <i>Regional Interests Planning Act 2014</i> • <i>Vegetation Management Act 1999</i> • <i>Environmental Offsets Act 2014</i>
Critical habitats and ecosystems	Previous studies/field work	Habitats or ecosystems that are considered 'important' or 'critical to the survival' of listed species or communities
Regional significance	Marine bioregional plan – north region North Commonwealth Marine Reserve Network West Cape York Commonwealth Marine Reserve North Marine Parks Network Management Plan 2018 West Cape York Marine Park Cape York Regional Plan RTA Weipa Land Use Management Plan Nov 2014	<ul style="list-style-type: none"> • Value protected under regional plan or policy • Value identified as a regional priority under regional plan or policy
Social and cultural	Included in national/state register	<ul style="list-style-type: none"> • Commonwealth Heritage List • Queensland Heritage Register • Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP) • Identified in previous engagement/reports

Criteria	Source	Measures
	Identified by traditional owners	<ul style="list-style-type: none"> Identified in previous engagement/reports/Cultural Heritage Management Plans (CHMPs)
	Contribute to the appreciation cultural and heritage of the region	
	Provide a connection to the landscape, history or previous or current use of the area	

2.4.2 Significance assessment

An assessment has been undertaken on all EVs identified as important at a national, regional or local level to determine those that contribute significantly to the expression of social, cultural, environmental or economic values of the Project area. These values have been classified as 'significant' as they are seen to contribute something special or unique and are necessary for sustained and continued persistence or recovery of the identified value within the Project area. The determination of a significant value is based on a number of factors, including whether:

- the EV represents an important population or cultural significance,
- the EV forms part of or supports a critical ecosystem,
- the EV provides for or forms part of critical habitat or breeding ground,
- the EV represents essential community infrastructure or is critical to the persistence of the local / regional economy or cultural / social values.

2.4.3 Confidence in robustness

To provide a measure of confidence in the data reviewed and the assessment of the significance of each EV, a level of confidence has been applied. The confidence criteria applied rate the 'quality of evidence' based on:

- **High:** There is a high level of confidence in the evidence supporting the findings. Further work is very unlikely to change the confidence rating.
- **Moderate:** There is a moderate level of confidence in the evidence supporting the findings. Some spatial or temporal data gaps may exist.
- **Low:** There is low confidence in the evidence supporting the findings. Further research may change the confidence rating.
- **Very low:** Any estimate of the confidence rating is uncertain based on significant data gaps.

3. Legislative context

Table 3-1 provides a high level overview of the legislation and policy applicable to the consideration of EVs at the Port of Weipa.

Table 3-1 Legislation context

Legislation/Policy	Value Protected	Relevance to Project area
Commonwealth		
EPBC Act	<p>The nine MNES protected under the EPBC Act are:</p> <ul style="list-style-type: none"> • world heritage properties • national heritage places • wetlands of international importance (listed under the Ramsar Convention) • listed threatened species and ecological communities • migratory species protected under international agreements • Commonwealth marine areas • the Great Barrier Reef Marine Park • nuclear actions (including uranium mines) • a water resource, in relation to coal seam gas development and large coal mining development 	<p>The following three MNES are relevant to the Project area:</p> <ul style="list-style-type: none"> • listed threatened species and ecological communities • migratory species protected under international agreements • Commonwealth marine areas: <ul style="list-style-type: none"> – Marine bioregional plans, including The North Marine Bioregional Plan – Marine reserves, including the West Cape York Marine Park. <p>These MNES have been used to measure the importance of an environmental value of the Port of Weipa at a National level.</p>
<i>Native Title Act 1993</i> (NT Act)	<p>The NT Act recognises the rights and interests over land and water possessed by Indigenous people (Aboriginal and Torres Strait Islander people) in Australia under their traditional laws and customs.</p>	<p>Native Title covers the entire claim area of the South of Embley project by the Wik and Wik Way People. There is no native title covering the Weipa/Napranum area.</p> <p>Native title provides for a measure of culturally significant importance at a National level.</p>

Legislation/Policy	Value Protected	Relevance to Project area
<i>Historical Shipwrecks Act 1976</i>	Historic shipwrecks from interference – recreation, research or commercial activities	There are no recorded historical ship wrecks in the Project area.
State		
<i>Environmental Protection Act 1994 (EP Act)</i>	<p>The EP Act aims to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.</p> <p>Regulates general environmental duty of care and allows for licencing and permitting of environmentally relevant activities.</p> <p>The EP Act regulates the following policies to protect EVs related to air, noise, water and waste:</p> <ul style="list-style-type: none"> • <i>Environmental Protection (Air) Policy 2008</i> • <i>Environmental Protection (Noise) Policy 2008</i> • <i>Environmental Protection (Water) Policy 2009</i> <p>The EP Act also manages <i>land on the Environmental Management Register (EMR) or Contaminated Land Register (CLR)</i>.</p>	<p>The EP Act protects the following EVs in the Project area:</p> <ul style="list-style-type: none"> • water resources (the watercourses within the study), • the air and acoustic environment that is conducive to protecting the health and biodiversity of ecosystems and human health and wellbeing, and • Land listed on the EMR/CLR
<i>Fisheries Act 1994</i>	The Fisheries Act regulates development assessment and the conservation and management of fisheries resources and habitats (including fish, marine plants and other fish habitats).	<p>The following fisheries resource are located within the Project area:</p> <ul style="list-style-type: none"> • Marine Plans • Fish Habitat Areas • Waterways for waterway barrier works <p>The resources listed above are MSES and have been used to measure the importance of an environmental value in the Project area at a State and regional level.</p>

Legislation/Policy	Value Protected	Relevance to Project area
<i>Vegetation Management Act 1999 (VM Act)</i>	The VM Act regulates the clearing of vegetation. The vegetation that is protected under the VM Act includes remnant vegetation (endangered, of concern and least concern regional ecosystems) and vegetation on declared areas.	Regional ecosystems are mapped within the Project area. Mapped regional ecosystems are considered MSES and have been used to measure the importance of native vegetation in the Project area at a State and regional level.
<i>Nature Conservation Act 1992 (NC Act)</i>	The NC Act protects all plants and animals that are native to Australia. The NC Act also provides for protected areas, including refuges.	Previous flora and fauna investigations within the Project area have identified a number of protected flora and fauna species. The Project area also contains areas mapped as high risk areas flora survey trigger mapping. High risk sites provide a level of protection for require endangered, vulnerable and near threatened species. Native plants and animals are considered MSES and have been used to measure the importance of native plants and animals in the Project area at a State and regional level.
<i>Water Act 2000</i>	The object of the Water Act is to provide for the “sustainable management of water and other resources and the establishment and operation of water authorities”. The Water Act deals with rights to access surface and groundwater resources, and the control of works with respect to surface and groundwater conservation and protection, and irrigation, some aspects of supply, drainage and flood control	The Project area traverses a number of mapped watercourses under the Water Act These watercourse are considered important as they provide critical habitat for aquatic species and hold particular cultural and economic values to the Port of Weipa.
<i>Planning Act 2016</i>	This Act establishes the framework for Queensland’s planning system and is supported by the <i>Planning Regulation 2017</i> that identifies the matters of state interest (values) to be protected from development.	The Project area includes the following MSES that are regulated under the <i>Planning Regulation 2017</i> : <ul style="list-style-type: none"> • Transport networks/infrastructure under the <i>Transport Infrastructure Act 1994 (TI Act)</i> • Coastal values under the <i>Coastal Protection and Management Act 1995 (Coastal Act)</i>

Legislation/Policy	Value Protected	Relevance to Project area
		<ul style="list-style-type: none"> • Water values under the Water Act • Fisheries values under the Fisheries Act • Heritage values under the Aboriginal Cultural Heritage Act 2003 (ACH Act) • Quarry material under the Water Act • Native vegetation under VM Act <p>Activities occurring in the Project area which will impact these matters require development approval under the Planning Act.</p> <p>The above MSES have been used to measure the importance of value in the Project area at a State and regional level.</p>
TI Act	<p>The object of the TI Act is to provide a regime that allows for and encourages effective integrated planning and efficient management of a system of transport infrastructure.</p> <p>Values protected under the Act include:</p> <ul style="list-style-type: none"> • Strategic Port Land • State Controlled Roads • Railway and Busway Corridors • Public and passenger transport facilities • Air transport • Public marine transport 	<p>The Port of Weipa includes land and water designated as Strategic Port Land and defined Port Limits.</p> <p>The Port of Weipa Land Use Plan articulates NQBP land use planning intentions at the Port of Weipa.</p> <p>A number of public boating facilities are located in the Project area (pontoon/boat ramps)</p> <p>There are no State Controlled Roads (SCR) within the Port of Weipa Project area. The Peninsula Development Road becomes a SCR east of the RAAF Base Scherger base.</p> <p>Transport infrastructure is considered important as it plays a vital contribution to social and economic welfare in the region.</p>
<i>Coastal Protection and Management Act 1995</i>	<p>The Coastal Act provides for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity through assessment of development on coastal land triggered under the Planning Act and management under the Coastal Management Plan.</p>	<p>The Port of Weipa Project area is located within the following areas under the Coastal Act that protect coastal resources/values from development:</p> <ul style="list-style-type: none"> • Coastal Zone • Erosion Prone Area • Storm tide – high/medium Hazard

Legislation/Policy	Value Protected	Relevance to Project area
	Coastal resources/values consist of the natural and cultural resources of the coastal zone and include physical features, processes, places or objects that have ecological, economic or social value.	<ul style="list-style-type: none"> • Coastal Management district • Tidal waterways <p>The above areas are considered MSES have been used to measure the importance of value in the Project area at a State and regional level.</p>
ACH Act	The ACH Act provides for recognition, protection and conservation of Aboriginal cultural heritage. Aboriginal cultural heritage is protected through a duty of care which requires all persons to take reasonable and practical measures to avoid harming cultural heritage.	<p>There is a number of known and unknown cultural heritage cultural heritage sites within the Project area. These values include:</p> <ul style="list-style-type: none"> • places of cultural significance to Traditional owners and include story places, traditional hunting and gathering areas and places of contemporary use for camping, fishing and hunting; • scar trees; • surface stone artefacts; • shell middens; and • Ethnographic sites. <p>Activities occurring in the Project area which will impact these values These sites are considered important as they hold particular culturally significant values and contribute to the cultural heritage landscape of the region.</p>
<i>Environmental Offsets Regulation 2014</i>	<p>This Act coordinates the delivery of environmental offsets in Queensland. Its purpose is to counterbalance the significant residual impacts of particular activities on prescribed environmental matters through environmental offsets.</p> <p>Environmental offsets are required where significant residual impacts on prescribed MNES, MSES, or Matters of Local Environmental Significance (MLES) are likely to result following consideration of avoidance and mitigation and management measures.</p>	<p>The following EVs are located within the Project area that trigger offsets under the Act:</p> <ul style="list-style-type: none"> • mapped MSES • Endangered, Vulnerable and Near Threatened (EVNT) flora (under the <i>Nature Conservation Act 1994</i>) • Fisheries resources under the Fisheries Act • Vegetation regulated under the VM Act • protected plants (endangered, threatened, near threatened or rare species) under the <i>Nature Conservation Act 1992</i>

Legislation/Policy	Value Protected	Relevance to Project area
		The requirement to provide offsets has been used as a measure of importance a value plays on a State and regional level.
<i>Local Government Act 2009 (LG Act)</i>	The (LG Act) designates the control and management of roads which are not SCRs to local governments. Local governments are also empowered to make local laws about matters including roads under the LG Act.	The management of local roads, utilities, waste fall under the local laws for each of the local government areas in the Project area, including: <ul style="list-style-type: none"> • Napranum Aboriginal Shire • Weipa Town • Aurukun Shire • Cook Shire Council Local Government infrastructure is considered important as it plays a vital contribution to social and economic welfare in the region
<i>Land Act 1994</i>	The Land Act provides for the administration and management of land in Queensland through the creation of different forms of land ownership.	A variety of tenure applies in the Project area. The majority of the Project area fall within the ML 7024.
<i>Queensland Heritage Act 1992</i>	Provides for the conservation of Queensland's cultural heritage. Under the Act, it is an offence to knowingly destroy or otherwise interfere with registered places or heritage items. The Act also sets out the assessment requirements for any development applications for development in or on a heritage place under the Planning Act.	No registered sites are listed under the Register of National Estate, the National Heritage List or the Queensland Heritage Register. Neither the Weipa Town Authority nor Napranum Aboriginal Shire Council have local heritage registers. <i>However a number of</i> non-indigenous cultural heritage sites have been recorded during surveys for developments in the Project area. Sites listed on the Queensland Heritage Register provide a measure of importance of cultural significance at a State, Regional and local level.
<i>Cape York Peninsula Heritage Act 2007</i>	Provide for the identification of the significant natural and cultural values of Cape York Peninsula, and cooperative and ecologically sustainable management of Cape York Peninsula. The Act provides provision to declare areas "national park" (Cape York Peninsula Aboriginal	The Project area is located within the Cape York Peninsula Region which is a declared area of international conservation significance. The Project area does not include "national park" (Cape York Peninsula Aboriginal Land) or Indigenous Community Use Areas defined under the Act.

Legislation/Policy	Value Protected	Relevance to Project area
	Land) and Indigenous Community Use Areas and the clearing of vegetation for special indigenous purposes.	
<i>Regional Planning Interests Act 2014</i>	<p>The Act identifies and protects the following matters of regional interests:</p> <ul style="list-style-type: none"> • Priority Agricultural Areas (PAAs) • Priority Living Areas (PLAs) • Strategic Environmental Areas (SEAs) • Strategic Cropping Areas (SCAs, formerly Strategic Cropping Land). <p>Regional Interests Development Approval (RIDA) is required when a resource or regulated activity is proposed to be located in an area of regional interest.</p>	<p>PLA (Napranum Aboriginal Shire, Napranum) is located in the Project area.</p> <p>A SEA is located to the north, south and east of the Project area, but does not impact the Project area directly.</p>

4. Environmental Values

Information on each of the EVs identified as being important is presented in this section. For ease of reference and reading, each EV has been summarised in tabular format presenting a brief description of the EV, where it is located, its regional/local importance, and what data has supported the determination of its relative significance.

This information provides a summary and critique of all data reviewed. The section is structured to present EVs in accordance with the categories identified in Table 2-1.

The Section 5 brings together key findings from each of the EV profiles and reviews and supports identification of those EVs which are locally significant.

4.1 Social and Other Values

4.1.1 Tourism, recreation and public amenity

Overall definition of EV

Description of EV

Tourism

The majority of the tourists that visit the Weipa region do so to participate in camping and recreational fishing activities (Rio Tinto Alcan, 2011). The Amrun Environmental Impact Statement (EIS) states that approximately 30,000 tourists visit the Weipa area each year.

Fishing is central to tourism in Weipa, with 97% of visitors to the broader region being tourists, and 71% of these travelling to the area to fish (DSDMIP, 2018). Tourism providers in Weipa provide for beach, deep-water and estuary fishing, as well as camping and bird watching (Rio Tinto Alcan, 2011). Fishing is widely practised throughout the Project area, the coastal areas and estuary systems.

Education

There are four childcare centres located within the Project area, including; Weipa Family Day Care Scheme, Cape Kids Childcare Centre, C&K Kindergarten and Napranum Early Childhood centre.

There are two schools located within the Project area; Western Cape College (prep – 12) and St Joseph's Parish School (prep – 6) (WTA, 2014).

Healthcare

Healthcare in the Project area include the Weipa Integrated Health Service (Weipa Hospital), the General Practice and the local dentist. There are also independent aged care, chronic health management services and alternative therapies available in town. Outreach and Health Services are available in Napranum and Arukun however, Weipa is the primary health service centre in the region. Complex cases would be referred to Cairns or Townsville.

Recreation

There are a number of recreational facilities available within Weipa, including squash courts, tennis courts, cricket and football ovals, lawn bowls club, golf course, dirt kart track, horse owners club, bow shooting range, rifle range, pottery club, aquatic centre and bicycle and pedestrian pathways (WTA, 2014).

The port is used by recreational and commercial tourist operators and there are no security-restricted areas on the water under normal operational circumstances. However, there is a ship safety exclusion zone 60 m from the Lorim Point Wharf. The port hosts a community

centre, a boat ramp and is planning for development in the near future of an Evans Landing precinct.

The primary Evans Landing public boat ramp is used recreationally and commercially by fishing charter operators and tourists. This recently constructed boat ramp is owned by DTMR and maintained by the Weipa Town Authority. This primary boat ramp is approximately 400 metres east of the original port Evans Landing boat ramp, which is now used as the Volunteer Marine Rescue (VMR) boat ramp. The primary boat ramp is considered an important piece of community infrastructure given it is used for a range of community and tourist events, including the Fishing Classic, which drew over 2,200 participants in 2017 and an estimated \$1 million in increased business opportunities for Weipa (DSDMIP, 2018). The boat ramp is accessible to the public, with additional boat ramps including a single lane ramp at Rocky Point (which is only accessible when tide height is above one metre) and a gravel ramp located on the north-western side of Andoom Creek.

The outdoor lifestyle, including pristine camping and fishing locations available in the Project area are considered a key social value for people who live in the area, in addition to being a considerable tourist attraction (Rio Tinto Alcan, 2011). Although fishing occurs throughout the Project area, important fishing areas identified in the South of Embley EIS and Supplementary EIS include the estuary, the shoals off Boyd Point (Three Mile), the 'Nine Mile Area', and areas of reef located north of Boyd Point and around Pera Head (Rio Tinto Alcan, 2011).

It is notable that access to some coastal areas is controlled by the shire councils. At the time of the South of Embley EIS, the need for an improved permit system was raised by the Traditional owners, to reduce inappropriate behaviour (such as pig hunting and dirt biking) occurring in these areas (Rio Tinto Alcan, 2011).

Communities

There are three Indigenous communities located within or close to the Project area, which include Napranum, Mapoon and Aurukun.

Location of EV

The facilities identified above are located within the Weipa town centre as well as within Napranum. The three indigenous communities are :

- Napranum, located 4 km south east of Weipa town centre
- Mapoon, approximately 60 km north of the Weipa town centre
- Aurukun, located 178 km south of Weipa town centre.

The port is located adjacent to land included within the Weipa Town Area and the local government area of Cook Shire Council. A small portion of land is adjacent to land governed by the Aurukun and Napranum shire councils. The Weipa Town Area is administered by the Weipa Town Authority, a division of Rio Tinto Alcan Pty Ltd.

Regional context

The Project area provides access to education, healthcare and recreation sites for both locals and tourists. The Project area also supports approximately 24,000 tourists each year with many tourists travelling to Weipa to camp or undertake recreational fishing.

Vulnerability

Other than mining, there is a strong reliance on tourism within Weipa. Tourism and the lifestyle of people in the area value the pristine environment in and surrounding the Project area, particularly for outdoor activities, with a focus on fishing and camping.

If other EVs within the region deteriorate, the impacts could be felt throughout the tourism industry in the area. There is potentially limited access to coastal areas due to control by shire councils. Therefore, open access coastal areas with high amenity values may be especially vulnerable to change, if access to such areas is limited.

Information gaps

Confirmation of the current regime that controls access to coastal areas should be undertaken to understand current recreational use of the coastal areas in the Project area and identify areas that are open access and highly valued. Much of the information around valued fishing areas was compiled during the South of Embley EIS and Supplementary EIS which were created in in 2011 and 2012. Current fishing areas and their value should be confirmed with recreational and tourism operators.

Confidence criteria assessment

Information used in this assessment is dated and has the potential to change at a site-level. However, it is unlikely that the high level understanding of recreational, tourism and public amenity values would change. In addition, it is noted that the social values of tourism, recreation and public amenity are largely based on the underlying EVs described elsewhere in this report.

Measure of importance

The overall EVs of the Project area, including the landscape and visual amenity, and the marine environment, underpin the recreational, lifestyle, and tourism values identified for the Project area. Degradation of those EVs, as discussed elsewhere in this report, would have considerable social implication to social and recreational values recognised of importance. Infrastructure that provides access to these activities in the Project area, including Evans Landing, which is within the Port itself, is highly valued. Table 4-1 identifies the assessment criteria that is applicable for the EV and evidence to support this.

Table 4-1 Statement of importance for tourism, recreation and public amenity

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	✓ Recreational, lifestyle, and tourism values.
Social and cultural	X	✓ Recreational, lifestyle, and tourism values.

Statement of significance

Overall, the tourism, recreation and public amenity environmental value is rated as not significant. While access to recreational facilities is important, the marine environment (particularly fisheries values) underpin the recreational, lifestyle, and tourism values identified. Accordingly, the importance of these social values is reflected elsewhere in this report with values such as fisheries recognised to be significant for the Project area.

Confidence of finding

There is a high level of confidence in assessment of social values however, additional consultation would improve understanding of local social significance and identify specific coastal areas that are valued for their amenity and accessibility.

4.1.2 Traffic Management

Overall definition of EV
Description of EV
<i>Air</i> Air transport to Weipa is via a daily QantasLink service or through charter flights. There is also a barge that runs between Cairns and Weipa twice a week.
<i>Road</i> The road network leading to and from the Project area is largely undeveloped, with access restricted to a few minor tracks. The main road to the Project area is the Peninsula Development Road (PDR). The PDR is an unsealed, SCR connecting Weipa to Mareeba. However, the PDR is prone to closure during the wet season. Between Napranum and Weipa, the road is commonly known as Kerr Point Road and John Evans Drive (Rio Tinto Alcan, 2011). The Aurukun Road connects the PDR to the township of Aurukun, but also provides access to the southern extent of the Project area, connecting to Beagle Camp Access Road, before separating into the Amban Access Road and Pera Head Access Road.
<i>Water</i> A twice-weekly barge service operates between Cairns and Weipa. The barge operates year round, including in the wet season. It is notable that the barge transports fresh produce during the wet season on a fortnightly basis.
<i>Services</i> The Weipa Taxi service provides taxi services for the broader region. A school bus service runs between Napranum and Weipa. Napranum has recently procured a 12 seater bus that is wheelchair accessible, which provides services to the local community. A private transport company provides bus transfers from the Cape York region to Cairns during the dry season. There are no other public transport services within the Project area.
Location of EV
The PDR connects to the Project area from the east. The Weipa airport is located approximately 5 km south east of Weipa town centre.
<i>Traffic volumes</i> Traffic flow figures for the PDR were supplied as part of the South of Embley EIS and revealed 2007 average annual daily traffic.

The following traffic flows were identified:

- PDR between Mareeba and Mt Mollow: 500
- PDR between Mt Mollow and Laura: 350
- PDR between Laura and Coen: 95
- PDR between Coen and Weipa: 90
- Kerr Point Road/John Evans Drive: 500

The data reveals that there is a high flow of daily traffic along the PDR between Mareeba and Laura, however after Laura, the numbers of cars that travel onwards reduces dramatically. The use of Kerr Point Road/John Evans Drive however is relatively high due to the use of the roads from parents and busses transporting kids from Napranum to school in Weipa.

Aurukun Road is owned by the Aurukun and Cook Shire Councils. Consultation undertaken as part of the South of Embley Supplementary EIS indicated that traffic volumes for Aurukun Road ranged between 50 to 80 vehicles per day (Rio Tinto Alcan, 2012).

Regional context

The capacity of the existing road network within the Project area provides access for local users. There is a limited road network located within the Project area and therefore the access that is provided is vital for local users to travel.

Vulnerability

The roads connecting to the Project area are largely unsealed and vulnerable to flooding during wet season, therefore limiting access to the Project area during certain times of the year. This greatly increases freight costs and results in isolation for some communities, including Aurukun.

During the wet season, the barge and air services are the only transport services accessible. The barge provides core community functions, including the transportation of produce.

Information gaps

Much of the information on traffic volumes was compiled during the South of Embley EIS and Supplementary EIS in 2011 and 2012. However, additional infrastructure has not been developed within the area, resulting in a likely minimal information gap regarding infrastructure and traffic volumes.

Confidence criteria assessment

Information used in this assessment is dated and has the potential to change at a site-level. However, it is unlikely that the high level understanding of the transport network would change.

Measure of importance

The transport infrastructure in the Project area is highly valued and is a vital contribution to social and economic welfare in the region. Existing transport infrastructure is highly valued due to its limited nature. Communities, including Napranum and Aurukun rely on the transport network to access social infrastructure (e.g. health and educational services) in Weipa. Table 4-2 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-2 Statement of importance for transport infrastructure

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	✓ Provide connectivity to the broader region.	
Social and cultural	✓ Foundational to the economy of the region. Provide connectivity to the broader region, increasing the access to employment and essential social services.	

Statement of significance

Appropriate traffic and transport infrastructure management is considered to be of high social significance. The road transport network in the Project area provides residents access to the broader region and inter-regional access, including priority services (e.g. health), which are provided in Weipa. Access to the broader region is foundational to the local economy. Barge and air services provide transportation services year round, and are of considerable significance during the wet season, when the road network is inaccessible.

Confidence of finding

The confidence in the understanding of the significance of the transport network to the local and regional community is high. The information provided in this assessment is up to date and unlikely to change considerable in the future without significant, if not insurmountable cost.

4.1.3 Fisheries

Overall definition of EV
<p>Description of EV</p> <p>There are a number of fishery operations operating within the Project area, including the Northern Prawn Fishery and the Gulf of Carpentaria Commercial Fisheries. Recreational fishing is also a large attraction to locals, tourists and Traditional Owners.</p> <p><i>Northern Prawn Fishery</i></p> <p>The main species caught within the northern prawn fishery include tiger prawns and banana prawns. The Tiger Prawn season takes place in the area between August and November, whilst the banana prawn season takes place between April to June (Rio Tinto Alcan, 2011). Prawns spawn offshore before migrating into inshore nursery grounds. The nursery grounds are usually located within seagrass beds or mangrove communities where they feed and grow, before returning offshore (Rio Tinto Alcan, 2011). Peak migration season of larvae and juveniles is between August and April.</p> <p><i>Gulf of Carpentaria Commercial Fisheries</i></p> <p>The Gulf of Carpentaria Inshore Finfish Fishery extends from the Queensland-Northern Territory border to Slade Point on the northwest coast of Cape York Peninsula. It has both inshore and offshore components that target various species. The inshore component (0-7</p>

nautical miles) targets species such as barramundi and threadfins, whilst the offshore component (7-25 nautical miles) targets various shark species, as well as grey mackerel (Rio Tinto Alcan, 2011). Spawning seasons occur between November and February and within this time, fishing is closed to allow for the respawning of key species (Rio Tinto Alcan, 2011).

The Gulf of Carpentaria Commercial Line Fishery extends from the Queensland- Northern Territory border to Slade Point on the northwest coast of Cape York Peninsula. The main target species is Spanish mackerel.

Recreational fishing

Recreational fishing is a popular pastime for the Weipa area for local residents, tourists and Traditional Owners alike. The common species targeted include barramundi, mangrove jack, fingermark, threadfins and mackerel (Rio Tinto Alcan, 2011) and is addressed in Section 4.2.4 and 4.3.4.

Location of EV

Banana prawns are targeted in areas less than 20 m deep, particularly around the coastal areas near Amrun.

The key locations for Spanish mackerel are within the reef communities, particularly around Pera Head, Boyd Point and Thud Point.

Charter fishing businesses mostly fish in the reefs within Albatross Bay.

Regional context

Northern Prawn Fishery

The Northern Prawn Fishery (NPF) is the most valuable commercial fishery in the area with annual value production between the years 1999 and 2007 averaging \$95 million (Rio Tinto Alcan, 2011). There are 15 statistical areas located within the NPF, with the Project area occurring within the Weipa statistical area (WPA). The WPA was determined to be a significant area of production for both tiger and banana prawns, producing the third largest catch in 2007 (Rio Tinto Alcan, 2011).

The South of Embley Supplementary EIS identifies the total catch for the WPA and total NPF catch between 2006 and 2010. The WPA contributes to a mean 7.6% of the total NPF catch for the 5 years studied, with 484 tonnes caught, compared to a total 6383 tonnes caught in the total NPF (Rio Tinto Alcan, 2012).

Gulf of Carpentaria Commercial Fisheries

In 2006, the Gulf of Carpentaria Commercial Fisheries had 87 licensed fishers whom harvested 1,782 tonnes with a gross value of \$12.8 million. The Weipa fishing region contributes approximately 3% of the total annual catch of the Gulf of Carpentaria Commercial Fisheries (Rio Tinto Alcan, 2011).

In 2006, the Gulf of Carpentaria Commercial Line Fishery had 27 licensed fishers whom harvested 237 tonnes with a gross value of \$1.6 million. The Weipa fishing region contributes approximately 12% of the total annual catch of the Gulf of Carpentaria Commercial Line Fishery.

Tourism and charter fishing

In 2001, there was an estimated eight guided fishing businesses running out of Weipa with a combined income of \$396,000, with anecdotal evidence suggesting this has increased dramatically since (Rio Tinto Alcan, 2011).

Vulnerability

The stocks of prawn species rely heavily on the availability of nursery habitats to support their juvenile phase. Therefore, threats to seagrass and mangrove communities would result in threats to prawn populations.

The production of inshore species is heavily reliant upon mangrove and seagrass communities and the connectivity between these communities as they provide key spawning and nursery habitats for these species (Rio Tinto Alcan, 2011).

The viability of the commercial, recreational and charter fisheries relies on healthy maintenance of stocks; which are dependent upon nursery habitats and appropriate fisheries management to support recruitment and persistence of stocks.

Information gaps

The information surrounding the fisheries operating in the Project area is outdated. Up to date information will help identify the economic importance of the fisheries operating within the Project area and any changes in fish/prawn populations as a result of change in broader EVs that may have occurred since the South of Embley EIS was completed.

Confidence criteria assessment

Information used in this assessment is dated and has the potential to change at a site-level, including on a year on year basis. However, it is unlikely that the high level understanding of fishery values would change.

Measure of importance

Commercial fishing is a small but important component of the economic landscape in the Project area and diversifies an economy that is largely reliant on mining. Table 4-3 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-3 Statement of importance for fisheries

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	✓ Economic diversification is a stated goal of the region, as outlined in the <i>Cape York Regional Plan</i> (DSDIP, 2014).
Social and cultural	X	✓ Considerable social and economic value to local sector, tourism and indigenous groups. An important diverse benefit to local economy that is otherwise largely reliant on mining.

Statement of significance

Commercial and recreational fisheries are rated as being a significant EV for the Project Area (inclusive of both study areas). This EV provides significant economic diversification as well as cultural, tourism and recreational benefits.

Confidence of finding

There is a high level of confidence in the significance of fisheries to the local and regional community at a high level.

4.1.4 Waste management

Overall definition of EV
Description of EV
<p>Waste collection within the Project area is managed by the Weipa Town Authority, the Napranum Aboriginal Shire, Mapoon Aboriginal Shire, and the Aurukun Shire Council.</p> <p>The Awonga Point Sewage Treatment Plant (STP) services the entire Weipa town area and is managed by the Weipa Town Authority. The Lorim Point STP services the Napranum town area and is managed by Rio Tinto Alcan. The Evans Landing Landfill provides a drop off station for recyclables for Weipa, Napranum and surrounds.</p>
Location of EV
<p>Weipa's landfill is located along Kerr Point Drive and is owned by Rio Tinto Alcan.</p> <p>The Awonga Point STP is released to the Mission River, whilst the Lorim Point STP releases to the Embley River post treatment.</p>
Regional context
<p>Management of rubbish and hard waste is council-resource intensive and extremely challenging, with transport costs within Cape York and to facilities outside of Cape York extremely high (NAILSMA, 2017). Similarly, the only recycling station in the region is present in Weipa; otherwise, transfer of recyclables is challenged by the poor transport network and the significant cost involved. The lack of infrastructure has resulted in illegal dumping being a significant problem in Cape York (NAILSMA, 2017).</p>
Vulnerability
<p>There is limited waste infrastructure in the region and, aside from Weipa, waste service provision is resource intensive and costly for local governments with often limited capacity for the ongoing management of these services. As Weipa provides waste management for surrounding towns, and the only recycling facility in the region, it is likely that these facilities play an important regional role in managing waste. Changes to the capacity of these facilities would likely impact on the region detrimentally, requiring other councils to divert resources to waste management. This would be complicated by the lack of capacity for waste management in the Cape York region, and practice of illegal dumping by both locals and tourists.</p>
Information gaps
<p>No notable gaps in the available information have been identified for waste.</p>
Confidence criteria assessment
<p>No understanding of capacity has been provided in the reviewed information. Information used in this assessment is dated and has the potential to change at a site-level. However, it is unlikely that the high level understanding of waste values would change.</p>

Measure of importance

Although waste is not a value that is readily identified by stakeholders or easily ‘fits’ within socio-economic or cultural criteria, it is worth considering that the impacts of poor waste management can have on public amenity and other EVs within the Project area and region generally. Table 4-4 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-4 Statement of importance for waste management

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	✓ Waste management facilities.
Social and cultural	X	✓ Waste management.

Statement of key environmental value

Waste management facilities, particularly those located in Weipa and managed by the Weipa Town Authority are of regional value. There are limited other waste management facilities in the region and, overall, there is limited capacity to manage waste resources in the region.

Confidence of finding

There is a high level of confidence in the value of waste to the local and regional community at a high level. The information provided in this assessment is up to date and unlikely to change considerably in the future without significant, if not insurmountable, cost.

4.1.5 Non-Indigenous Cultural Heritage

Overall definition of EV
<p>Description of EV</p> <p>History of the Project area dates back to 1606 with early European exploration, however, it was not until 1882 when the Weipa region was first populated and used as a cattle station.</p> <p>It was not until 1955 that bauxite deposits were discovered within the Project area and then finally mined in 1958. The Weipa township was then established in 1963 (WTA, 2014).</p> <p><i>National, State and Local Heritage Registers</i></p> <p>No registered sites are listed under the Register of National Estate, the National Heritage List or the Queensland Heritage Register.</p> <p>Neither the Weipa Town Authority nor Napranum Aboriginal Shire Council have local heritage registers.</p>

Recorded sites

The surveys conducted as part of the South of Embley EIS identified the following non-indigenous cultural heritage sites:

- An unused airstrip is located south of Boyd Point and was constructed in 1940 by members of the Weipa Mission community
- A concrete slab and pole located at False Pera Head
- Two sawn log crossings at Norman Creek and another crossing Ward River
- Remnants of a drilling camp has been reported in the general vicinity of the log crossing Ward River
- Remnants of a drilling camp recorded near an unnamed creek north of Norman Creek
- Remnants of house stumps near Hey Point.

There are another three non-indigenous sites located within the Project area however they are not classed as 'heritage' as they are roughly within the past 40 years. These include:

- Two fishing huts believed to be from the 1970s
- A plane crash site dating back to 1993 located near Norman Creek
- A camp used by a transient man in the 1980s located near Hey Point.

Location of EV

As most of the non-indigenous cultural heritage is associated with early exploration and drilling for bauxite, most of the sites are located within the Amrun–Boyd Point study area. Refer Figure 4-1 for the location of non-indigenous heritage sites.

Regional context

The Burra Charter was used during the South of Embley EIS to assess the significance of the heritage sites and indicated that they did not have a level of significance high enough to warrant listing on any registers. The Amrun-Boyd Point study area itself however was listed as low to medium due to its connections to the Weipa Aboriginal Reserve.

Vulnerability

The non-indigenous cultural heritage sites have been impacted by fires that are known to impact the area frequently. As a result, the first drilling camp and the house stumps could not be identified; this is believed to be a result from frequent fires and flooding (Rio Tinto Alcan, 2011).

Non-Indigenous cultural heritage is not significant enough to warrant listing on either national or state registers. A number of the sites are highly degraded, as a result of environmental events.

Information gaps

No notable gaps in available information were identified for this value.

Confidence criteria assessment

Given the substantial level of survey effort undertaken in support of the South of Embley EIS, further work is very unlikely to change the estimates of effect.

Measure of importance

Non-indigenous cultural heritage is rated as not significant. Whilst a number of identified non-indigenous cultural heritage sites are of local significance, and the sites contribute to an appreciation of cultural heritage and history in the region, non-indigenous cultural heritage overall is not significant enough to warrant listing on any registers. Table 4-5 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-5 Statement of importance for non-indigenous cultural heritage

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	✓ Appreciation of cultural heritage and history of the region.	X

Statement of significance

Non-indigenous cultural heritage is rated as not significant. There are no sites deemed significant enough to warrant listing on either national or state registers.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of considerable heritage surveys and studies undertaken within the Project area for the South of Embley EIS.



Legend

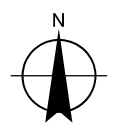
- Albatross Bay
- Amrun
- Boyd Point
- Port of Weipa
- Watercourse
- Secondary Road
- Local Road
- ▲ Non-Indigenous Site

Google Earth
 Image © 2016 CNES/Airbus
 Data SIO, NOAA, U.S. Navy, NGA, GEBCO
 Image © 2016 DigitalGlobe

Paper Size ISO A4

Kilometres

Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



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Non-indigenous Heritage Sites

FIGURE 4-1

4.1.6 Indigenous Cultural Heritage

Overall definition of EV

Description of EV

The Cape York region has evidence of Indigenous people occupying the area for over 35,000 years with radiocarbon determinations from finds around Albatross Bay dating back approximately 2,500 years (Stone, 1992). It is believed that due to formation of the current coastline and stabilisation of sea levels, evidence of occupation prior to this was destroyed (Rio Tinto Alcan, 2011).

In 1896, the Weipa Aboriginal Reserve was established and comprised of 647 km² within the Project area. The Reserve then moved to Napranum in 1931-1933 due to an outbreak of malaria. When the Weipa township was established in 1964-1967, the new town was called Weipa North, and the former mission became Weipa South. Over time, the Weipa South community grew and became known as Napranum (WTA, 2014).

Native Title covers the entire claim area of the Amrun project by the Wik and Wik Way People (NQBP, 2013). There is no native title covering the Weipa/Napranum area.

The Weipa area is one of the most intensively archaeologically studied regions in Cape York, following many years of archaeological surveys and thousands of kilometres of pedestrian surveys for the Rio Tinto Alcan bauxite mining operation (Ó Foghlú, Wesley, Brockwell, & Cooke, 2016; Shiner & Morrison, 2009). From these surveys, the following is known to occur in the area:

- 15 places of cultural significance to Traditional owners and include story places, traditional hunting and gathering areas and places of contemporary use for camping, fishing and hunting;
- 525 scarred trees;
- 23 surface stone artefacts (with a total of 43 artefacts);
- 111 shell middens; and
- Ethnographic sites.

In addition to cultural heritage surveys, the Weipa region has been subject to a number of archaeological surveys and studies. The Project area retains a diverse range of material that is of value from both a cultural heritage and an archaeological perspective.

Specifically, the shell mound sites found in the Project area and the broader Albatross Bay region are recognised to provide one of the largest concentrations of shell mound sites in northern Australia (Brockwell et al., 2017; Fanning, Holdaway, & Allely, 2018; Michael Morrison, 2013, 2015). Investigation undertaken of shell mound sites have contributed significantly to understanding of Indigenous production strategies dating to the Holocene period. Specifically, investigations in the last ten years have demonstrated that Aboriginal populations engaged in flexible production strategies that mobilised at key times to target localised abundances (Michael Morrison, 2013; Mick Morrison, 2013). Further, it is likely that such mobilisations facilitated levels of cooperative labour and social interaction at scales that were previously considered uncommon (*ibid.*).

Similarly, the Project area and its surrounds hosts a significant array of culturally modified trees (Michael Morrison, McNaughton, & Shiner, 2010; Mick Morrison & Shepard, 2013). Specifically, there is a significant landscape of trees modified for sugar bagging, the study of which has contributed to historical understanding of mid-century Aboriginal food production and remote mission economies (Michael Morrison et al., 2010).

Beyond cultural heritage places, many flora and fauna species that occur in the Project area have significant cultural heritage value for Aboriginal people – the value of which have been discussed with Traditional Owners and documented by Rio Tinto Alcan (2011).

Location of EV

Scarred trees were found broadly distributed across the Project area and its surrounds. Although scar frequency typically increases in proximity to water sources (i.e. the Embley River and its tributaries), scar trees are also strongly associated with areas of historical activity. For example, scar trees with over 40 scars are strongly associated with the Dingawulung Cattleyard, Mbinning, and Wathayn Outstation (Michael Morrison, 2013).

Shell matrix sites are found in coastal and tidal areas along the Pine and Mission rivers north of Weipa and the Hey and Embley rivers to the south (Rio Tinto Alcan, 2011)

The two largest stone artefact scatters are located in the upper reaches of creeks, while one artefact was found on a sand dune near the coast and another on a midden adjacent to Norman Creek (Rio Tinto Alcan, 2011). An earth mound that contained a glass fragment, which demonstrates post contact activity at the site is located at Diigwulung (Ó Foghlú et al., 2016)

The exact locations of the ethnographic sites have been recorded in heritage surveys undertaken in the area; while the location of these is confidential, it was noted in the South of Embley EIS that these sites were located along the coast line.

Refer to Figure 4-2 for Indigenous heritage sites that have been recorded on DATSIP, this however, does not include sites that were recorded during previous surveys.

Regional context

The Weipa shell mounds are known to be of high importance to Traditional Owners and are of national archaeological value with a number of research projects being undertaken since the 1970s (Bailey 1977, 1993, 1999; Brockwell et al., 2017; Fanning, Holdaway, & Allely, 2018; Michael Morrison, 2013, 2015; Morrison, Wight, & Evans, 2018; Ó Foghlú et al., 2016; Shiner, Holdaway, & Fanning, 2018; Shiner & Morrison, 2009).

Similarly, certain examples of culturally modified trees have been assessed to be of high significance due to their research potential, preservation and representativeness (Rio Tinto Alcan, 2011).

Vulnerability

Rio Tinto Alcan has an established Community, Heritage and Environment Management Plan in place over the Project area, which provides a long-term strategy for management of land access, fire, flora and fauna, environmental monitoring and further documentation of places of cultural heritage significance. As a consequence of surveys undertaken by Rio Tinto Alcan, WCCC and Traditional Custodian, Indigenous cultural heritage is well understood in the area.

Information gaps

The exact location of the ethnographic sites is confidential; all areas likely to be affected by development must be surveyed with the Western Cape Chamber of Commerce (WCCC) and Traditional Owners to establish separate heritage action plans for each location (Rio Tinto Alcan, 2011).

Confidence criteria assessment

Given the significant surveys undertaken in support of the South of Embley EIS and Rio Tinto Alcan's operations in the area, further work is very unlikely to change the estimates of effect.

Measure of importance

Indigenous cultural heritage has been assessed by Aboriginal stakeholders to be of high significance. Sites of high significance, and those of lower to moderate significance, contribute to the cultural heritage landscape of the region. Table 4-6 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-6 Statement of importance for indigenous cultural heritage

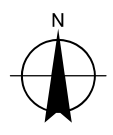
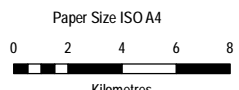
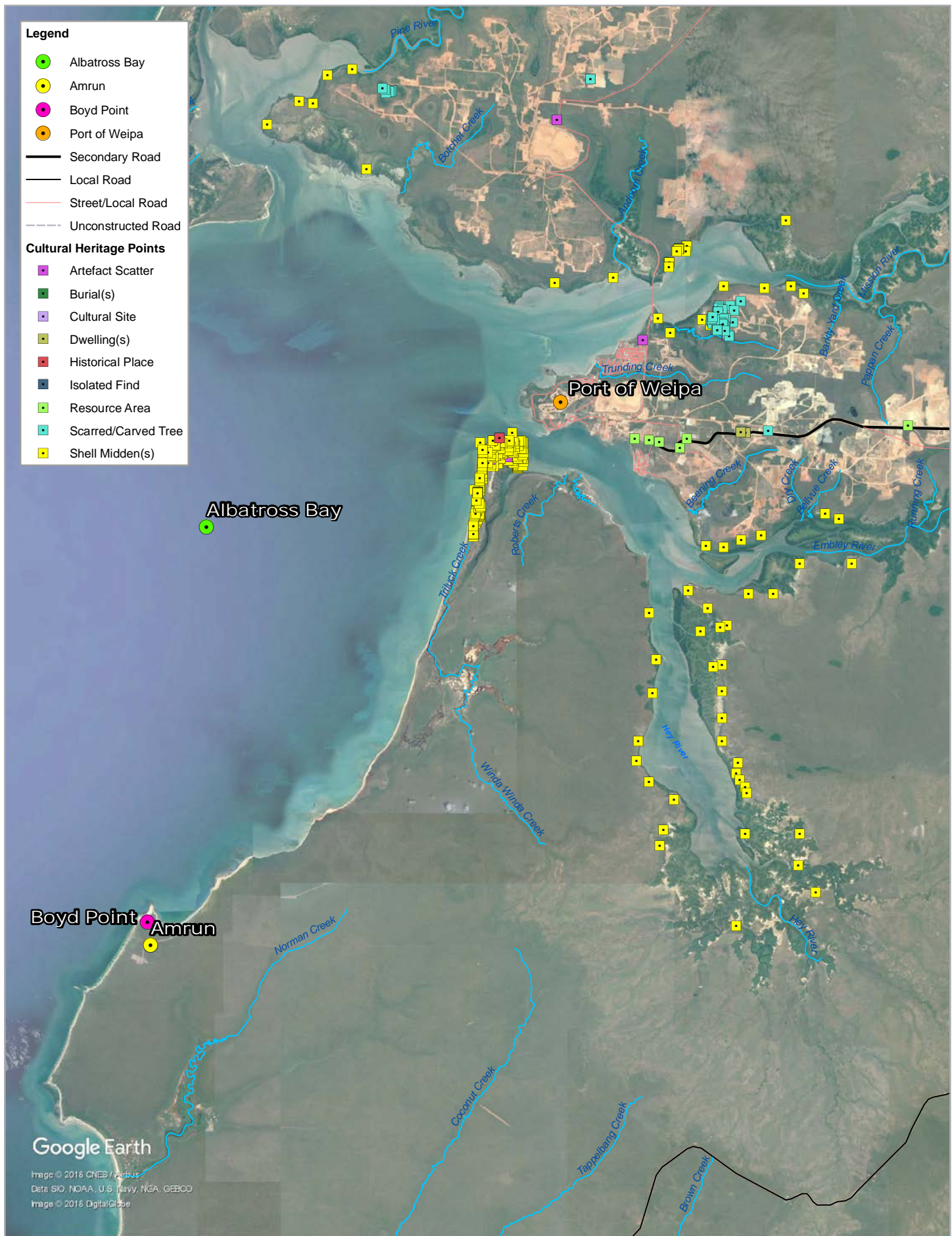
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	✓ Indigenous cultural heritage sites in the Project area include sites that have national archaeological significance. There are also sites of high significance to Indigenous parties, as recognised under the ACH Act.	
Social and cultural	✓ Contains sites of high significance and sites listed on DATSIP. Weipa Aboriginal Reserve has historic significance and is representative of an important phase of Australia's history.	

Statement of significance

Indigenous cultural heritage is rated as a significant environmental value for the Project area. Shell middens, stone axes and a number of the woomera scarred trees have been assessed to have high archaeological and cultural heritage significance (Rio Tinto Alcan, 2011). The significance of Aboriginal cultural heritage is established by Indigenous parties under the ACH Act. At the time of the South of Embley EIS, story places and shell middens were assessed to be highly significant (Rio Tinto Alcan, 2011). While further consultation may better inform significance assessments, there is ample current knowledge to affirm that indigenous values are significant for the Project area.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the distribution, and prevalence of Indigenous cultural heritage across the Project area. Reports also validate the importance of this EV to the Indigenous communities of the area. However, it is noteworthy that the location of cultural heritage sites is confidential, and engagement with Indigenous parties would be necessary to confirm the significance of known and unknown cultural heritage values for any area.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

Indigenous Heritage Sites

FIGURE 4-2

4.2 Aquatic Ecosystems – Marine and Coastal

4.2.1 Seagrass

Overall definition of EV

Description of EV

The Project area is home to a number of seagrass communities in which a variety of species can be found. The most common seagrass species that have been recorded within the overall Project area include:

- *Halodule uninervis*, *Syringodium isoetifolium*, *Enhalus acoroides*, *Halophila decipiens*, *Halophila ovalis* and *Thalassia hemprichii* within the Port of Weipa study area; and
- *Halophila decipiens* and *Halodule uninervis* near within the Amrun-Boyd Point study area.

Location of EV

Multiple surveys have occurred within the Project area, which have identified that seagrass communities occur at a number of areas within Albatross Bay, and are typically located within sheltered, shallow sand and mud banks within shallow intertidal flats (Rio Tinto Alcan, 2015a).

Within Port of Weipa study area, seagrass communities are located within the Mission and Embley Rivers, as well as within Pine River Bay and Hey River. Within the Amrun-Boyd Point study area, smaller populations have been recorded near Boyd Point and between False Pera Head and Thud Point (refer to Figure 4-3).

Long-term seagrass monitoring has occurred annually within the Port of Weipa since 2000. The monitoring has been undertaken at three scales, with greater intensity monitoring undertaken around port and shipping infrastructure (Chartand et al., 2009). Refer to Figure 4-3 for the intensive monitoring area and the location of the mapped seagrass communities.

A benthic habitat survey was completed within the Amrun-Boyd Point study area in October 2007, June 2008, November 2008, June 2009 and June 2010.

Figure 4-3 identifies the location of seagrass communities within the Project area.

Regional context

Seagrass communities are important habitats, particularly within the Weipa study area, as they provide habitat and act as a key food source for a number of species, particularly those of conservation significance, such as dugongs and green turtles.

Seagrass communities also provide an important nursery ground for juvenile crustacean and other fishery species, supporting the fisheries that operate within the Gulf of Carpentaria. The productivity of the gulf fisheries relies heavily on the maintenance of intact and functioning inshore habitats. In the open mud flats, the seagrass meadows, as well as mangroves, may provide the only habitat for fish and shrimp to shelter from predation (National Oceans Office, 2004).

Vulnerability

Seagrass populations declined from a coverage of approximately 5000 hectares within the entire Port of Weipa limits in 2001 to approximately 3800 hectares in 2002 and 3200 hectares in 2008. This was believed to be associated with extended La Niña events in 2002 and 2006 that saw reduced rainfall across much of eastern Australia (Sozou & Rasheed, 2018 and BOM, 2014). Results of the 2012 Port of Weipa Long-term Seagrass Monitoring Programs also confirmed these findings, concluding that annual fluctuations in seagrass meadows were as a result of changes in regional and local climate conditions (Sozou & Rasheed, 2018).

However, monitoring across the Port limits has shown improvements in the size and health of meadows since losses were recorded. This recovery coincides with an extended period of below average tidal exposure and rainfall (Sozou & Rasheed, 2018).

Seagrass are known to be resilient species that show recovery from periodic disturbances, such as degraded water quality or seabed disturbance from severe storms/cyclone activity. Other stressors to seagrass communities generally include sea level rise, changes in sea temperature, habitat modification (from development activities) and land-based activities (such as increased levels of extractive mining) resulting in a degradation of water quality. Decline in seagrass habitat could impact on ecosystem structure, processes and connectivity between the inshore and offshore habitats (DSEWPaC, 2012b).

Information gaps

There is a lack of long term monitoring of seagrass communities within the Amrun-Boyd Point study. However, surveys undertaken as part of the South of Embley EIS, identified only minor seagrass communities within the Amrun-Boyd Point study area. Therefore it is postulated that the lack of seagrass monitoring within the Amrun-Boyd Point study area is due to the lack of seagrass communities present.

Confidence criteria assessment

Seagrass communities are well understood and rigorously monitored within the Weipa study area. The existing information of the seagrass communities within the Project area provide sufficient understanding of cyclical nature and pressures impacting the seagrass in the area.

Measure of importance

Seagrass communities within the study area are considered to be of high local and regional importance. Table 4-7 identifies how this value has been rated against the assessment criteria to determine its importance.

Table 4-7 Statement of importance for seagrass

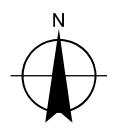
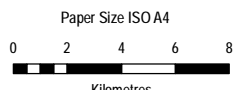
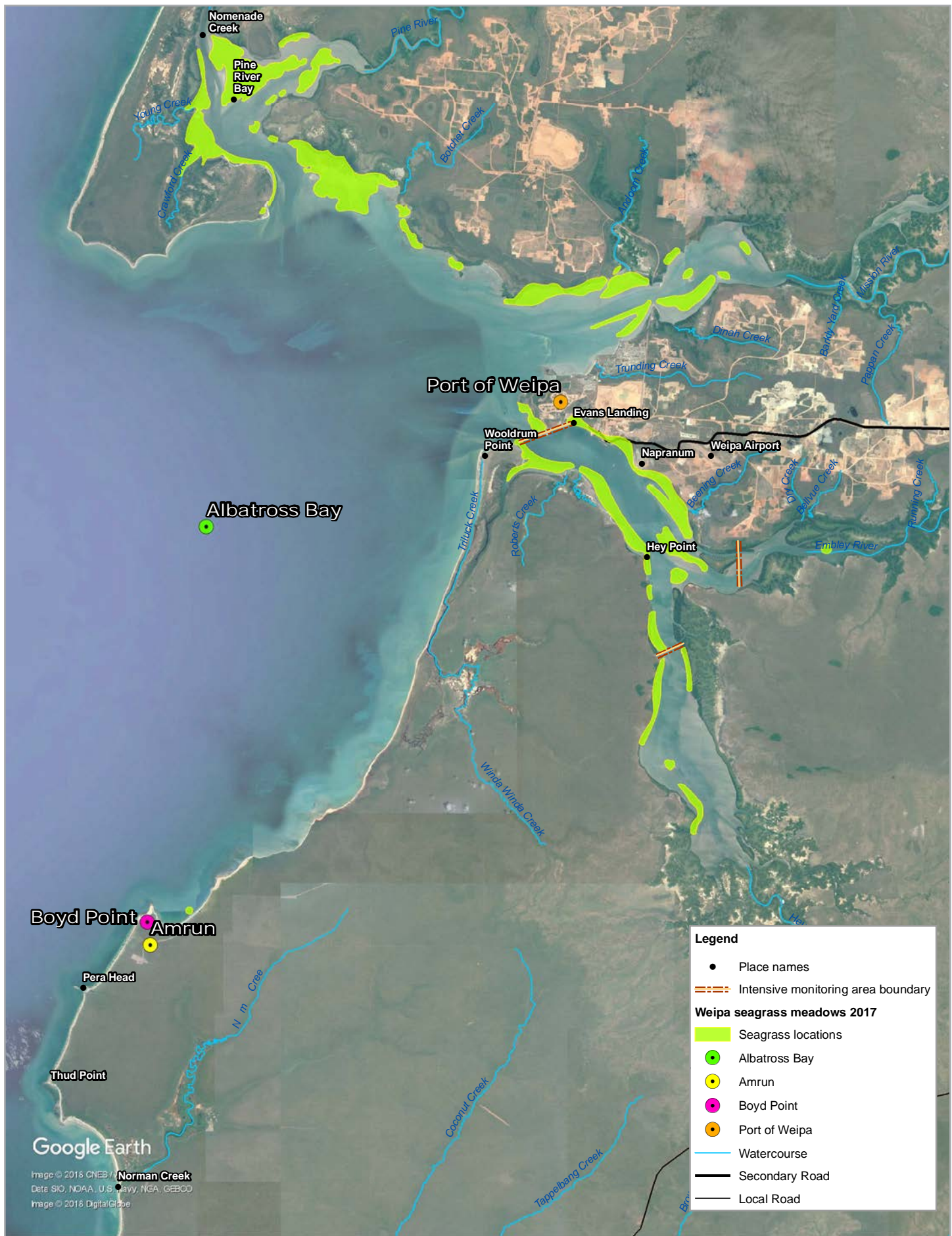
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	✓ Seagrasses are defined as a marine plant and are therefore protected under the Fisheries Act.
Critical habitats/ecosystems	X	✓ Nursery grounds, refuge areas and feeding grounds for conservation and fishery important species. Provide critical ecosystem functioning such as nutrient cycling, carbon sequestration and sediment stabilisation. Provide connectivity between inshore and offshore habitats.
Regional significance	X	✓ Provide an important nursery ground for fisheries species, supporting the Gulf of Carpentaria fisheries.
Social and cultural	X	✓ Provide an important nursery ground for fisheries species, supporting the commercial and recreational fisheries operating within the Gulf of Carpentaria. Provide an important habitat for culturally important totem species

Statement of significance

Seagrass is rated as being a significant EV for the Project area. This EV provides ecosystem services that benefit numerous other EVs, including those that support commercial and recreational fishing, protected species, and indigenous values.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the distribution, diversity and prevalence of seagrasses across both study areas. Reports also validate the importance of this EV in supporting other ecosystem functionality within the Project area, inclusive of fisheries, protected marine megafauna, nutrient cycling and coastal sediment stability.



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Seagrass

FIGURE 4-3

4.2.2 Coral Reefs

Overall definition of EV

Description of EV

Whilst the majority of the Gulf consists of sandy habitats, there are some patchy areas of coral reefs. The coral reef systems within the Project area consist of both hard and soft corals, as well as a number of other benthos. The types of benthos present within the coral reef areas include:

- Corals (massive coral, branching coral, tabulate coral, encrusting coral, foliose coral),
- Hydroids,
- Sponges,
- Soft coral,
- Algae (brown macroalgae, green macroalgae, red macroalgae, coralline algae),
- Other biota (anemone, ascidians, gorgonians, holothurians, sipunculid, bivalve, gastropod, zoanthid, nudibranch, bryozoan, crustacean, sea pen)

The hard coral cover in the reef areas include species from the following genera:

- Porites, branching Acropora, Turbinaria, Montipora, Lobophyllia, Platygyra, Pavona and Favia.

The hard coral communities located within the Amrun-Boyd Point study area consist of small to medium sized colonies of corals from the families Dendrophylliidae, Faviidae and Poritidae (Advisian, 2016b). These species are typical of marine environments that experience high turbidity and/or temperature. Surveys undertaken by Advisian (2016b) revealed adaptive growths of the common genera found, with species appearing flattened, indicating an adaptation to consistent low light conditions.

Coral monitoring surveys were undertaken pre and post dredging within the Amrun-Boyd Point study area by Advisian (2016a). This included a baseline survey undertaken pre dredging (February 2016), and then post dredging surveys at one month (May 2016) and two months post dredging (June 2016). The surveys were undertaken at several locations between Boyd Point and False Pera Head. The survey found no statistical difference in hard coral cover during the pre and post-dredging surveys (Advisian, 2016a).

Location of EV

Albatross Bay is a large shallow bay varying between 0-20 m in depth, providing the suitable habitat for coral reef systems evidenced through the persistence of a number of small fringing coral reefs (NQBP, 2009). Nine Mile Reef is also located approximately 8 km North West of Thud Point.

The location of coral reef systems within the Project area are identified in Figure 4-4.

Regional context

Coral reefs are identified within the North bioregional plan for the North Marine Region as being regionally significant. The coral reefs present within the Project area would not account as a regionally significant system due to the patchy nature of the system. The corals are also well represented in their growth form and diversity throughout the broader region.

Whilst the coral reefs located within the Project area are not locally significant, the North bioregional plan for the North Marine Region identifies that coral reefs within the Gulf of Carpentaria provide high value by supporting aggregations of marine life, biodiversity and endemism. The corals provide breeding and aggregation areas for many fish species, including mackerel and snapper, as well as offering refuge to sea snake and apex predators (DSEWPac, 2012b).

Vulnerability

Global warming and El Nino events pose major long-term threats to the health of coral reefs (National Oceans Office, 2004). Surveys undertaken in 2015/ 2016 determined that coral bleaching observed within the Amrun-Boyd Point study area was a result of wider sustained elevations of sea temperatures, which were observed throughout northern tropical waters between February and April 2016 (Advisian, 2016a).

The Water Quality Trigger Report undertaken by Advisian in 2016, revealed that the three most dominant coral families in the area were those that have a high or intermediate tolerance to suspended solids (Advisian, 2016b).

Certain species of coral are known to be resilient to changes in water temperatures, periodic disturbances such as water quality and increased sediment load. Other stressors to coral communities generally include sea level rise, extreme levels of cyclonic activities and habitat modification (from development activities). Decrease in coral abundance could impact on ecosystem structure, processes and connectivity between the reefs and adjacent waters (DSEWPaC, 2012b).

Information gaps

Whilst surveys were undertaken in 2008 as part of the South of Embley EIS, and again in 2016 during dredging activities in the Amrun-Boyd Point study area, there is a lack of long term coral monitoring data that would inform temporal resilience of coral assemblages within the region.

There have been extensive seabed surveys for seagrasses and benthic infauna within the Weipa study area; these have not affirmed the presence of extensive coral reefs in those areas. As such, while dedicated coral reef monitoring is not regularly completed at Weipa; this is likely reflective of a lack of extensive reef systems suitable for monitoring.

It is also not well understood how the reef systems support demersal and pelagic species in the Amrun-Boyd Point study area (Rio Tinto Alcan, 2011). As the fisheries operating within the overall Project area rely on a number of demersal and pelagic species which are known to use reefal systems during life history development, it is expected that these reef systems are important to supporting regional biodiversity although this is not supported by detailed studies.

Confidence criteria assessment

There are a number of spatial and temporal data gaps in regards to the extent and value of the coral reef communities within the Project area. As such, the importance of these systems to the values for the Project area are inferred with reference to the fisheries and other assemblages expected dependency on these areas.

Measure of importance

Coral reefs within the Project area provide habitat for a variety of species, including commercial fish, sea snakes and apex predators. Whilst they do not form part of a larger network of coral reefs, the reefs are considered to be of regional significance by providing shelter and feeding grounds for a number of fishery species. Table 4-8 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-8 Statement of importance for coral reefs

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓	
	Refuge areas and feeding grounds for conservation and fishery important species.	
Regional significance	✓	
	Refuge areas and feeding grounds for conservation and fishery important species.	
	Identified in the Marine bioregional plan for the North Marine Region.	
Social and cultural	✓	
	Refuge areas and feeding grounds for conservation and recreationally important fishery species	

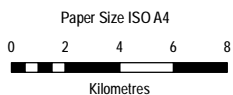
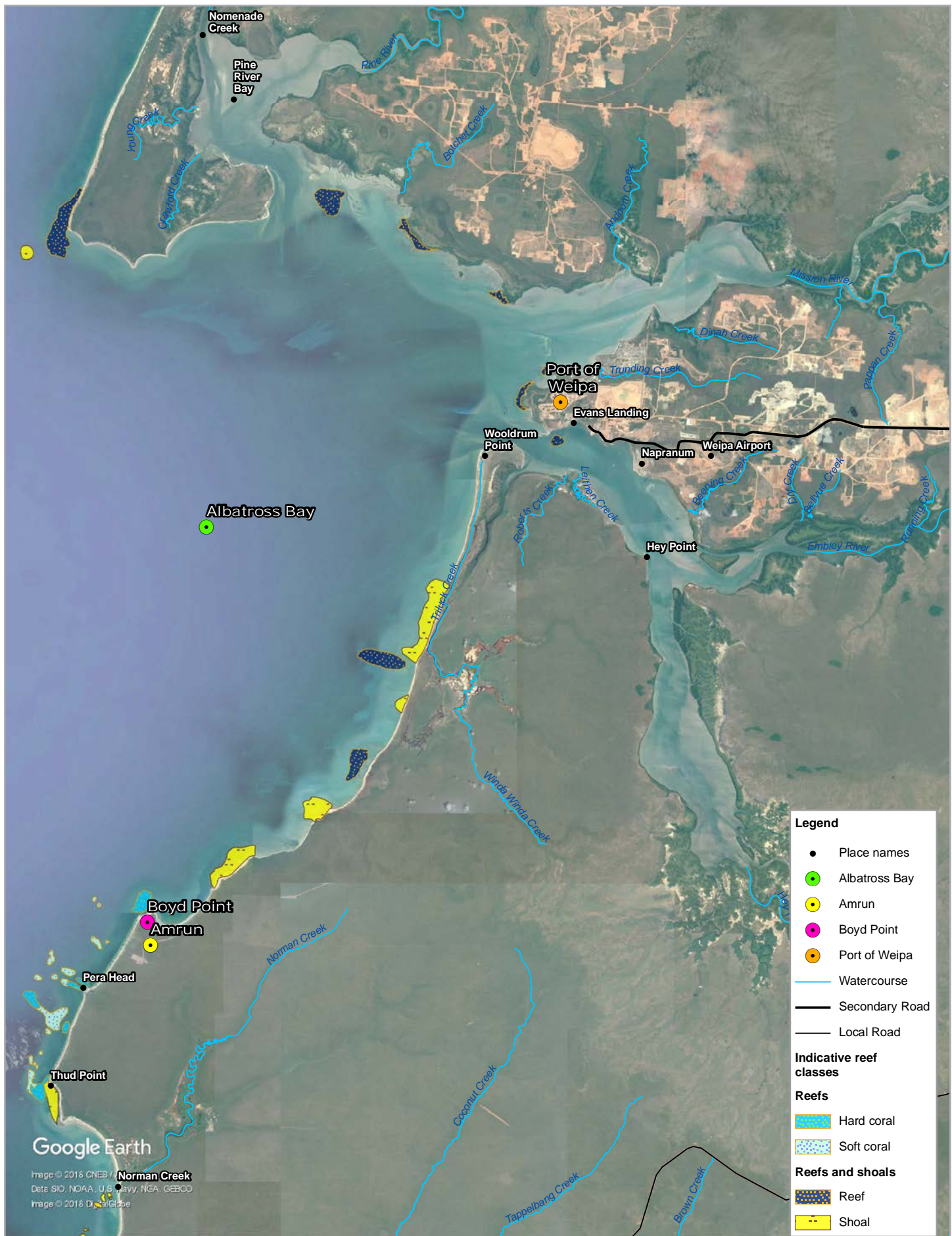
Statement of significance

Coral reefs are not rated as being a significant EV for the Project area (inclusive of both study areas). The reefs that are present are patchy and do not present a connected continuum of reef. The coral reef patches that occur within the Project area are not spatially unique but are well represented in their growth form and diversity throughout the broader region. They are not considered to provide critical habitat or diversity on which other EVs depend.

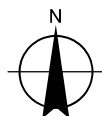
Confidence of finding

The statement of significance is considered to have a moderate level of confidence. This moderate confidence rating is informed by:

- The limited number of surveys that have been targeted on the distribution and condition of coral reefs within the study area
- Reports that identify and describe the importance of this EV in supporting other ecosystem functionality within the Project area
- Reference to fisheries and protected marine megafauna that may use these areas.



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54



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Coral Reefs

FIGURE 4-4

4.2.3 Non-reefal benthic fauna and infauna

Overall definition of EV

Description of EV

Port of Weipa study area

Surveys of benthic fauna within the Albatross Bay spoil ground and adjacent areas have been undertaken in 1996, 1998, 2000, 2004, 2009, 2014 and 2015.

The 2009 survey indicated that benthic infauna communities in the Port of Weipa study area were low in abundance and diversity. The area was reported to be dominated by opportunistic species that have the ability to adapt to highly variable sedimentary conditions (Ports and Coastal Environmental, 2013). The dominant groups identified during the 2009 survey consisted of molluscs (36%), crustaceans (29%), polychaetes (25%) and echinoderms (3%), with the remaining group comprising of 'other' phyla (such as anemones, phoronida, sipunculids and a fish) (GHD, 2009). The most dominant species found was the Arcidae (ark shell) bivalve mollusc *Anadara (Cunearca) ferruginea* which accounted for 35% of the total individuals found (GHD, 2009).

Benthic fauna surveys were then undertaken in 2014 pre and post-dredging in the Port of Weipa study area to inform potential dredging impacts on benthic communities within the spoil grounds. Pre-dredging findings showed high numbers of Polychaetes (57%) with the remaining percent comprising of bivalves (18%), 'other' (asascidians, anemones, echinoderms, gastropods, nemerteans, oligochaetes, fish, sipunculids and a small octopus) (17%), and crustaceans making up 8% (GHD, 2015a). Post dredging findings (undertaken 6 weeks post dredging) revealed a difference in the community composition within the spoil ground and included a composition of bivalves (60%), polychaetes (29%), 'other' (6%) and crustaceans (5%) (GHD, 2015a).

A key difference between pre and post dredging was the prevalence of polychaetes from the family Ampharetidae, and small bivalves from the families Mactridae and Tellinidae. Ampharetidae polychaetes are classed as second stage colonists and are capable of colonising new areas and rapidly increasing in number (GHD, 2015a). Similarly, both Mactrid and tellinid bivalve families are known to facilitate the recruitment of other taxa and act as indicators of community succession (GHD, 2015a).

The findings of the 2015 surveys revealed that while there were some differences in assemblages' pre and post-dredging, infaunal assemblages appeared to be resilient to dredging related impacts, with 2015 surveys reflecting the pre-dredging composition.

Findings were considered to be consistent in compositional analysis to those of historic infauna assessments completed for the Gulf (e.g. Poiner *et al.* 1987).

Amrun-Boyd Point study area

Sampling for estuarine benthic macroinvertebrates was undertaken in May 2009 as part of the Rio Tinto Alcan South of Embley EIS and revealed low abundance of benthic fauna. This was determined to be as a result of an oligotrophic environment. The estuarine benthic communities were characterised as depauperate due to the low salinity and brackish nature of the estuary environments.

Specimens collected from the lower Norman Creek and lower, mid and upper Ward River included taxa of: Annelida, Arthropoda, Crustacea and Mollusca. The greatest abundance in specimens was observed in the lower Norman Creek and lower Ward River (Rio Tinto Alcan, 2011).

A single specimen of a Mysid (shrimp) was found in the upper Ward estuary and belonged to the family *Lepidomysidae*. The species is known to be a stygofauna and is known to occur in groundwater and caves, although they can occur in brackish waters away from caves. Its finding suggests that the sample site could be in a groundwater upwelling location (Rio Tinto Alcan, 2011).

Location of EV

Port of Weipa study area

The surveys undertaken as part of the Port of Weipa maintenance dredging were located within the Albatross Bay spoil grounds (current and historic) as well as in locations adjacent in directions considered to be upstream and downstream of potential impacts at a distance of 200 m, 1000 m and 2000 m.

Amrun-Boyd Point study area

The surveys undertaken as part of the South of Embley EIS identified infauna in the Norman Creek and Ward River.

Regional context

The Gulf of Carpentaria basin is characterised by moderately abundant and diverse communities of infauna, dominated by polychaetes, crustaceans, molluscs and echinoderms (DSEWPaC, 2012a). Benthic fauna and infauna are locally important in cycling of nutrients and organic matter. Surveys undertaken in 2014 and 2015 reveal that the assemblages present are resilient to the impacts caused by dredged material deposition, with many family groups being common and persistent features of the benthic infauna in Weipa (GHD, 2015b).

Vulnerability

The benthic communities within Port of Weipa study area demonstrated high variability reflective of the natural variability of such assemblages and their responsiveness to the natural variability of sediments across Albatross Bay.

Physical habitat modification as a result of development activities (such as dredging) could lead to direct disturbance (removal) of existing benthos at dredging locations and smothering at the locations where the dredging material is being placed. Studies do show recovery of communities; frequency of temporal impacts would need to be carefully managed to avoid permanent degradation of local diversity.

Information gaps

The South of Embley EIS identified that further sampling would be required to characterise benthic fauna communities during the dry season.

Confidence criteria assessment

Benthic infauna can be used as indicators of change, particularly with regard to seabed impact disturbance events. Existing information for Weipa supports understanding of change in communities in response to anthropogenic and climatic influences offshore; inshore data and information of relevance to Amrun is however lacking.

Measure of importance

Benthic fauna and infauna are locally important in cycling of nutrients and organic matter. Table 4-9 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-9 Statement of importance for non-reefal benthic fauna and infauna

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	✓ Mix and oxygenate sediment. Food source for a variety of species, such as fishery significant species.	
Social and cultural	X	X

Statement of key environmental value

The non-reefal benthic fauna and infauna EV is rated as not significant. The non-reefal benthic fauna and infauna with the Project area are known to be widely distributed throughout the region. They are not unique to the Project area and are known to be highly resilient and persistent to changes in water quality.

Confidence of finding

The statement of significance is considered to have a moderate to high level of confidence. This moderate confidence rating is on the basis of level of spatial data that informs the distribution and diversity of infauna within the Port of Amrun area. The high confidence rating is on the basis of significant temporal data that informs the distribution and diversity of infauna within the Port of Weipa spoil ground.

4.2.4 Marine Fauna

Overall definition of EV

Description of EV

The EPBC Act Protected Matters Search Tool undertaken in 2018 identified the following protected marine fauna species as known or likely to occur in the overall Project area:

- 4 sawfish
 - dwarf sawfish, freshwater sawfish, green sawfish and narrow sawfish
- 3 whales and other cetaceans
 - Irrawaddy dolphin and indo-pacific dolphin
- 1 marine mammal
 - Dugong
- 6 marine reptiles
 - loggerhead turtle, green turtle, leatherback turtle, hawksbill turtle, olive ridley turtle, flatback turtle and estuarine crocodile
- 25 marine birds
 - Common sandpiper, common noddy, fork-tailed swift, great egret, sharp-tailed sandpiper, red knot, curlew sandpiper, oriental cuckoo, lesser frigatebird, great frigatebird, swinhoe's snipe, pin-tailed snipe, white-bellied sea-eagle, black-winged stilt, bar-tailed godwit, black-faced monarch, spectacled monarch, satin flycatcher, eastern curlew, little curlew, whimbrel, osprey, rufous fantail, common greenshank and marsh sandpiper.

The Wildnet records identifies the olive ridley turtle, the flatback turtle and the Australian humpback dolphin as also recorded within 1 km of the overall Project area.

Sawfish

Three species of sawfish have been assessed as likely to occur within the Project area. The Green, Narrow and Dwarf Sawfish are all likely to occur within the Project area and all are species of conservation significance.

Mammals, whales and other cetaceans

The South of Embley EIS surveys identified that several marine fauna are known to occur within the Amrun-Boyd Point study area and consist of:

- Indo-pacific humpback dolphin, inshore and offshore forms of the bottlenose dolphins and Australian snub fin dolphin;
- the Bryde's whale may sporadically inhabit the Project area; and
- Dugong

A baseline dolphin survey was undertaken in 2014 by GHD for the Amrun region. The survey identified 110 dolphin groups, with a total group size of 476. The most frequently seen species was the Australian humpback dolphin, followed by the Indo-Pacific bottlenose dolphin (GHD, 2015c). Small numbers of Australian snubfin dolphins were observed, primarily around Thud Point and within the Archer, Ward and Watson River systems within the Aurukun Estuary (GHD, 2015c). Gray's spinner dolphins and one group of offshore bottlenose dolphins were also observed near Thud Point (GHD, 2015c).

Marine reptiles

All six species of marine turtle were assessed as likely to occur within the Project area through the South of Embley EIS. The EPBC Protected Matters Search Tool (PMST) identified the green, olive ridley, flatback and hawksbill turtles as known to occur in the area,

whilst the loggerhead and leatherback turtles were identified as likely to occur. The Atlas of Living Australia identifies 10 recordings of the hawksbill turtle and one recording of the flatback Turtle within and around the Project area. Marine Turtle nest surveys were undertaken in 2016 and 2017 to observe the nesting locations and hatchling survival. Results from the two years identified an increase in nests within the Amrun-Boyd Point study area, with numbers increasing from 129 to 214 confirmed and potential nests (Pendoley Environmental Pty Ltd, 2017 and 2018).

The South of Embley EIS surveys identified the olive ridley, flatback and hawksbill turtles as known to occur within the Project area, as well as forage in the surrounding reef systems. Both the flatback and hawksbill turtles are known to nest on the beach between Boyd Point and Pera Head. The loggerhead, green and leatherback turtles may be transient through the area to forage on the surrounding reef systems or seagrass beds.

The baseline dolphin survey undertaken by GHD in 2014 also recorded other mega fauna species during the survey. This included sightings of 10 flatback turtles, 11 green turtles, 13 hawksbill turtles and 124 turtles that were not able to be identified.

Surveys undertaken as part of the Port of Weipa Environmental Constraints Assessment in October 2016 identified the estuarine crocodile as present within the Port of Weipa study area. The estuarine crocodile is also known to occur in the Amrun-Boyd Point study area with evidence of a nest occurring within Winda Winda Creek and sightings during the South of Embley EIS along Norman Creek and its tributaries, as well as south of Boyd Point.

Sea snakes

No sea snake species are listed as threatened under the EPBC or NC Act, however they are listed as marine species under the EPBC Act. Sea snakes are known to occur in the Project area with the most dominant species being spine-bellied sea snake. Other species that are known to occur include; horned sea snake, Dubois' sea snake, golden sea snake, Stoke's sea snake, beaked sea snake, elegant sea snake, and ornate reef sea snake.

The dolphin baseline survey also identified 91 sea snakes, with the main species observed being the spine-bellied sea snake and the elegant sea snake.

The 2017 inshore dolphin surveys identified

Fish and other invertebrates

Foreshore species consist of Queenfish, Milkfish and Blue Salmon whilst the reef habitats support demersal and pelagic species.

Three sygnathid species listed under the EPBC Act are known to occur within the Project area and consist of; Big Belly Seahorse, Spotted Seahorse and White's Seahorse.

Location of EV

Marine fauna are found throughout the entire Project area and can utilise multiple habitats within the area. Recorded locations of marine fauna are identified in Figure 4-16.

Regional context

The North Marine Bioregional Plan identifies a number of species as conservation values and a priority for conservation efforts in the north marine region, these include:

- Sea snakes;
- Dwarf, freshwater and green sawfish;
- Flatback, green, hawksbill, leatherback, loggerhead and olive ridley turtles;
- Estuarine crocodile;

- Dugong; and
- Australian snubfin, indo-pacific humpback and indo-pacific bottlenose dolphins

The National Conservation Values Atlas by the Department of Environment and Energy maps the Project area as a biologically important area for the lesser frigatebird, flatback turtle, green turtle, hawksbill turtle, leatherback turtle, olive ridley turtle, Australian snubfin dolphin, Indo-Pacific dolphin, bottlenose dolphin and the Indo-Pacific humpback dolphin.

The South of Embley EIS noted that the population of sawfish within the Gulf of Carpentaria is of global significance (Rio Tinto Alcan, 2011). The National Oceans Office (2004) suggests that this could be as a result of the Northern Territory possibly being the last remaining area containing viable sawfish populations.

A significant proportion of the world's dugong population is known to occur in Australia's northern waters. It was estimated in 2002 that there are approximately 80,000 dugongs in Australian waters, with surveys in 1994 estimating that the population in the Gulf of Carpentaria coast was around 23,000 (National Oceans Office, 2004).

The dugong has significant cultural value for many Indigenous People, with the species playing an essential role in the Aboriginal traditional culture (National Oceans Office, 2004).

Vulnerability

Marine debris constitutes the primary constraint of concern for the conservation values of sea turtles. Sea level rise, changes in sea temperature, ocean acidification, pollution, noise and light pollution constitute other constraints of potential concern for the conservation values of the other marine fauna within the area (DSEWPaC, 2012b).

Studies undertaken as part of the South of Embley EIS identified that turtle nests located along the beaches near Boyd Point showed signs of significant predation and destruction by feral pigs due to the large population of feral pigs within the Project area. The Supplementary EIS also indicates that the major threat to sea snakes is prawn trawling (Rio Tinto Alcan, 2011).

Information gaps

Biologically important areas have not yet been mapped for seabirds (except the lesser frigatebird), loggerhead turtle, sea snakes, dugongs, sawfishes, river sharks, estuarine crocodile, seahorse or pipefish in the North Marine Region (DSEWPaC, 2012a).

The distribution of syngnathids is poorly known and therefore syngnathid species other than those listed above, may occur within the Project area.

Accurate and up to date data on the population sizes of marine fauna in the overall Project area is lacking.

Confidence criteria assessment

There is sufficient information on sea turtle, dolphin and dugong species and the estuarine crocodile to make a reliable assessment of risk. However, there are some gaps in information in regards to species distribution and abundance for saw fishes, river sharks, sea snakes, seahorses and pipefish.

Measure of importance

The area supports populations of marine species which are important globally (green, hawksbill and flatback turtles, sawfish and river sharks) and nationally (sawfish and river sharks). A number of these marine fauna species are listed under state and federal legislation as threatened, migratory, marine and cetacean. Table 4-10 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-10 Statement of importance for marine fauna

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	✓	
	<p>Supports EPBC Act listed species.</p> <p>Supports nationally and globally significant populations of sawfish and river sharks.</p> <p>Support a significant proportion of the world's dugong populations.</p>	
MSES	✓	
	<p>Supports NC Act listed species.</p> <p>Estuarine crocodile is abundant and widespread throughout Project area.</p>	
Critical habitats/ecosystems	✓	
	<p>Green, leatherback, loggerhead and olive ridley turtle are known to use the Project area for feeding, breeding and nesting, making it a critical habitat and biologically important area.</p> <p>Australian snubfin dolphin, Indo-Pacific humpback dolphin and Indo-Pacific bottlenose dolphin known to use Project area for breeding and foraging.</p>	
Regional significance	✓	
	<p>Supports species listed under the West Cape York Commonwealth Marine Reserve; including flatback, hawksbill and olive ridley turtles, and the lesser frigatebird.</p> <p>Supports species listed under the Marine Bioregional Plan, including; seahorses and pipefish, dolphins, dugong, reptiles, sawfishes and river sharks, and seabirds (DSEWPaC, 2012a).</p> <p>Supports globally significant populations of the green, hawksbill and flatback turtles.</p>	
Social and cultural	✓	
	<p>Dugong and turtles have significant social and cultural value for Traditional Owners in the area</p>	

Statement of significance

Overall, marine fauna is rated as not significant. However there are a specific species that are rated as significant including inshore dolphins, dugongs and sawfish. There is a relatively large data gap in the knowledge of sawfish populations and distribution. They are however known to be rare, and any known populations of the species could be a significant population.

Confidence of finding

The statement of significance is considered to have a moderate to high level of confidence, dependent on the species being assessed. The moderate confidence rating is on the basis of insufficient data to support understanding of river sharks, sea snakes and syngnathids populations within the study area. The high confidence rating is on the basis of significant spatial and temporal data to support understanding of those species rated as significantly important in the Project area.

4.2.5 Marine water quality management

Overall definition of EV

Description of EV

Surveys

Water quality monitoring was undertaken within the marine environment of the Project area as part of the South of Embley EIS. There were three major surveys (short term and long term) that were used to identify the marine water quality. The surveys undertaken included:

- Short term survey undertaken in October 2007;
- Long term in-situ logger data collection between November 2007 and March 2008; and
- Long term in-situ data collection at Boyd Point from December 2006 to July 2007 and December 2007 to March 2008 (information was sourced from Chalco).

The short term survey included sampling from 24 sites within the Project area and included locations within the Embley and Hey Rivers, near the proposed spoil ground for Amrun, near the Albatross Bay spoil ground and near the near shore reef and soft sediment habitats around Boyd Point.

The long term in-situ logger data collection was undertaken at three sites, near Boyd Point, the proposed spoil ground for Amrun and near Pera Head. The loggers recorded data at the site at 10 minute intervals between November 2007 and March 2008. Additional data from two in-situ loggers by Chalco at Boyd Point included relevant marine water quality data between December 2006 and July 2007 (Rio Tinto Alcan, 2011).

Further surveys were then undertaken between June to September 2010 and February to April 2012 as part of the Dredge Management Plan for the South of Embley Project. These results include both wet and dry season data for the Boyd Point area and Pera Head. The results from these surveys are included below.

Marine water quality monitoring was undertaken as part of the South of Embley EIS and Dredge Management Plan. The water quality values from the above surveys include:

- **pH** in marine waters ranged between 7.0-7.7 pH units whilst estuarine waters ranged between 5.1-7.7 pH units.
- **Electrical conductivity** in marine waters ranged from 19,000 to 53,200 microsiemens per centimetre ($\mu\text{S}/\text{cm}$).
- **Turbidity** in marine waters ranged between a median of 5.9 to 16.5 NTU, with lower results occurring in the dry seasons. Turbidity in estuarine streams ranged between 1.2 to 5 NTU.
- **Total suspended solids (TSS)** ranged between a median of 1.8 to 21.3 mg/L, with lower results occurring in the dry season. The highest median TSS results were recorded at Boyd Point (with a median of 21.3 mg/L in the wet season), whilst the lowest median results were recorded at Pera Head (with a median of 1.8 in the dry season) (Rio Tinto Alcan, 2015b).
- **Dissolved organic carbon** in the estuaries ranged from 0.5 to 5 mg/L, with a median of 2 mg/L.
- The maximum concentrations of **total phosphorus**, **total nitrogen** and **ammonium** in estuarine/marine waters was 0.18, 4.8 and 1.8 mg/L, respectively.
- **Hardness** in the marine waters ranged from 1,475 to 6,418 mgCaCO₃/L. Estuarine hardness ranged from 3.4 to 6,800 mgCaCO₃/L which reflects the seasonal freshwater inflows.

- The concentration of dissolved **aluminium** in the estuarine and marine water sample exceeded the low reliability default ANZECC/ARMCANZ (2000) trigger value for marine water. The remaining **metals** did not exceed the ANZECC/ARMCANZ guideline trigger values.

Further surveys have occurred in recent years as part of the Amrun facilities dredging activities. This included baseline surveys in 2015 and 2016, as well as monitoring pre, during and post dredging. Baseline surveys reflect similar results for turbidity as the previous sampling, with 80th percentile trigger levels ranging between 3 – 7 NTU during dry season and between 8 – 35 NTU during wet season (Rio Tinto Alcan, 2017).

The mean dry season turbidity trigger levels at 80thile and 95thile across sites within the **Amrun-Boyd Point study area** are 5 and 7.25 NTU respectively (Advisian, 2016b).

The mean wet season turbidity trigger levels at 80thile and 95thile across sites within the **Amrun-Boyd Point study area** are 20 and 65.25 NTU respectively (Advisian, 2016b).

These levels are slightly higher than those recorded by Rio Tinto Alcan in 2008, however, the higher wet season levels may be as a result of limited wet season monitoring occurring in 2008.

Location of EV

The marine water quality is for the whole of Albatross Bay region.

Regional context

The Environmental Protection (Water) Policy 2009 addresses water pollution in coastal areas and includes water quality objectives to protect and enhance EVs (EHP, 2013).

Coastal vegetation (e.g. dunes, freshwater estuarine and marine wetlands) stabilise sediment and processes nutrients, which in turn, promotes healthy groundwater and surface water processes and water quality (EHP, 2013).

Vulnerability

Mining activities and vegetation clearing can also impact on the quality of marine water and lead to increased sedimentation and contamination. Increased sedimentation and contamination caused by on-land activities could lead to cumulative impacts on other EVs that rely on the marine waters within the overall Project area.

Information gaps

There is a lack of widespread and regular marine water quality sampling. However, sampling has been undertaken during dredging activities at both the Port of Weipa and the Amrun facility and provide both pre and post dredging water quality results.

Confidence criteria assessment

The geographic (Weipa and Amrun) and historic extent of marine water quality monitoring within the Project area is not considered sufficient to reliably assess potential changes to the marine water quality as a result of development activities such as dredging within the ports.

Long term water quality monitoring data is required to establish the seasonal and land based influences on water quality. Future increases in pressures from port related activities (including dredging) land based run off from urban, industrial and agricultural sources could impact on the water quality in the area. Without good water quality conditions, marine ecology could be compromised.

Measure of importance

The marine and estuarine environment within the Project area and surrounding region is considered an important area for protected species, providing feeding, breeding and nesting grounds. The water quality of the marine environment is therefore of high local significance due to its supporting role to other EVs. Table 4-11 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-11 Statement of importance for marine water quality

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	✓	
	The existing water quality supports prevalence and health of protected matters including turtles, dugongs and inshore dolphins.	
MSES	✓	
	The existing water quality supports prevalence and health of protected matters including marine reptiles, seagrasses and mangroves.	
Critical habitats/ecosystems	✓	
	The existing water quality supports maintenance of habitats such as inshore coral reefs and seagrasses of importance to protected species and fishery species.	
Regional significance	✓	
	The existing water quality supports prevalence and health of important ecosystems as well as protected matters including turtles, dugongs and inshore dolphins.	
Social and cultural	✓	
	The existing water quality supports prevalence and health of culturally and recreationally important species.	

Statement of significance

Marine water quality is rated as not significant overall EV for the Project area. Marine water quality in Weipa and the Gulf is considered to be of higher turbidity than other regions due to prevailing conditions. Water quality also shows significant variance throughout the year in the Gulf region depending upon seasonal inputs. The EVs dependent on the water quality of the Gulf already exhibit resilience to this natural variability. The natural variability means ability to detect changes in water quality in response to potential impacts is limited. Instead, management and measuring condition of EVs that are dependent upon maintenance of water quality conditions provides a better approach to managing risk to EVs of the Project area. As such, while water quality supports a number of EVs, it is not considered to be a significant EV in and of itself.

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. This moderate level of confidence rating is on the basis of a number of marine water quality surveys undertaken, mostly in response to dredging activities.

4.2.6 Protected areas

Overall definition of EV

Description of EV

The overall Project area is not located within a North Commonwealth Marine Reserve, however, the Gulf of Carpentaria and West Cape York marine reserves are located within close proximity to the site. Although the overall Project area is not within these marine reserves, a number of the major conservation values identified for these marine reserves are known to occur within the Project area.

Albatross Bay is recognised as containing environmentally important marine habitats. The Pine River Bat Fish Habitat Area A (FHA) is located in the northern extent of the Project area and consists of the northern side of Mission River and the whole of Pine River Bay (DEEDI, 2011). The Pine River Bay FHA covers 25,573 hectares, with 25,560 ha falling into management area A and 13 ha falling into management area B (NPSR, 2012).

Location of EV

The Pine Rivers FHA is located in the northern extent of the Project area, in Mission River and Pine River Bay (refer to Figure 4-18).

Regional context

Fish habitat areas provide a number of habitat and fishery values to the surrounding environment. The FHA consists of seagrass and mangrove forests which provide essential nursery, feeding and habitat areas for fishery important species, such as banana prawns, tiger prawns, mackerel, barramundi, mangrove jack, fingermark and queenfish (NPSR, 2012). The Pine River Bay is included under the Cape York Regional Plan (DSDIP, 2014).

The Pine River Bay has both cultural and fisheries significance to the Thanakwith Anguthimiri and Thanakwith Thayngath People (NPSR, 2012).

Vulnerability

The Pine Rivers FHA is vulnerable to impacts from development and increased use from recreational users. Increased sediment and storm water runoff can also cause a significant problem to the fish habitat areas due to decreased water quality. However, under Department of Agriculture and Fisheries, development of any structure within a fish habitat area requires prior authorisation.

Information gaps

No notable gaps in the available information have been identified for protected areas.

Confidence criteria assessment

Current monitoring of seagrass within the protected area (refer to Section 4.2.1) provide sufficient information to make a reliable assessment of risk. Further information may be needed to monitor condition of the mangrove communities within the protected area to determine the overall condition of the FHA.

Measure of importance

The protected areas, in particular the Pine River FHA, is considered to be of high local and regional importance. The area consists of both seagrass meadows and mangrove forests, both of which are well studied and known to support both conservation significant and important fishery species. Table 4-12 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-12 Statement of importance for protected areas

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	✓ Declared fish habitat area.
Critical habitats/ecosystems	X	✓ Pine Rivers Bay FHA provides essential nursery, feeding and habitat areas for commercially important species.
Regional significance	✓ Support fisheries species, supporting the Gulf of Carpentaria fisheries.	✓ Support fisheries species, supporting the Gulf of Carpentaria fisheries. FHA under the Cape York Regional Plan.
Social and cultural	X	✓ Pine River Bay has both cultural and fisheries significance to the Traditional owners in the area

Statement of significance

Protected Areas are rated as not significant. The Project area is not in a Marine Park zone and is a significant distance from other Commonwealth Marine Reserves. The extant protected areas provide protection to species that are of high value to the Project area. Accordingly, the Protected Areas have intrinsic value but are not significant as standalone entities. These protected areas are also governed through existing planning instruments that manage potential impacts or risk of interference.

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. This moderate confidence rating is on the basis of available data from other EVs such as seagrass, mangroves and wetlands. Existing reports do not describe the current status of the protected areas within the study areas.

4.2.7 Mangroves

Overall definition of EV

Description of EV

The mangrove assemblage within Albatross Bay is extremely diverse, with thirty species of mangrove having been recorded, making it the most extensive system on the eastern Gulf of Carpentaria (Rio Tinto Alcan, 2013). The mangrove assemblages in the overall Project area are dominated by closed *Rhizophora*, *Avicennia* and *Ceriops* forests (Rio Tinto Alcan, 2011).

Location of EV

Extensive mangrove communities occur in sheltered tidal areas within the estuary and tidal creeks of the three major watercourse systems; Hey River, Embley River and Mission River. There are, however, also mangrove assemblages occurring within Norman Creek, Winda Winda Creek and Crawford Creek (Rio Tinto Alcan, 2011).

It is estimated that there is 80 km² of mangroves located along the banks of the Embley River (NQBP, 2009).

Regional context

The low lying nature of Weipa means the area has a lack of topographical protection, meaning it is susceptible to adverse weather events. However, the existence of mangroves along the coastlines can act as a natural buffer against storm surges and tidal cycles, protecting the shorelines and low lying areas.

The mangroves also provide:

- Important habitat for a number of species, including; prawns, fish, birds and estuarine crocodiles, as well as providing year round shelter and food;
- Nursery habitat for fishery significant species such as barramundi, banana prawns and mud crabs; and
- Water filtration, sediment stabilisation and coastal protection.

The South of Embley EIS references research undertaken by CSIRO into mangrove lined banks and their importance as nursery habitats for white banana prawns which revealed that these areas are the only nursery habitat utilised by the species. The mangrove communities are therefore of high regional importance due to their influence into the development and growth of fishery significant species, as well as their habitat importance to other species (including those of conservation value) (NQBP, 2009).

Mangroves provide significant cultural value to the local Traditional Owners, with mangrove plants being used for a variety of purposes, such as for food, medicine, implements, dyes, fibres and seasonal indicators. The fauna associated with the mangrove communities also form an integral part of the diet of many coastal Aboriginal groups (National Oceans Office, 2004). Whilst most other food sources are seasonally restricted, mangrove communities can provide a guaranteed food source all year round (National Oceans Office, 2004).

Vulnerability

Although there has been no large scale clearing of mangroves in the Project area, minor localised clearing of mangrove communities could cause impacts to a number of other EVs that rely on the mangroves as habitat and food source.

Information gaps

There is a lack of knowledge in regards to the health of the mangroves within the Project area which could affect the regional importance of these systems. The coverage of mangroves within the overall Project area is outdated.

Confidence criteria assessment

There is sufficient information to make a reliable assessment of risk. However the condition of the mangrove communities in the area is not well understood.

Measure of importance

Mangrove communities within the Project area are considered to be of high regional importance. Table 4-13 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-13 Statement of importance for mangroves

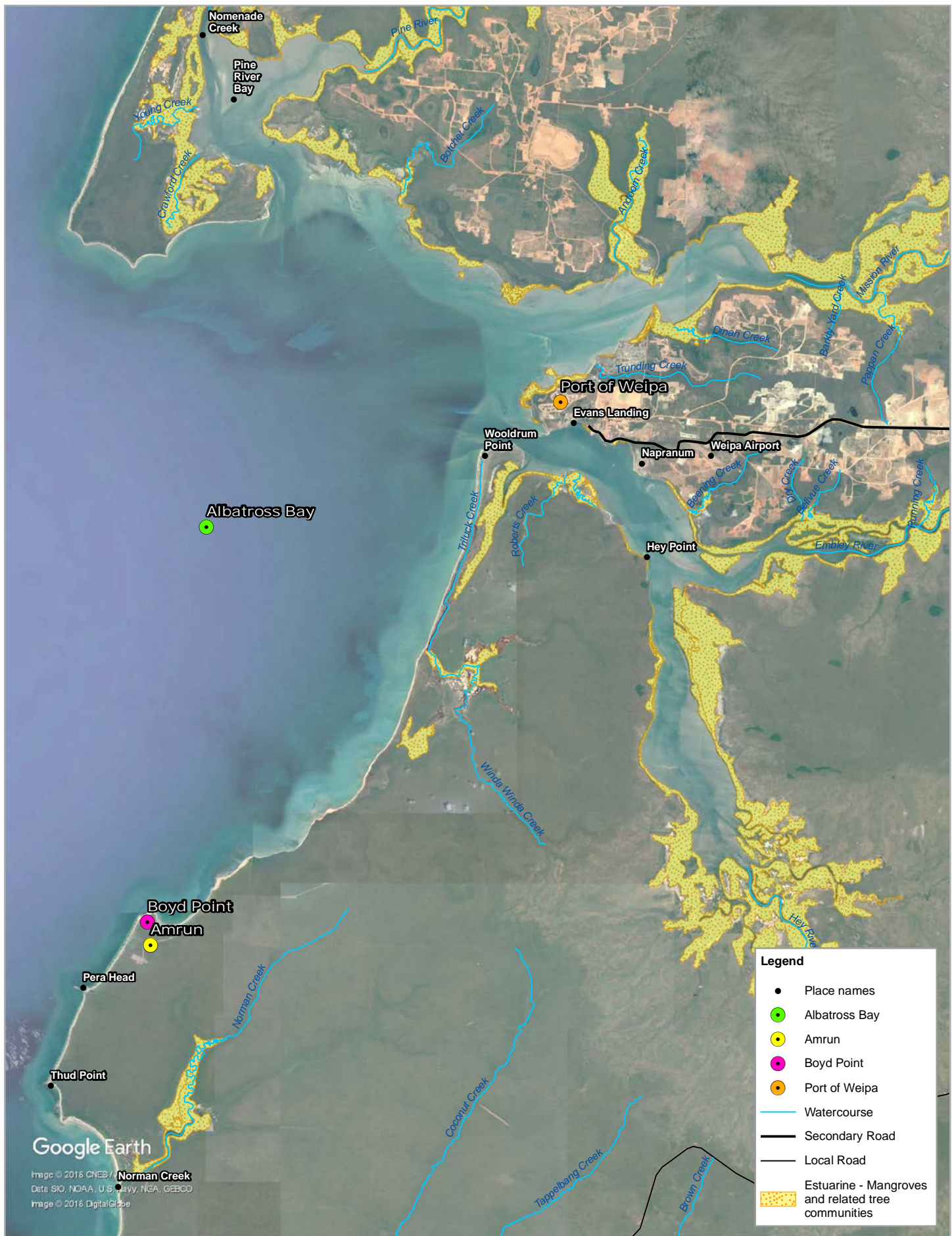
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	✓ Protected under <i>Fisheries Act 1994</i> .	
Critical habitats/ecosystems	<p style="text-align: center;">✓</p> <p>Nursery grounds, refuge areas and feeding grounds for conservation and fishery important species, such as barramundi, banana prawn and mud crab.</p> <p>Provide critical ecosystem functioning such as nutrient cycling, sediment stabilisation and coastal protection.</p>	<p style="text-align: center;">✓</p> <p>Nursery grounds, refuge areas and feeding grounds for conservation and fishery important species, such as barramundi, banana prawn and mud crab.</p> <p>Provide critical ecosystem functioning such as nutrient cycling, sediment stabilisation and coastal protection.</p> <p>Provide connectivity between inshore and offshore habitats.</p>
Regional significance	✓	
	Nursery grounds, refuge areas and feeding grounds for conservation and fishery important species, as barramundi, banana prawn and mud crab.	
Social and cultural	✓	
	Provide significant cultural value to the local Traditional owners.	

Statement of significance

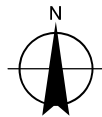
Mangroves are rated as being a significant EV for the Project area (inclusive of both study areas). This is reflective of the ecosystem service benefits mangroves provide across physical and biological attributes of the Project area. This is also reflective of the use of mangroves by protected species and fishery species that are also recognised to be significant EV's for the Project area, and of the cultural value to Traditional Owners within the Project area.

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. This moderate confidence rating is on the basis of available data from other EVs such as seagrass, protected areas and wetlands. Existing reports do not describe the current status of the mangroves within the Project area.



Paper Size ISO A4
 0 2 4 6 8
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

Project No. 41-31822
 Revision No. C
 Date 29/08/2018

Mangroves

FIGURE 4-5

4.2.8 Wetlands

Overall definition of EV

Description of EV

Directory of Important Wetlands in Australia

The closest important wetland as listed under the Directory of Important Wetlands in Australia is located approximately 10 km south of the study area and is the Archer Bay Aggregation. The Archer Bay Aggregation covers approximately 29,931 ha (Rio Tinto Alcan, 2011). The wetlands are listed due to them meeting five of the six possible criteria used to determine wetlands of national significance. The Archer Bay Aggregation meets the following criteria (Blackman et al., 1992):

1. It is a good example of a wetland type occurring within a biogeographic region in Australia;
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail;
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; and
6. The wetland is of outstanding historical or cultural significance.

Aquatic Conservation Assessment Wetlands

A number of non-riverine wetlands as mapped under the Aquatic Conservation Assessments are located within the Project area with those in the area ranging between medium to very high conservation significance. The conservation significance for these wetlands were determined using the criteria outlined in the Aquatic biodiversity assessment and mapping method (AquaBAMM) (Clayton et al., 2006). The criteria these wetlands are assessed against include:

- Naturalness
- Representativeness
- Diversity and richness
- Rarity
- Special features.

Vegetation Management Wetlands

A number of vegetation management wetlands as mapped under the *Vegetation Management Act 1999* are located within the Project area. The vegetation management wetlands overlap with the wetlands mapped under the Aquatic Conservation Assessment.

Matters of State Environmental Significance Wetlands

Three MSES wetlands are located within the Project area. One is located to the west of Pine River, one is located to the north of the Mission River and one is located northeast of Weipa town centre.

Location of EV

A high percentage of the wetlands are located within the Weipa area, as well as to the north of Mission River and consist of medium to very high conservation significance wetlands. The Archer Bay Aggregation is located in the southern extent of the Amrun-Boyd Point study area and incorporates the Ward River.

Regional context

The Archer Bay Aggregation is identified as the best example of a large estuarine embayment with brackish and freshwater wetlands in the Cape York Peninsula. The Archer Bay Aggregation has very high cultural significance to the Indigenous community in the area (Blackman et al., 1992). The site is virtually pristine and supports roosting, feeding and breeding for a number of waterbirds, particularly the magpie goose (Blackman et al., 1992).

The wetlands provide important habitat to a number of listed species of conservation significance as well as providing habitat to important populations of waterbirds (Rio Tinto Alcan, 2011).

Vulnerability

The wetlands in the Project area are vulnerable to impacts by feral pigs as well as to impacts caused by decreased water quality as a result of increased sedimentation and contamination from mining and vegetation clearing activities.

Information gaps

There is a lack information as to how the wetlands located in the Project area support flora and fauna species. There is also a lack of information regarding the MSES wetlands that are located within the Project area.

Confidence criteria assessment

Existing information from seagrass, protected areas and mangrove sources could provide sufficient information to make a reliable assessment of risk on wetlands in the area. However, the condition of these wetlands, especially those within the Project area, is not known.

Measure of importance

The MSES wetlands within the Project area are considered to be of high state conservation significance. Table 4-14 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-14 Statement of importance for wetlands

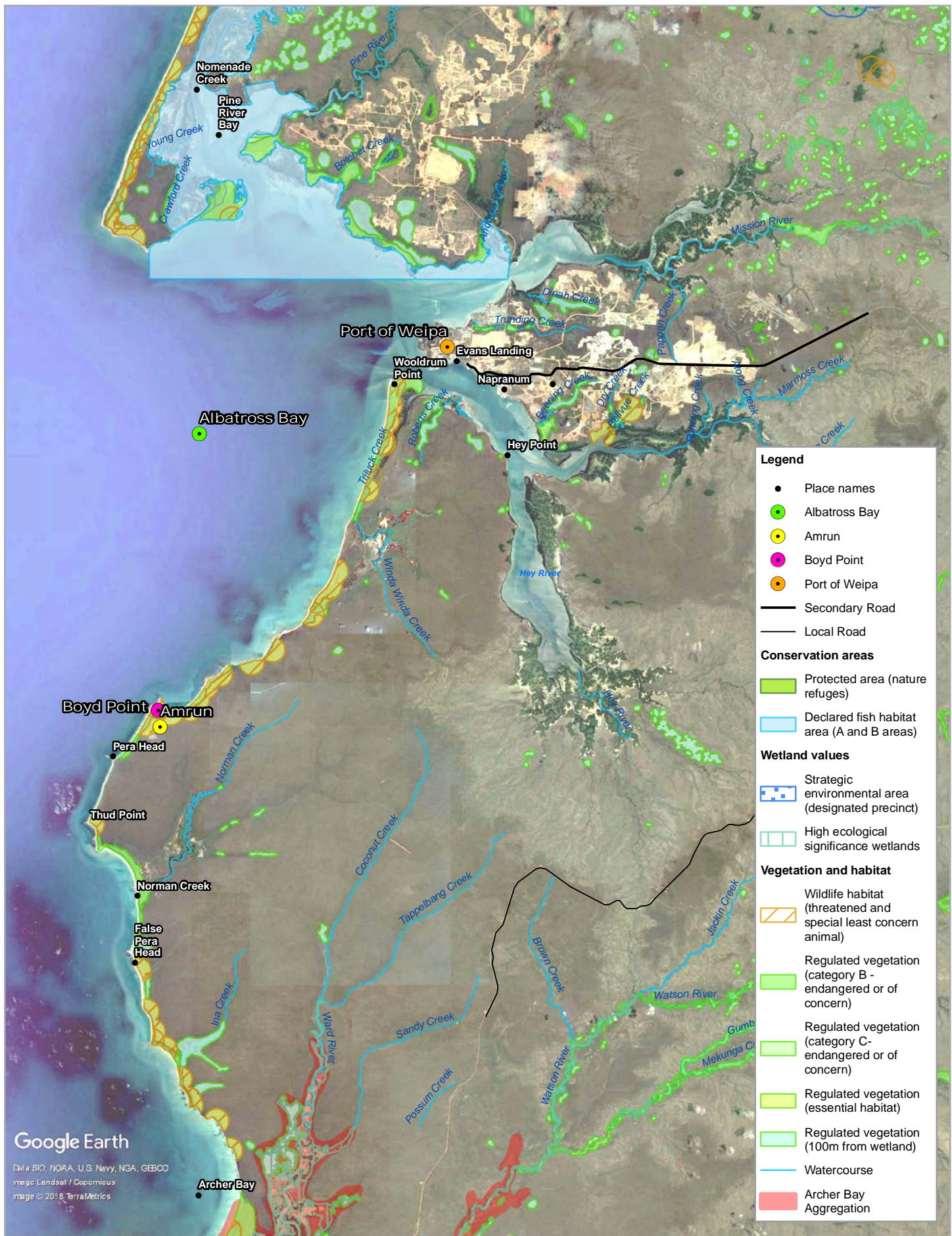
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	✓ MSES listed wetlands	
Critical habitats/ecosystems	X	✓ Supports roosting, feeding and breeding for conservation significant species and waterbirds.
Regional significance	X	X
Social and cultural	✓ Provide social and cultural values to Traditional owners.	

Statement of significance

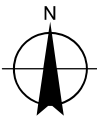
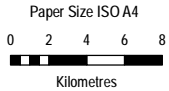
Wetlands are rated as not being significant. The wetlands that occur in the Project area are not unique to the Gulf region, with many areas of more pristine wetland habitat better represented outside the Project area. Accordingly, while the wetlands provide roosting habitat and other values, these values are not significantly represented in the Project area as there is better representation of wetlands elsewhere.

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. This moderate confidence rating is on the basis of available data from other EVs such as seagrass, mangroves and protected areas. Existing reports do not describe the current status of the wetlands within the study areas.



Google Earth
 Data: SIO, NOAA, U.S. Navy, NGA, GEBCO
 Image: Landsat / Copernicus
 Image © 2018, TerraMetrics



North Queensland Bulk Ports
 Port of Weipa Environmental Values Assessment

Project No. 41-31822
 Revision No. C
 Date 29/08/2018

Wetlands

FIGURE 4-6

4.3 Aquatic Ecosystems – Freshwater

4.3.1 Catchments and streams

Overall definition of EV

Description of EV

Catchments

There are three main catchments in the Project area, the Mission River, Embley River and Watson River Catchments. The watercourses within these catchments include:

- **Mission River:** Botchet, Andoom, Dinah, Trunding and Pappan Creeks
- **Embley River:** Beening, Dry, Bellvue, Winda Winda, Triluck and Robert's Creeks.
- **Watson River:** Norman and Coconut Creeks.

Refer to Figure 4-7 for the catchments and watercourses within the Project area.

The drainage patterns of the catchments within the Project area are dendritic and are typified by confluences with one or more tributaries that join to larger reaches (Rio Tinto Alcan, 2011).

Watercourses

Watercourses in and around the overall Project area include: Mission River, Hey and Embley Rivers, Andoom, Botchet, Dinah, Pappan, Trunding, Bellvue, Dry and Beening Creeks.

The watercourses in the southern extent of the Project area include: Winda Winda, Triluck, Robert's, Norman and Coconut creeks.

The watercourses are separated into the following systems;

- Perennial flowing streams;
- Semi-perennial coastal lakes and lagoons;
- Perennial channel hosted pools and lagoons;
- Coastal swale swamps;
- Tree swamps;
- Seasonal stream channels;
- Seasonal coastal lakes;
- Spike rush swamps; and
- Estuaries.

Location of EV

The South of Embley EIS identifies these systems as occurring within the following locations of the study area:

- **Perennial flowing streams:** Winda Winda Creek System and the Norman Creek System have seasonal flow regimes that retains perennial freshwater pools throughout the dry season.
- **Semi-perennial coastal lakes and lagoons:** Pera Head, adjacent to the mouth of Norman Creek, in the lower reaches of the Ina Creek system and adjacent to the lower Ward River estuary.
- **Perennial channel hosted pools and lagoons:** Occur in the mid and lower reaches of the Norman Creek tributaries and within the Ina Creek system.
- **Coastal swale swamps:** Occur in the Embley River estuary and adjacent to the northern tributaries of the Norman Creek estuary.

- **Tree swamps:** One tree swamp occurs in an isolated tributary of the Hey River estuary whilst another is located within the bauxite plateau and connected to the Coconut Creek/Ward River drainage system.
- **Seasonal stream channels:** Occur in the upper catchment tributaries of Norman and Coconut Creeks, as well as throughout Winda Winda and Ina Creeks. Also occur in lower catchment areas linking coastal tree swamps and lakes to the coast at False Pera Head and in both the lower Ina and Waterfall Creeks.
- **Seasonal coastal lakes:** Usually occur in large wetland aggregations near spike rush swamps. Occur in the Ward River and Winda Winda creek as well as adjoining to the Norman Creek estuary.
- **Spike rush swamps:** Occur in the lowermost reaches of Norman and Winda Winda creeks and adjoining estuarine sites of the low Ward River system.
- **Estuaries:** There are six estuarine systems located within the Project area, these are located within the Norman, Leithen and Ina Creek estuaries, as well as the Ward River, Triluck Creek and Hey/Embley Rivers.

Regional context

The catchments within the Project area provide habitat for a range of freshwater biota, including conservation significant species (such as the estuarine crocodile).

Vulnerability

Catchments are vulnerable to flooding and impacts caused by land clearing and development. The surface and ground water quality is further mentioned in section 4.3.2 and 4.3.3.

Information gaps

No notable gaps in the available information have been identified for catchments and streams.

Confidence criteria assessment

There is sufficient information available on the catchments and stream networks to make a reliable assessment of the risks.

Measure of importance

The Project area contains a diverse range of freshwater habitats across three catchments. Perennial waterways are of particularly high importance as these provide permanent aquatic refuges in what is a highly seasonal environment. Table 4-15 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-15 Statement of importance for catchments and streams

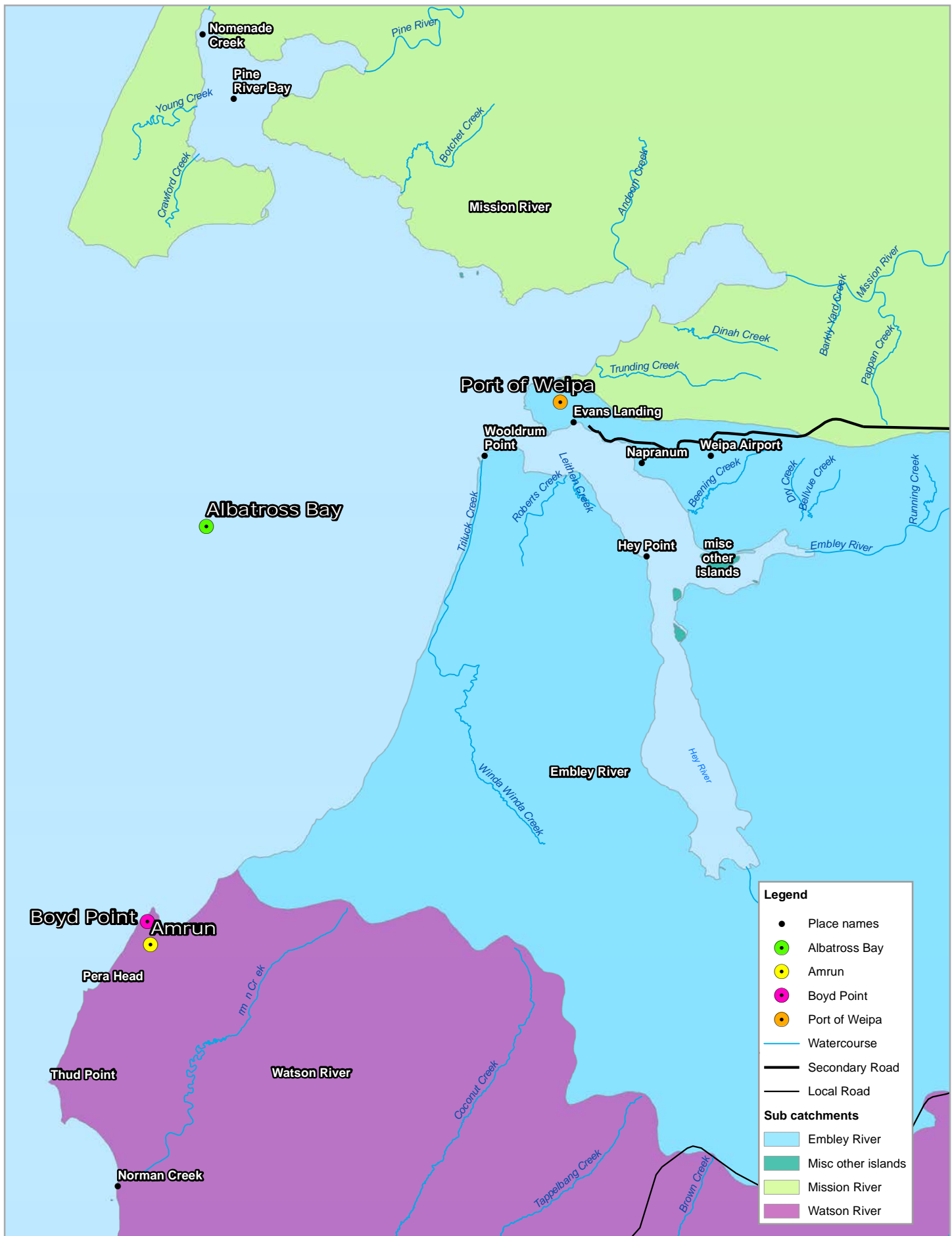
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓	
	Perennial waterways provide permanent aquatic refuges in what is a highly seasonal environment. Seasonal streams and coastal lakes represent critical resources, providing essential linkages in the landscape between permanent and ephemeral aquatic habitats and support a range of ephemeral aquatic species. Estuaries provide critical habitat for conservation significant species.	
Regional significance	✓	
	Permanent flowing streams provide dry season refuges, food chain productivity and downstream nutrient export and habitat for conservation significant species.	
Social and cultural	X	X

Statement of key environmental value

Catchments and streams are rated as being a significant EV for the Project area (inclusive of both study areas), with the key value being in the estuarine environment, not the upstream catchments. The local estuarine environment provides linkage for fishery and other species between nursery habitat and coastal environs. The productivity of the Gulf is dependent upon the maintenance of estuarine habitats and connectivity between these inshore and offshore systems. The estuarine environments within the Project area provide year round benefits for protected and commercially relevant species (vs seasonal only) and are therefore, of significant importance within the region.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the distribution, diversity and prevalence of catchments and streams across both study areas. Reports also validate the importance of this EV in supporting other ecosystem functionality within the Project Area, inclusive of fisheries, protected fauna, nutrient cycling and sediment stability.

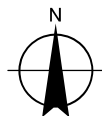
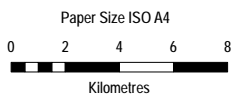


Legend

- Place names
- Albatross Bay
- Amrun
- Boyd Point
- Port of Weipa
- Watercourse
- Secondary Road
- Local Road

Sub catchments

- Embley River
- Misc other islands
- Mission River
- Watson River



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

North Queensland Bulk Ports
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Revision No. C
Date 3/09/2018

Sub catchments and waterways
in the study area

FIGURE 4-7

4.3.2 Surface water quality

Overall definition of EV

Description of EV

Albatross Bay has experienced minimal water quality impacts in the past due to the relatively undeveloped nature of the area, a small population and a lack of industries that have the potential to release pollutants to the waterways (GHD, 2005).

The freshwater found within the Project area is similar to other tropical waters found in northern Australia and can be summarised as mildly acidic, with low conductivity and hardness (Rio Tinto Alcan, 2011). The aluminium and iron concentrations within the freshwater is elevated due to the presence and influence of the bauxite plateau. The low hardness and conductivity in the water is likely the cause of the lack of freshwater molluscs and 'soft' exoskeleton crayfish (Rio Tinto Alcan, 2011).

Four rounds of samples were undertaken as part of the South of Embley EIS. These samples were conducted during mid dry seasons in 2007, late dry season in 2007, wet season in 2008 and early dry season in 2008. Surface water characteristics for the Project area are as follows:

- **pH:** Streams and tree swamps were generally acidic with the 20th percentile being 4.6 whilst the 80th percentile were 5.8 and 5.5 respectively.
- **Electrical conductivity:** Ranged between 12 to 136 microsiemens per centimetre. The median conductivity for freshwater swamps was 27 microsiemens per centimetre whilst the freshwater streams were 21 microsiemens per centimetre. During the later dry season, conductivity in pools and streams that became isolated, increased. Conductivity in estuaries ranged from 50 to 51,590 microsiemens per centimetre which reflects the tidal influence.
- **Turbidity:** Turbidity was generally low within the Project area, with a median of 1.1 NTU in tree swamps and 1.4 NTU in streams.
- **Nutrients:** the freshwater within the Project area had maximum concentrations of 0.06mg/L total phosphorous, 1.1 mg/L total nitrogen and 0.45 mg/L ammonium.
- **Dissolved Organic Carbon:** Ranged between 0.5 to 10 mg/L, with a median of 1 mg/L for freshwater and 2.5 mg/L for tree swamps.
- **Hardness:** Ranges between 0.4 to 9 mgCaCO₃/L with a median of 1.34 mgCaCO₃/L for freshwater swamps and 1.3 mgCaCO₃/L in freshwater streams.
- **Metals:** The maximum dissolved concentration of arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc were less than the Australian and New Zealand Environment Conservation Council (ANZECC) and the Agricultura and Resource Management Council of Australia and New Zealand (ARMCANZ) guideline trigger values.

The water quality characteristics of the Project area reflect the nature of water flowing throughout the bauxite terraces (Rio Tinto Alcan, 2011).

A Receiving Environment Monitoring Program (REMP) was developed for monitoring the water quality (amongst other values) within the receiving waters in accordance with the EA EPML0072513 (Rio Tinto Weipa, 2018). The REMF focusses on the mining areas, mine infrastructure areas, Evans Landing Landfill and the Awonga Point sewage treatment plant, north of Embley River. Monitoring sites have been established within a number of creeks (Andoom, Luthing, Botchett, Beening, Trunding, Peppan and Marmoss Creeks), swamp (Tea Tree Swamp) and rivers (Embley, Mission, and Pine Rivers).

Location of EV

A total of nineteen monitoring locations were set up in five watercourses to determine the surface water quality of the freshwater and tree swamp catchments. The monitoring was undertaken in Norman, Triluck and Ina Creeks, as well as within the Ward and Hey Rivers.

Regional context

The environmental values of the watercourses within the Project area that are to be protected are defined in the *Environmental Protection (Water) Policy 2009* and include:

- Biological integrity of a slightly modified aquatic ecosystem;
- Suitability for recreational use;
- Suitability for minimal treatment before supply as drinking water;
- Suitability for agricultural use; and
- Suitability for industrial use.

The Western Cape Water Quality Improvement Plan provides a benchmark for monitoring and measuring water quality in the region to assist in appropriate decision making and planning. The plan is based on principles of the National Water Quality Management Strategy developed by Australia and New Zealand.

Vulnerability

Surface water quality in the region is subject to substantial temporal and spatial variation influenced by strong seasonality in rainfall and variation in the level of influence by existing mining and ports activities.

Information gaps

There is a lack of knowledge in regards to the surface water quality in the Weipa area. The studies were also undertaken a number of years ago and therefore may be outdated.

Confidence criteria assessment

The level of sampling undertaken is not considered sufficient to reliably assess the current risks of impact to surface water quality. However the implementation of the REMP will involve periodic sampling across the receiving environment which will enable understanding of existing conditions and potential risk to the water quality.

Measure of importance

Surface water quality plays a critical role in maintaining the quality of residential and industrial water supplies within the region and maintaining natural ecosystem functions.

The availability and quality of water is central to maintaining the EVs of Cape York, and the quality of the social, cultural and economic life of its people¹. Table 4-16 identifies the decision making behind the statement of importance for surface water quality.

¹ Cape York Natural Resource Management https://www.capeyorknrm.com.au/sites/default/files/downloads/a4invest_web_1.pdf

Table 4-16 Statement of importance for surface water quality

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓ Maintains natural ecosystem functions.	
Regional significance	X	X
Social and cultural	✓ Maintains quality water supplies.	

Statement of significance

Surface water quality is not rated as being a significant EV for the Project area (inclusive of both study areas). Surface water inputs to the region are highly seasonal driven by the monsoonal wet and dry seasonal cycle. Surface water quality, therefore, shows significant variance throughout the year depending on rainfall and runoff. The EVs dependent on the surface water quality already exhibit resilience to this natural variability. The natural variability means ability to detect changes in surface water quality in response to potential impacts is limited. Instead, management and measuring condition of EVs that are dependent upon maintenance of surface water quality conditions provides a better approach to managing risk to EVs of the Project area. As such, while surface water quality supports a number of EVs it is not a considered to be a significant EV in and of itself.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis that surface water quality is known to play a crucial role in sustaining the health and seasonality of aquatic ecosystems on Cape York and is essential for maintaining the quality of local water supplies in the Weipa region.

4.3.3 Groundwater quality

Overall definition of EV
<p>Description of EV</p> <p>The groundwater bodies within the Project area have been defined as shallow aquifers and artesian aquifer resources. The artesian resources are hosted within the Gilbert River formation and Garraway Beds, and the shallow aquifer resources are hose occurring within the formations above the Rolling Downs Group (Rio Tinto Alcan, 2011). The geological units typical of the area are identified in section 4.4.1.</p> <p>Contour mapping shows that the directional flow of the groundwater is generally from east to west.</p> <p><i>Shallow aquifers</i></p> <p>The coastal dunes, estuaries and delta deposits have the potential to be saline due to the risk of saltwater intrusion due to the proximity to the coast.</p> <p>The Ferruginous duricrust (bauxite) is highly permeable and is usually unsaturated, with the water table residing in the underlying Bulimba formation (Rio Tinto Alcan, 2011).</p>

Most of the shallow aquifers in the southern extent of the Project area are poorly developed and discontinuous and are separated from the artesian aquifers by 500 m thick mudstones of the Rolling Downs Group (Rio Tinto Alcan, 2011).

Groundwater characteristics of the shallow aquifers within the Project area are as follows:

- **pH:** Was generally acidic with levels ranging between 3.9 – 6.5. Such acidic ground waters are typical of leached, tropical environments that have rapid recharge rates though rainfall and a low residence time.
- **Hardness:** Ranged between <1.0 to 6 mg/L CaCO₃. This was generally consistent with the surface water hardness. The hardness ranged between 14 to 168 mg/L CaCO₃ in the brackish ground waters and had a maximum of 54,530 mg/L CaCO₃ in the saline ground water.
- **Metals:** The maximum dissolved concentration of arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc were less than the ANZECC/ARMCANZ guideline trigger values. The concentration of dissolved iron in the brackish waters tended to be higher than that of the fresh groundwaters.

Artesian aquifers

The Gilbert River formation is the main artesian groundwater resource in the region and occurs across the entire Western Cape region. Groundwater characteristics of the artesian aquifers within the Project area are as follows:

- **pH:** pH ranged between 4.7 – 8.3.
- **Electrical conductivity:** The artesian groundwater was generally brackish with EC ranging from 1,800 microsiemens per centimetre to 16,000 microsiemens per centimetre.
- **Hardness:** hardness of the artesian groundwater was generally low with <50 mgCaCO₃/L. However, some areas showed hardness up to 1,060 mgCaCO₃/L.

A REMP was developed for monitoring the groundwater quality (amongst other values) within the aquifers in accordance with the EA EPML0072513 (Rio Tinto Weipa, 2018).

The groundwater monitoring network focusses on the mining areas (Weipa and Andoom) and Evans Landing Landfill, north of Embley River.

Location of EV

Shallow aquifers

Investigative bores were set up in 2006/2007 (as part of the South of Embley EIS) within the southern extent of the Project area to monitor the groundwater quality. Generally, all the groundwater was freshwater, except for a bore located near Norman Creek which was saline, and three bores located Coconut and Ina Creeks which were brackish. (Rio Tinto Alcan, 2011).

The 2012 South of Embley Supplementary Report to the EIS noted that there are a number of small domestic bores that access water from the aquifers whilst two larger bores were taking water from the Gilbert River Formation. It was determined that the major usage for the bore water was for irrigation, livestock water and campground water source (Rio Tinto Alcan, 2012).

Artesian aquifers

Within the Project area, artesian formations are confined due to the overlying mudstones of the Rolling Downs Group. The confining layer has a low hydraulic conductivity and holds the groundwater within the aquifer under pressure. Thus, the water within this aquifer is suitable for extraction (Rio Tinto Alcan, 2011).

Regional context

The environmental values of the groundwater within the Project area that are to be protected are defined in the *Environmental Protection (Water) Policy 2009* and include:

- Biological integrity of an aquatic ecosystem;
- Suitability for agricultural use; and
- Suitability for industrial use.

The Bulimba formation hosts a high yielding shallow aquifer which is an important resource within the Weipa peninsula. The aquifer contains groundwater that is suitable for agricultural and industrial use.

The groundwater in the Project area is currently used for industrial and mining purposes (Rio Tinto Alcan, 2011).

Vulnerability

Groundwater in the Project area is vulnerable to over extraction by industrial use. Over extraction will also lead to decreased groundwater quality. The acidity of the groundwater occurs due to the low residence times of water within the aquifers due to extraction.

Information gaps

Rates of extraction due to the new Amrun mining activities and the impacts of this on the groundwater levels and quality.

Confidence criteria assessment

Impacts on ground water may effect industries known to the local ground water, however further investigation would be required to determine what the impact may be for each individual area and to determine if any impact on ground water is observed over distance. Implementation of the REMP will involve periodic sampling across the groundwater monitoring network which will enable understanding of existing conditions and potential risk to the water quality.

Measure of importance

Ground water quality is an important resource in the area and if negatively impacted, may lead to social and economic implications given industry and agriculture depend on it. Table 4-17 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-17 Statement of importance for groundwater quality

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	✓ Located within Great Artesian Basin. Forms part of the Gilbert River formation.	
Social and cultural	✓ Agriculture and industry dependant on groundwater.	

Statement of significance

Groundwater is not rated as being a significant EV for the Project area (inclusive of both study areas). The groundwater within the Project area is currently used for mining and agricultural practices, however, aquifers are not unique to the Project area and are connected more widely at a regional level.

Confidence of finding

Due to the fact that not enough is known about the specific effects on environmental factors if over extraction or contamination were to occur. The statement of significance is considered to have a moderate level of confidence.

4.3.4 Freshwater fish

Overall definition of EV

Description of EV

Majority of the species found within the Amrun-Boyd Point study area consisted of estuarine species (twenty-one species). However, surveys did identify ten freshwater species and a further fourteen species occurring in both freshwater and estuarine sites (Rio Tinto Alcan, 2011).

Species identified in the freshwater sites were dominated by small to medium species, including rainbowfish (two species), Eel-tailed Catfish (two species), Mouth Almighty and Sailfin Glassfish.

Black-banded rainbowfish were dominant in flowing sites such as the semi-perennial and perennial reaches of creeks, however they were absent from the seasonal catchments and co-dominant with Chequered rainbowfish in the freshwater reaches of the Ward River (Rio Tinto Alcan, 2011). Sailfin Glassfish were the second most dominant species in the Winda Winda Creek system and a prominent component of the freshwater sites in the Ward River. Larger bodied fish were generally absent from the Project area, particularly in Winda Winda and Norman Creeks. However, some were identified in the lower freshwater reaches of the Ward River. Archerfish, mullet and bony bream dominated the catches within the Ward River, with longtom, large bodied shovel-nosed catfish and barramundi also present (Rio Tinto Alcan, 2011).

Norman Creek was found to host a total of 15 species of freshwater fish (including silverbidy, scat and black bream) and four species of macrocrustacea (Rio Tinto Weipa, 2016).

A Norman Creek Fishway and Fish Monitoring and Management Plan was developed (Rio Tinto Weipa, 2016) in accordance with Appendix 1, Condition 4 of the Coordinator Generals Evaluation Report of the South of Embley Project. The plan was developed to integrate monitoring and management efforts for the sustainability of freshwater fish and macrocrustacean community of Norman Creek during the operation of the Dam C and associated fishway. The plan proposed to monitor the downstream reaches of the Norman Creek to inform function, hydrology and streamflow connectivity.

Location of EV

The Ward River catchment showed the largest variability in species present, with 34 species (27 from estuarine sites and 16 from freshwater sites) recorded. The Norman Creek catchment had 32 species recorded (24 from estuarine sites and 15 from freshwater sites). The smaller catchments showed a smaller diversity in species within 18 species identified in the Winda Winda Creek, eight within Ina Creek, six from Pera Head lagoon and one from an isolated tree swamp in the Hey River catchment (Rio Tinto Alcan, 2011).

Regional context

Species of restricted distribution are known to occur in the Project area and include; Spotted Blue-eye, Black-banded rainbowfish, swamp crayfish and freshwater crab.

During the 2008 surveys, a new species of freshwater crab, *Austrothelphusa sp. nov.* was collected from Winda Winda Creek. Further survey work in 2009 identified this species in two other sites in the Winda Winda Creek Catchment but was not located outside of this (Rio Tinto Alcan, 2012).

Vulnerability

Vulnerability and threats to freshwater fish include:

- Habitat destruction and degradation
- Traditional hunting
- Incidental capture in fishing nets
- Pollution and debris

Information gaps

Seasonal variability in fish communities may not be reflected in the surveys undertaken in May 2008 and 2009 as part of the South of Embley EIS. Therefore this may not show the full extent of species present in the Project area. The studies were also undertaken a number of years ago and therefore may be outdated.

The lower numbers recorded in the smaller catchments may also reflect the less sampling effort undertaken.

Confidence criteria assessment

Given the complex and dendritic nature of freshwater systems within the Project area, there is currently low to moderate confidence in the reliability of information on freshwater fish present and the potential risks to those species.

Measure of importance

A number of freshwater species with the potential to occur have restricted or patchy distributions. While these species are not currently listed under state or federal legislation, localised impacts on these species could have heightened significance at a regional level. Table 4-18 identifies the decision making behind the statement of importance for catchments and streams.

Table 4-18 Statement of importance for catchments and streams

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓ Contains restricted habitat for least concern fish species.	
Regional significance	X	X
Social and cultural	✓ Support fishing industry	

Statement of significance

Freshwater fish are rated as not a significant EV for the Project area (inclusive of both study areas). The freshwater fish present in the Project area are not unique to the area and are represented within freshwater habitats throughout the Gulf region.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the

distribution, diversity and prevalence of freshwater fish within the study areas. Weipa has a well-established commercial and recreational fishing industry that is dependent on the health of freshwater fish stocks. These also play a crucial role in maintaining local food webs, particularly migratory birds which rest and feed in the Weipa area.

4.4 Landform and Biota

4.4.1 Topography, geology and soils

Overall definition of EV

Description of EV

Topography

The topography of the Amrun-Boyd Point study area comprises primarily of undulating bauxite plateau landforms cut by a network of rivers and smaller creeks to the south. Topography mapping identifies areas around the watercourses as generally below 30 m AHD, whereas the eastern extent of the Amrun-Boyd Point study area consists of areas that range between 50 and 90 m AHD (refer to Figure 4-8).

The Weipa area study area is relatively low lying and exposed, with majority of the Weipa study area laying between 10-20 m AHD (refer Figure 4-8).

Geology

The Queensland Government MinesOnlineMaps 1:100,000 Detailed Surface Geology shows the dominant geological unit is TQd/a-CKG, which consists of aluminous laterite, including bauxite (refer to Figure 4-9). This is mapped over majority of the Project area. The geology mapped around the watercourses within the Project area is Qc-CKG, which consists of coastal flats, comprising mud, silt and sand.

The coastal margins located Wooldrum Point and Thud Point consist of the geological unit Qhcb-QLD, which is comprised of moderately well-sorted, fine to coarse grained quartzose to shelly sand and some gravel.

The estuarine and coastal plains on the coastal margin near Wooldrum Point also contains the geological unit Qhm-CKG, near estuarine and coastal plains and is comprised of shelly quartz sand, calcarenite and coquina (refer to Figure 4-9).

Soils

Surveys undertaken in 2007 as part of the South of Embley EIS identified ten soil types within the Project area (Rio Tinto Alcan, 2011). These soil types include kandosols, hydrosols, tenosols and vertisols and are made up of:

- Soils that make up majority of the Project area and align with the geological unit TQd/a-CKG.
 - Red Kandosol on level to gently undulating plains on low plateaux in lower slopes and drainage areas with *E. tetradonta* and bloodwood tall woodlands
 - Red Kandosol on level to gently undulating plains on low plateaux with *E. tetradonta* and bloodwood tall woodlands
 - Yellow Kandosol found on level to gently undulating plains on low plateaux with *E. tetradonta* and bloodwood tall woodland
 - Yellow Kandosol found on level to gently undulating plains on low plateaux on lower slopes and drainage areas with *E. tetradonta* and bloodwood tall woodland
- Soils that align with the geological unit Qc-CKG and occur along watercourses
 - Redoxic Hydrosol found on broad range depressions and swamps on level plains to undulating rises with Bloodwood and *E. tetradonta* tall open woodlands with *Banksia* sp., swamp mahogany and *Melaleuca* sp.
- Soils on the coastal margin that align with the geological unit Qhcb-QLD
 - Orthic Tenosol found on beach ridges with woodlands and herblands and minor open heath or dwarf-open heath

- Orthic Tenosol on dunes and beach ridges with *E. tetradonta* woodlands and tall woodlands, open heaths and dwarf heaths
- Soils on the coastal margin (estuarine and near coastal plains) near Wooldrum Point
 - Supratidal Hydrosol found on supra-tidal and inter-tidal flats with the occasional mangroves or halophytes
 - Grey or Aquic Vertosol found on level to gently undulating plains on beach ridges or chenier plains with tussock grasslands
 - Intertidal Hydrosol found on intertidal flats with mangroves

The Weipa region does not have as detailed mapping of soils in the area. Mapping on the Australian Soil Resource Information Systems maps the whole Weipa region as containing kandosols, however, field surveys to verify this have not been undertaken (CSIRO, 2013). Figure 4-10 shows the mapped soil types within the Project area.

Location of EV

The red kandosol is the most widespread soil type in the area, covering most of the low lying areas. The redoxic hydrosols are located along all the creek lines except near the outlets to the Gulf, where they consist of intertidal hydrosols, orthic tenosols and yellow kandosols.

Regional context

Soils do not directly contribute to regional significance, however they provide the foundation for vegetation and fauna communities to develop on, which contribute to the areas visual amenity.

The environmental values of the land that are to be protected or enhanced are:

- Integrity of the topsoil;
- Maintenance of a stable, non-polluting landform.

Vulnerability

Erosion

The hydrosol and tenosol soils located within drainage areas of the Project area have a higher erosion potential than the other soils recorded in the study (Rio Tinto Alcan, 2011). Disturbance and/or removal of vegetation to these soils pose the issue of instability and erosion.

Acid Sulfate Soils

Acid sulfate soils are common in areas below 5 m above sea level and are typical of areas where swamps and mangroves occur. Laboratory tests undertaken as part of the South of Embley EIS assessed the acidity of the soils and found that the red kandosols present were slightly acidic, with a pH ranging between 5.7 and 6.5. The yellow kandosol and redoxic hydrosols were generally more acidic within pH ranges of 5.0 to 6.5 and 4.5 to 6.5 respectively.

Acid sulfate soils have been mapped in the Weipa area to occur near Evans landing, as well as offshore of Evans landing (GHD, 2017).

Clearing

Clearing for mining activities is the major contributor to soil degradation in the area, which can increase sediment loads to surrounding waterways and impact the health of surrounding vegetation.

Information gaps

Lack of knowledge surrounding the potential for actual acid sulfate soils within the Project area. Rio Tinto has desktop mapping detailing the likelihood of PASS based on areas below 5m AHD. Accurate and targeted field testing to determine the accuracy of mapping has not occurred within the Amrun-Boyd Point study area.

Confidence criteria assessment

The existing information surrounding topography, geology and soils provides a clear understanding of the current environment. It is unlikely that further studies would change the topography, geology or mapping of soils within the Project area.

Statement of importance

The soils located within the study area are considered to be of moderate importance on a regional scale due to the support it provides to other EVs. Table 4-19 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-19 Statement of importance for topography, geology and soils

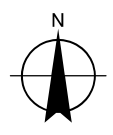
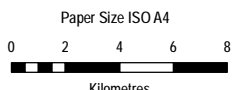
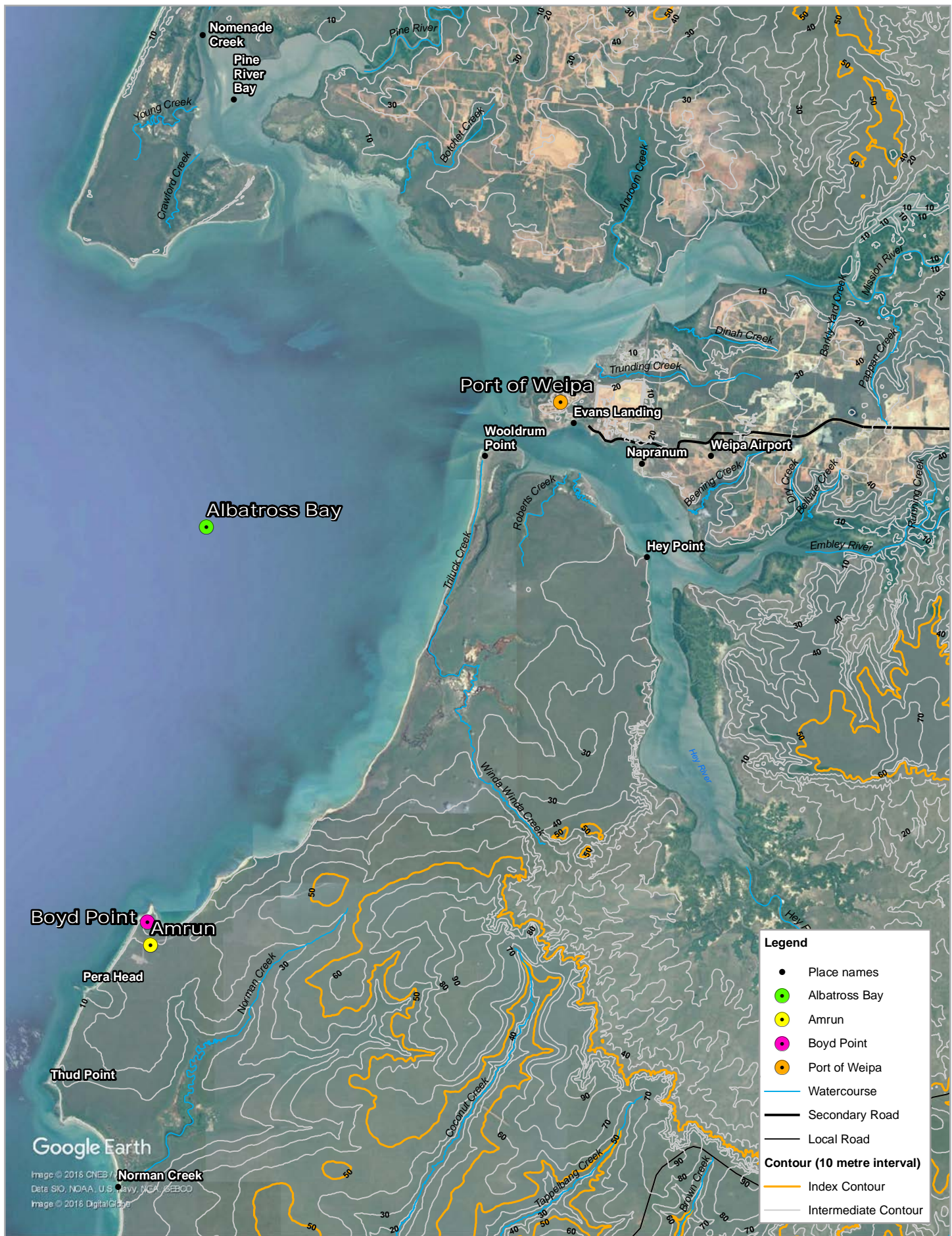
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓ Provide the foundation for other EVs.	
Regional significance	X	X
Social and cultural	X	X

Statement of significance

Topography, geology and soils are rated as not a significant EV for the Project area (inclusive of both study areas).

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs distribution of soils and geological formations across the Project area.



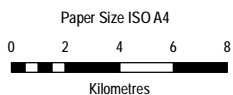
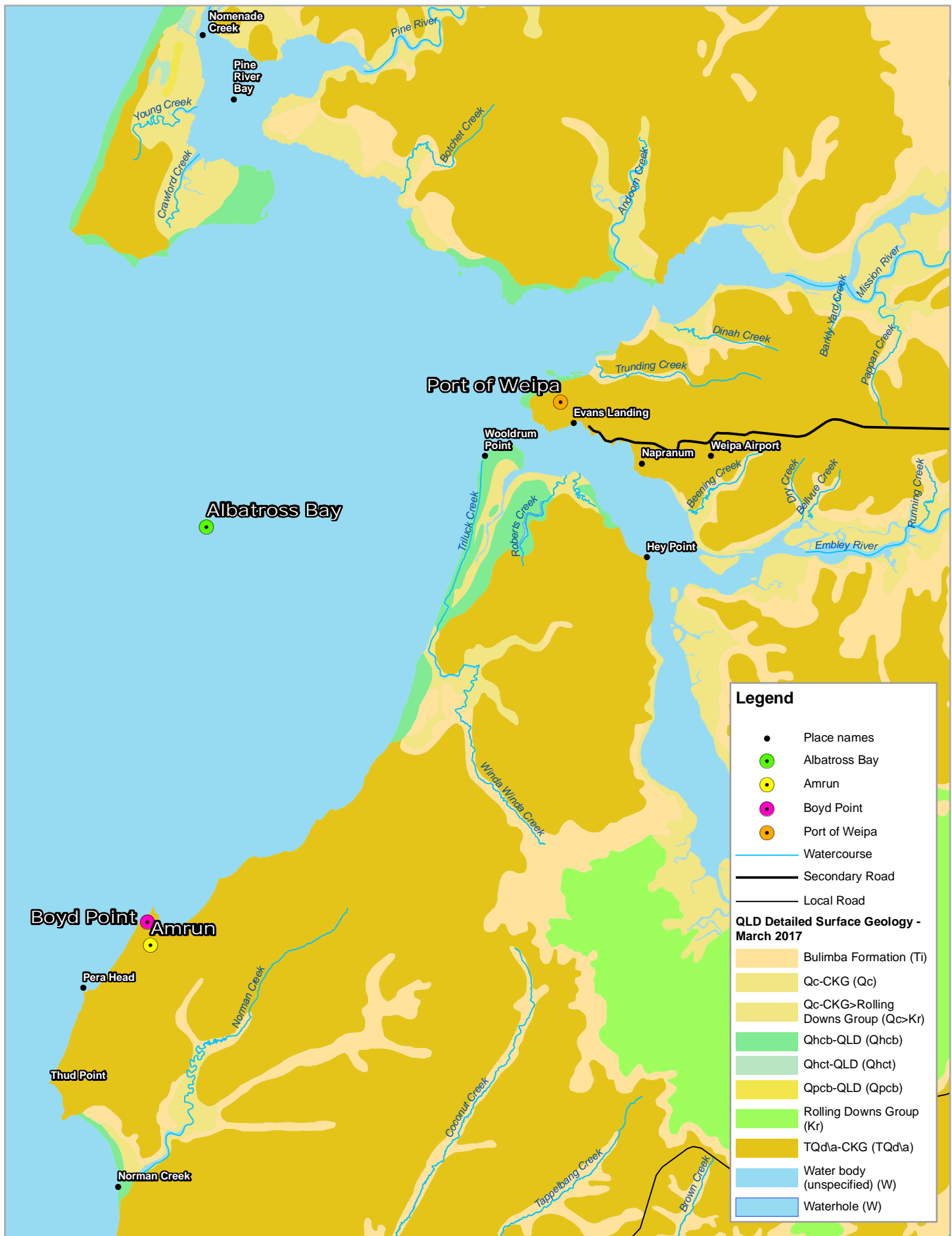
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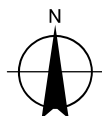
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

Topography map

FIGURE 4-8



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

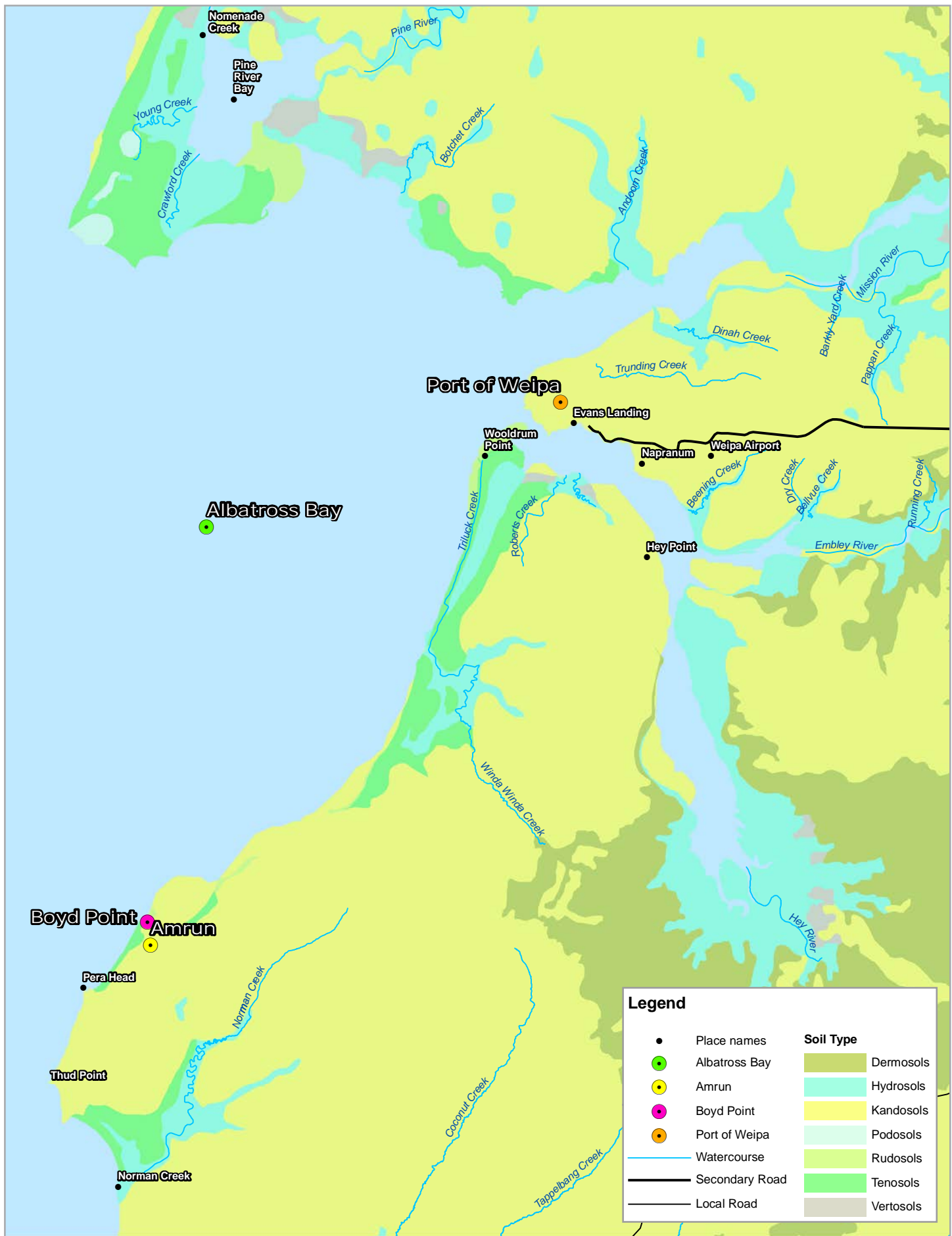


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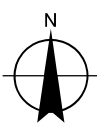
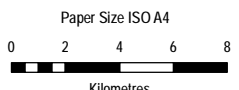
Detailed Surface
Geology map

FIGURE 4-9



Legend

●	Place names		Soil Type		Dermosols
●	Albatross Bay			Hydosols	
●	Amrun			Kandosols	
●	Boyd Point			Podosols	
●	Port of Weipa			Rudosols	
—	Watercourse			Tenosols	
—	Secondary Road			Vertosols	
—	Local Road				



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

Soil type

FIGURE 4-10

4.4.2 Land use/management

Overall definition of EV

Description of EV

Local Government Areas

The Project area falls within the following local government areas:

- Napranum Aboriginal Shire
- Weipa Town
- Aurukun Shire
- Cook Shire Council

Land Use

The majority of the Project area is proposed or currently used for mining purposes, whilst other land uses in the area include:

- Port activities at the Port of Weipa
- Military activities at RAAF Base Scherger
- Managed resource protection
- Residential
- Services
- Utilities
- Land in transition

Areas within the Project area are utilised by recreational vehicle users and Traditional Owners (Rio Tinto Alcan, 2011). There are no rural properties in the southern extent of the Project area, with the closest properties occurring within the Weipa town centre.

RTAW Land Use Management Plan

Land zones have been designated as part of the RTAW Land Use Management Plan. These land zones are based on historical and current land uses in conjunction with environmental and social values. The five separate land use zones (with seventeen subzones) cover land owned, leased or managed by RTAW and include:

- Weipa Township (WTA);
- Mining Operations;
- Mining Infrastructure;
- Special Use; and
- Restricted Use (including undisturbed areas).

The land use zones were established through the integration of regulatory requirements and tenure status with the physical, operational, environmental and social characteristics of the land. Each land use zone has specific acceptable and prohibited activities (land uses) that can occur in an area and require approval from RTA prior to development being undertaken (RTA 2014).

Contaminated land

The Port of Weipa study area has been subject to a number of industrial and development activities over the years, resulting in a number of contaminated sites. Four lots located within the Port of Weipa area are recorded on the Department of Environment and Science's (DES) EMR. However, there are a total of 55 other known contaminated sites within the Port of Weipa constraints, with potentially more unknown contaminated sites in the remaining overall Project area. Those located within the Port of Weipa include, but are not limited to; New

Lorim Point Power Station Tanks, Evans Landing pesticide storage tank, Evans Landing Beneficiation plant and Mobill Coastal Bulk Plant Evans Landing North tanks.

Location of EV

Local Government

Refer to Figure 4-11 for the location of the local government areas.

Weipa Town is located within the centre of the Project area, with most of the Weipa mining activities occurring to the east of this. Andoom mining area is located in the northern section of the study area, whilst the Amrun mining area is located in the southern section. Refer to Figure 4-12 for the land uses within the Project area.

RTAW Land Use Management Plan

The location of the land use zones and sub zones are shown in Figure 4-13. The majority of the Project area is zoned as Restricted Use (Protected & Conservation, Rehabilitation and Provisional Mining Use). The remainder is made up of Weipa Township, Special Use and Mining Infrastructure.

Potential for Contaminated land

The lots within the Port of Weipa area that are recorded on the EMR or have the potential to contain contamination include:

- Lot 4 of SP273187: Listed on the EMR for notifiable activities including hazardous contaminants (Cu, Pb, TBT). Sources of contamination on the site include bulk petroleum fuel storage tanks located in the centre of the site (now redundant), an industrial laundry facility in the North West corner of the lot, and a pesticide storage and distribution facility (GHD, 2017).
- Lot 15 of SP116851: Listed on the EMR for notifiable activities including hazardous contaminants. The site has potentially been subjected to contamination from heavy metals as a result of accidental burning of batteries stored at the site (GHD, 2017).
- Lot 29 of SP116854: Listed on the EMR for notifiable activities including chemical storage of more than 10 t that are listed under the dangerous goods code. The site has potentially been subjected to contamination from heavy metals as a result of accidental burning of batteries stored at the site, as well as the site currently being used as the Humbug Terminal Facility (KC, 2018) and Humbug Wharf Battery Disposal Area (GHD, 2017).
- Lot 14 of SP120446 (an amalgamation of Lot 29 WP18 and Lot 4 of WP7): Listed on the EMR for notifiable activities including petroleum/oil storage and hazardous contaminants. The site has potentially been exposed to contamination from heavy metals as a result of accidental burning of batteries stored at the site. The site is also listed for storing petroleum products or oil (a) in an underground tank with >200 L capacity or (b) in above ground tanks (GHD, 2017).
- Lot 17 of SP116853 is not listed on the EMR, however it has been used for the disposal of spoil generated from surrounding properties and has the potential for asbestos contamination (GHD, 2017).

Regional context

The land uses within the area, including mining and port activities support the economy of the region. Supporting the workforce within the Project area.

Vulnerability

The main vulnerability to land use and management is the significant damage caused from fires and feral pigs, particularly in the Amrun-Boyd Point study area. The Port of Weipa study area is also constrained by a number of contaminated sites, which would reduce the ability to undertake other activities on the sites.

Information gaps

Further testing of proposed infrastructure works on EMR sites may uncover latent contamination issues, particularly in the constraints of the Port of Weipa and areas used for mining activities.

Confidence criteria assessment

There is documented evidence of areas with potential for soil contamination, however it is likely that there are unknown sites of contaminated present, which may be identified through further testing.

Measure of importance

The current land uses within the Project area are utilised by the community and support the economy of the region, with a majority of the Project area being within mining leases. Table 4-20 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-20 Statement of importance land use/management

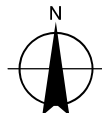
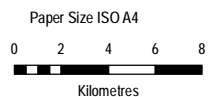
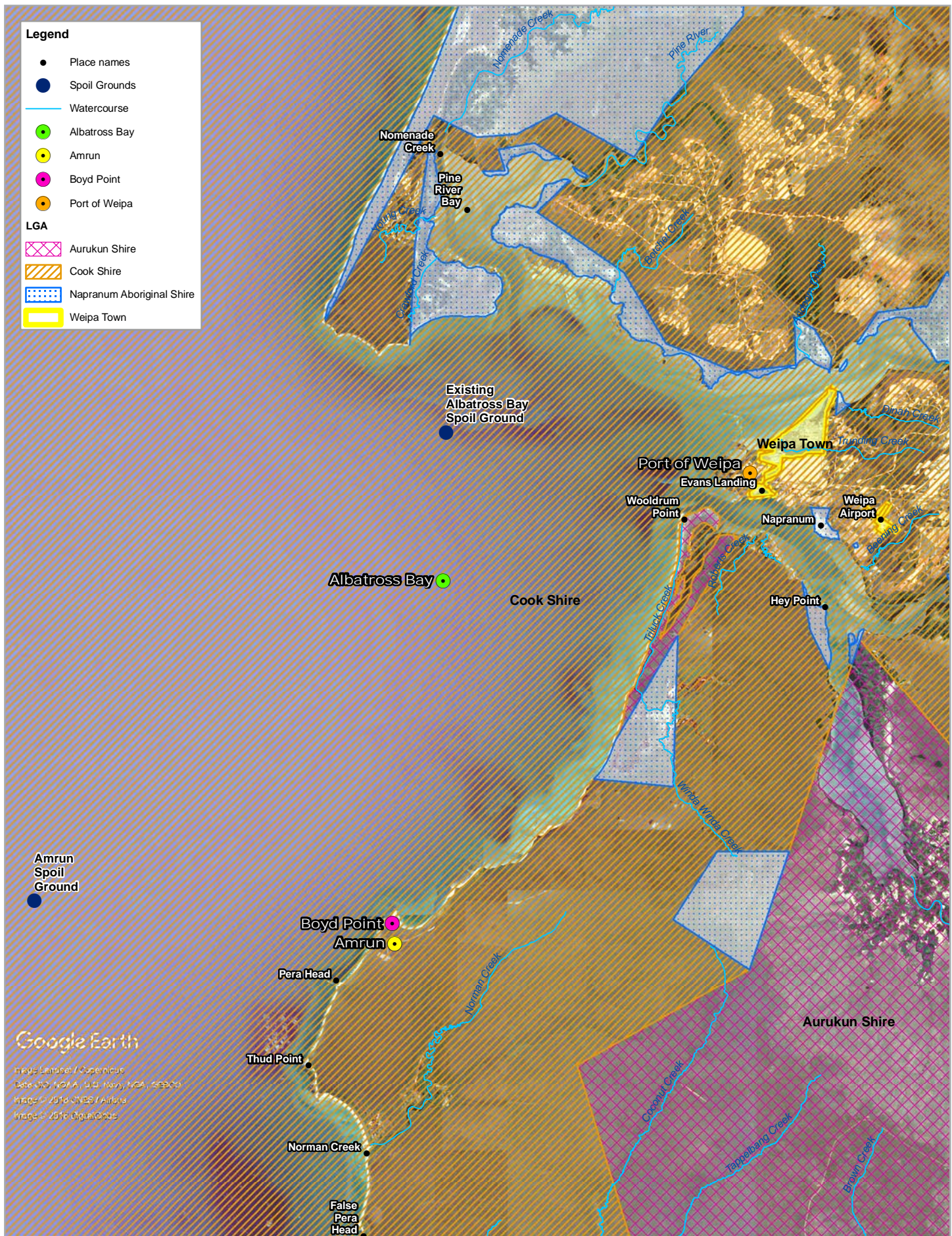
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	✓ Supports economy	

Statement of significance

Land use/management is rated as being not a significant EV for the Project area (inclusive of both study areas).

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the uses of the land within the Project area.



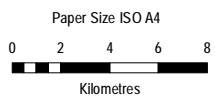
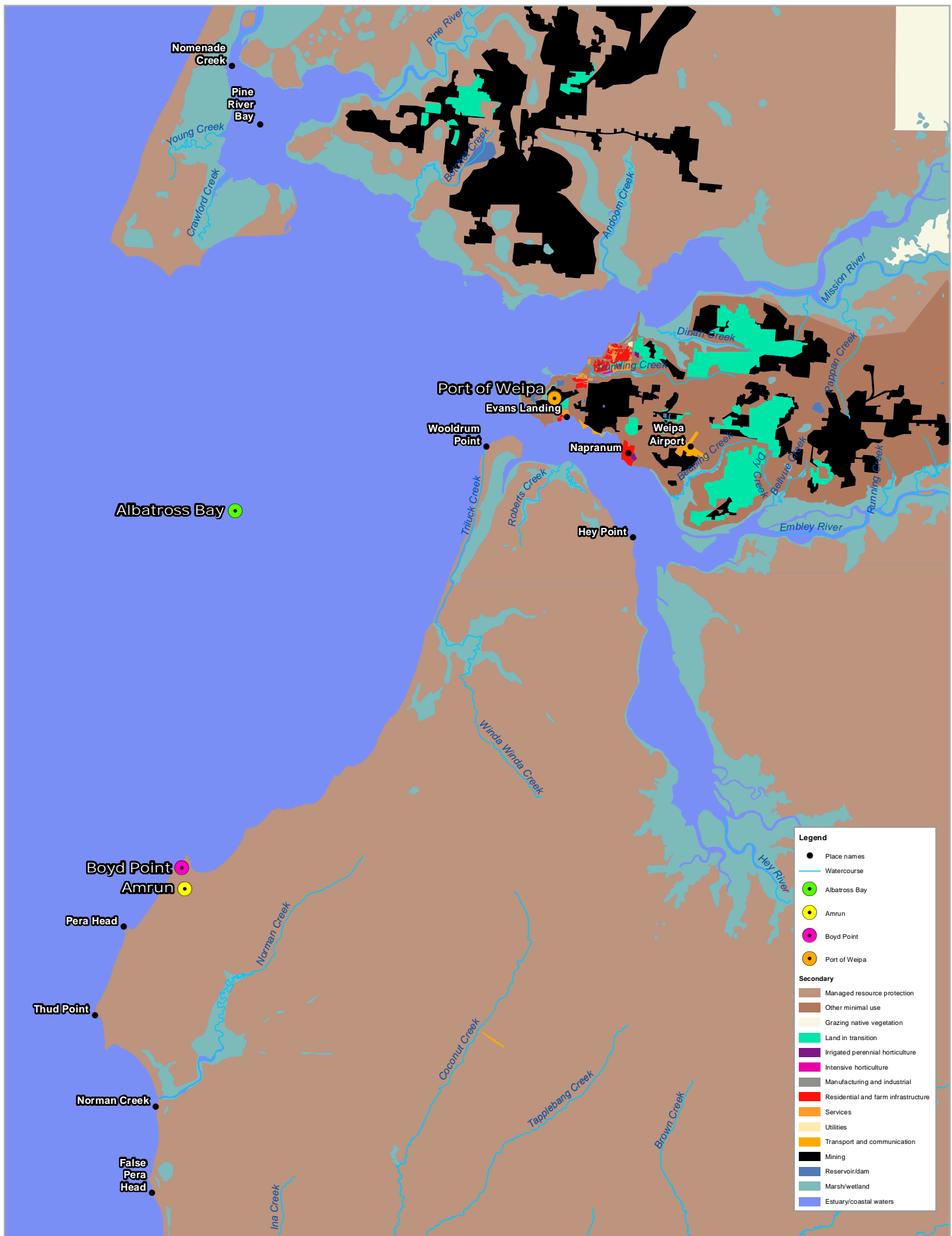
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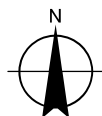
Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54

Local Government Areas

FIGURE 4-11



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



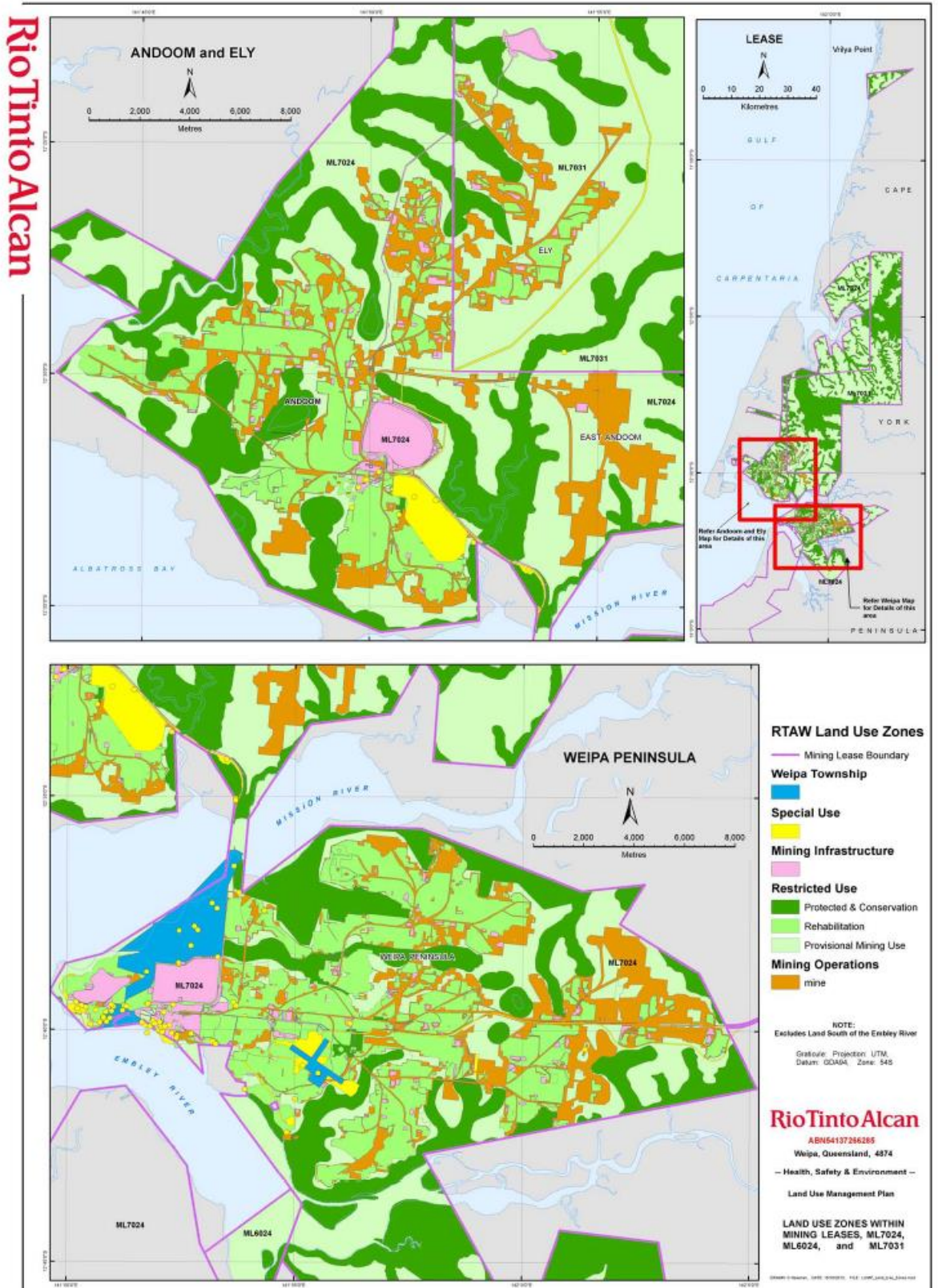
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Land use

FIGURE 4-12

Figure 4-13 RTAW Land Use Zones



4.4.3 Terrestrial vegetation communities

Overall definition of EV

Description of EV

Bioregion

The Project area is within the Weipa Plateau biogeographic subregion of the Cape York Peninsula Bioregion (DES, 2018a, 2018c and 2018d).

Regional Ecosystems

The region includes several broad vegetation types, including mangroves, vine forest, swamps and wetlands, *Casuarina sp.* woodlands and *Eucalyptus tetrodonta* woodlands.

DES regional ecosystems mapping identifies 35 regional ecosystems for the Amrun-Boyd Point study area, and consist of:

- **No Concern at Present:** 3.1.1a, 3.1.3, 3.1.5, 3.1.6, 3.2.5a, 3.3.10a, 3.3.14, 3.3.22, 3.3.25a, 3.3.49b, 3.3.50, 3.3.5a, 3.3.60a, 3.3.63, 3.3.64, 3.3.9a, 3.5.36a, 3.5.36b, 3.5.39, 3.5.4, 3.5.41, 3.7.3, 3.9.4a
- **Of Concern:** 3.10.1d, 3.10.20b, 3.2.10a, 3.2.25, 3.2.2a, 3.2.3a, 3.3.66x1a

DES regional ecosystems mapping identifies 14 regional ecosystems for the Port of Weipa study area, and consist of:

- **No Concern at Present:** 3.1.1a, 3.1.1, 3.1.5, 3.1.6, 3.1.3, 3.2.5a, 3.2.25, 3.3.14, 3.3.22, 3.3.22a, 3.3.64, 3.5.43, 3.5.36b, 3.5.36a, ,

Ground surveys undertaken as part of the South of Embley EIS and as part of the Port of Weipa Environmental Constraints Assessment identified 27 regional ecosystems (REs) as occurring within the Project area, fifteen of which were not mapped on DES' regional ecosystems mapping. The land zones and corresponding REs that were identified during the field surveys consist of:

- **Land Zone 1** – Marine Deposits: REs 3.1.1a, 3.1.1c, 3.1.3, 3.1.5 and 3.1.6
- **Land Zone 2** - Coastal sand dunes and swales: RE 3.2.2, 3.2.3, 3.2.5a, 3.2.6a, 3.2.10c, 3.2.25
- **Land Zone 3** - Alluvial plains and piedmont fans: RE 3.3.5, 3.3.9, 3.3.14a, 3.3.21, 3.3.49b, 3.3.50a, 3.3.60a, 3.3.61, 3.3.63, 3.3.64, 3.3.65
- **Land Zone 5** - Sand deposits forming gently undulating plains (includes laterite plateau): RE 3.5.2, 3.5.4, 3.5.11, 3.5.22c
- **Land Zone 7** - Duricrusts formed on a variety of rock types: RE 3.7.3

Threatened Ecological Communities

Studies undertaken as part of the South of Embley EIS and Port of Weipa Constraints Analysis identified that there were no threatened ecological communities located within the surveyed extents of the Project area.

Vegetation Communities

Surveys recognized seven types of communities that supported the fauna that occurs in the Project area:

- Darwin Stringybark (*Eucalyptus tetrodonta*) open forest on laterite;
- Riparian Gallery Forest and associated alluvial/colluvial woodland;
- Notophyll Vine Forest on lateritic red earths;
- Paperbark Woodland and Wetland Swamps;
- Foreshores, Tidal Flats and Beach Strand habitats;

- Semi-evergreen Coastal Vine Forest; and
- Mangroves and Estuaries.

The most widespread vegetation community in the Project area is the Darwin Stringybark open forest on laterite, covering more than 80% of the Project area (Rio Tinto Alcan, 2011).

Location of EV

Regional Ecosystems

The regional ecosystems mapped within the Project area are grouped into five land zones which assist in determining where these regional ecosystems occur. Refer to Figure 4-14 for the locations of each regional ecosystem.

Vegetation Communities

- The notophyll vine forest only occurs in the Hey Point area with occurrences ranging in size from 2 to 50 ha and are consistent with RE 3.5.4.
- Paperbark woodland and wetland swamps is associated with the lower reaches of Winda Winda Creek, Norman Creek and Ward River.
- Foreshores, Tidal Flats and Beach Strand habitats occur as a discontinuous band along the coast line of the Project area.
- Semi-evergreen Coastal Vine Forest primarily occurs behind coastal dunes whilst the mangrove and estuary habitats are mostly associated with the creeks located within the Project area.

Regional context

Of Concern regional ecosystems as listed under the VM Act, occupies approximately 377 hectares of the Project area (pre-Amrun clearing activities). Both of these regional ecosystems occur within land zone 2- coastal sand dunes and swales.

Riparian gallery forests (which consists of RE 3.3.9 and 3.3.5) contains high floristic diversity and contains habitat for threatened flora species such as the Chocolate Tea Tree Orchid (Rio Tinto Alcan, 2011).

Vulnerability

The regional ecosystems are vulnerable to the regular bushfires that occur in the area. The southern extent of the Project area has been vulnerable to fires in four to nine of the last ten years (NAFI, 2017). With the latest fires occurring in 2016 and 2017 (NAFI, 2017).

Apart from feral pigs, the Cape York Peninsula has a low incidence of problem feral animals and weeds (Mackey et al., 2001). However, the feral pigs are known to cause disruption to vegetation, as well as impact stream and flood environments.

The vegetation communities are also at risk of clearing due to bauxite mining that occurs within the area, especially in the southern extent of the Project area.

Twenty-five regional ecosystems are known to occur in the Project area, with two listed as 'of concern' under the *Vegetation Management Act 1999*.

Information gaps

The extent of the regional ecosystems within the southern extent of the Project area is likely to have reduced since the works in Amrun began.

Confidence criteria assessment

Through the reporting of on ground surveys (Rio Tinto Alcan, 2011) and historical aerial imagery (Qimagery, 2018), there is a high degree of confidence of the terrestrial vegetation communities within the Project area. However, due to the age of the previous surveys, extensive mining practices may result in a change to on ground communities.

Key species that define the mapped ecosystems are known to be susceptible to fire (DEE 2018). Loss of these species would result in a change in species composition with these ecosystems (DEWHA 2008b).

Measure of importance

The regional ecosystems that are mapped through the Project area are not of high importance in their own right. However, as the mapped ecosystems are linked closely with habitat requirements of conservation significant species, the importance of the mapped REs is dependent of the individual species. Table 4-21 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-21 Statement of importance for terrestrial vegetation communities

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	✓ Provide habitat for conservation significant flora and fauna	
Regional significance	✓ Provide habitat for conservation significant flora and fauna	
Social and cultural	X	X

Statement of significance

Terrestrial vegetation communities are rated as not a significant EV, particularly given the importance of mapped REs is dependent upon the individual species in which they support.

Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is based on the significant spatial and temporal data that informs the distribution and composition across the study areas. Surveys conducted throughout the study areas provide further evidence that although the ecosystems are identified as being of high quality they do not have significant importance for the project areas.

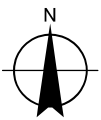
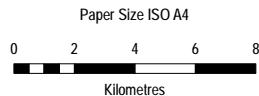


Legend

- Place names
- Albatross Bay
- Port of Weipa
- Watercourse
- Secondary Road

Regional ecosystem and remnant map

- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystems
- Category C area that is a least concern regional ecosystems
- Non Remnant



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54

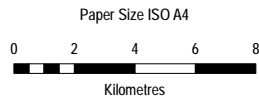
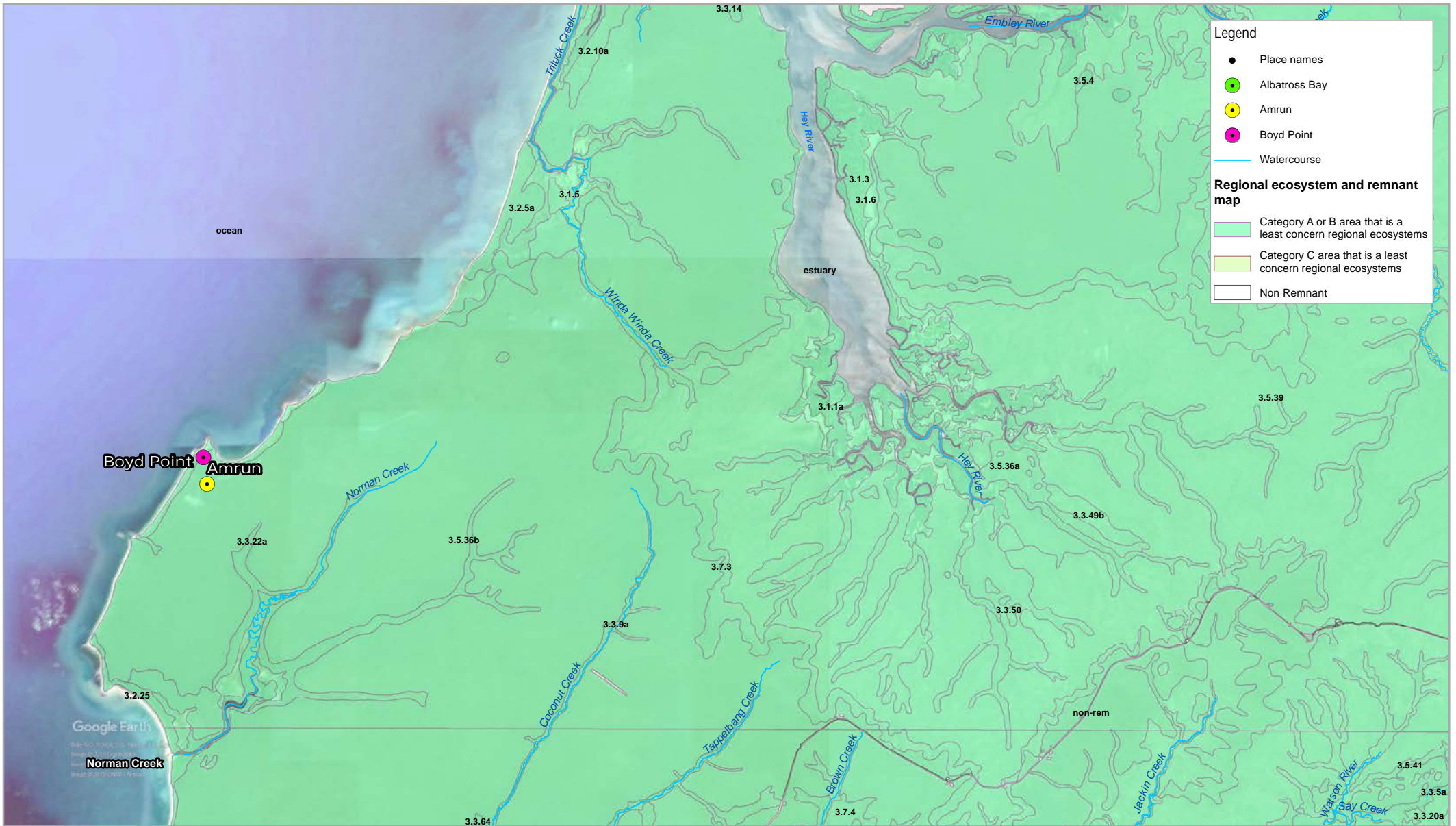


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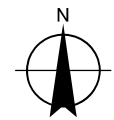
Regional ecosystem
 classifications under the VM Act
 - Port of Weipa

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FIGURE 4-14a



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



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Regional ecosystem
 classifications under the VM Act
 - Amrun

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FIGURE 4-14b

4.4.4 Terrestrial flora

Overall definition of EV

Description of EV

EPBC Act and NC Act listings

The EPBC Act PMST identifies four terrestrial flora species as known or likely to occur in the Project area, these include: *Calophyllum bicolor*, *Dendrobium johannis*, *Solanum dunalianum* and *Xylopiya monosperma*. The search also identified the *Dendrobium bigibbum* as 'may occur', however, surveys undertaken as part of the Amrun EIS South of Embley EIS identified the species as occurring within the Amrun – Boyd Point Study area.

DES's WildNet records identified 10 terrestrial flora that have been recorded within 1 km of the Project area. These include: *Acacia ommatosperma*, *Calophyllum bicolor*, *Dendrobium bigibbum* (Cooktown orchid), *Fimbristylis adjuncta*, *Habenaria hymenophylla* (rainforest habenaria), *Lepturus geminatus*, *Paspalum multinodum*, *Sarcobolus vittatus*, *Solanum dunalianum*, *Spathoglottis plicata* (New Guinea ground orchid) and *Xylopiya monosperma*.

Surveys

Several detailed flora surveys were undertaken between 2006 and 2012 over the Amrun-Boyd Point study area. The surveys identified 519 plant taxa, two of which are listed as vulnerable under the EPBC Act and NC Act; *Dendrobium johannis* (chocolate tea tree orchid) and Cooktown orchid. The Darwin Stringybark woodland community was also a focus of the studies due to the large coverage of the community throughout the Amrun-Boyd Point study area (Rio Tinto Alcan, 2015c).

A follow up survey was undertaken in 2013 to determine the population, distribution and ecological requirements of the abovementioned orchid species within a particular area of the Amrun-Boyd Point study area. The survey determined that the chocolate tea tree orchid was abundant along stream margins and alluvial terraces, with a total of 749 orchids recorded on 381 host trees. The survey noted that the orchid preferred three species as hosts, swamp penda (*Xanthostemon crenulatus*), swamp box (*Lophostemon suaveolens*) and paperbark (*Melaleuca viridiflora*) (Rio Tinto Alcan, 2015c).

Whilst the survey recorded large numbers of chocolate tea tree orchid, the Cooktown orchid was rare and only occurred in small numbers along stream margins. The species occurred on similar species as the chocolate tea tree orchid and the low densities of the species was concluded to be as a result of recent fires (Rio Tinto Alcan, 2015c).

In the Amrun Project, 2017 Annual Compliance Report for RioTinto, it was reported that the records of chocolate tea tree orchid identified in the Amrun EIS South of Embley EIS were incorrect. The species recorded is reported to be *Dendrobium trilamellatum* (fragrant tea tree orchid) (NC Act - least concern). Chocolate tea tree orchid is still considered to be present within the Amrun – Boyd Point study area as it is recorded within the wildnet results. Location data for orchid species is not available through the species profile as illegal harvesting is a key threat. Atlas of Living Australia (ALA, 2018) shows a nearby record under the species synonym fragrant tea tree orchid.

The South of Embley EIS concluded that there was 'considerable floristic diversity' within the southern extent of the Amrun – Boyd Point study area. A total of 34% of the species identified are associated with *Eucalyptus tetradonta* woodland, which comprises of approximately 85% of the southern extent of the Amrun – Boyd Point study area (Rio Tinto Alcan, 2011).

The most common and widespread species within the Amrun – Boyd Point study area consist of; *Eucalyptus tetradonta* (Darwin stringybark), *Corymbia nesophila*, *Erythroleum chlorostachys* (red ironwood) and *Parinari nonda* (Nonda plum); as well as *Planchonia careya* (cocky apple) and *Acacia rothii*.

The common ground cover species included *Heteropogon triticeus* (giant speargrass), *Coelospermum reticulatum*, *Spermacoce brachystema* and *Smilax australis* (lawyer vine) (Rio Tinto Alcan, 2011).

Location of EV

Individuals of the Cooktown orchid were recorded in coastal vine forests and mangroves along Norman Creek, Coconut Creek and the Ward River (Rio Tinto Alcan, 2011). Potential regional ecosystems for the species include: 3.1.1 a, 3.1.1 c, 3.2.2, 3.3.5 and 3.5.4 (Rio Tinto Alcan, 2011).

Individuals of the chocolate tea tree orchid is restricted to mesic habitats, typically as an epiphyte on mature *Syzygium* spp. and *Melaleuca* spp. trees in riparian gallery forests, as well as on the margins of swamps (Rio Tinto Alcan, 2011). Potential regional ecosystems for the species include: 3.2.3, 3.3.5, 3.3.9, 3.3.14a and 3.3.21 (Rio Tinto Alcan, 2011).

Regional context

The Cooktown orchid occurs in at least 30 subpopulations across Cairns, throughout Cape York, the Torres Strait and in southern Papua New Guinea (DEE, 2016). The species has also been recorded at several locations within the Weipa region, particularly within notophyll vine forests on coastal dunes. The Cooktown Orchid was identified at 69 locations within the Amrun – Boyd Point study area (Rio Tinto Alcan, 2011).

The chocolate tea tree orchid is known to occur in the Iron Range National Park and the Cape York and Torres Strait (Queensland) Natural Resource Management Regions which are located over 100 km from the Amrun – Boyd Point study area. However, individuals were identified at 76 locations within the Amrun-Boyd Point Project area during surveys undertaken as part of the South of Embley EIS (Rio Tinto Alcan, 2011).

Pandanus (*Pandanus spiralis*) has significant cultural heritage value due to its use for basket weaving and costume making, whilst the nuts are also edible. The South of Embley EIS notes that these species contain contemporary importance due to their continual use by Traditional owners (Rio Tinto Alcan, 2011).

Within Australia, some of these species only occur in Cape York. Two species, *Acacia ommatosperma* (NC Act –near threatened) and *Solanum dunalianum* (NC Act and EPBC Act – vulnerable) only known to occur within approximately 200 km from the Project area. *Solanum dunalianum* has an estimated area of occupancy 42 km² located largely within the Project area.

Vulnerability

The Cooktown orchid is sensitive to fires and therefore occurs in areas of the Project area where fires are infrequent. The Cooktown orchid is also vulnerable to illegal collection, as well as impacts by feral pigs (DEE, 2016).

The chocolate tea tree orchid is vulnerable to illegal collection and habitat degradation from settlement and visitation (DEWHA, 2008a)

Information gaps

There is little information available for the terrestrial flora in the Weipa region. There is also little information in regards to the effects of fire and subsequent changes to fauna habitat quality and utilisation of various fauna species.

Size of vegetation that is located within the Project area and whether this has changed since the last survey was conducted.

Confidence criteria assessment

Based on current distribution data for the species recorded within the Project area, the significance of the local populations of terrestrial flora can be determined with some confidence. However due to the lack of compressive studies there are still unknown factors regarding the exact distribution. Species confirmed by the Queensland herbarium have been recorded within the Project area. It is unknown if more species may be present but it is confirmed that there are conservation significant species in the area.

Due to the undeveloped nature of the area, large extents of vegetation are unlikely to have been thoroughly surveyed. Therefore many individuals from the already identified species or other species may be present but yet to be recorded.

Measure of importance

The documented conservation significant flora species are considered to be important on a regional state and national level due to the restricted distribution of the species. Table 4-22 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-22 Statement of importance for terrestrial flora

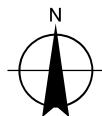
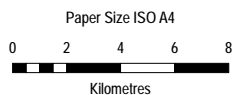
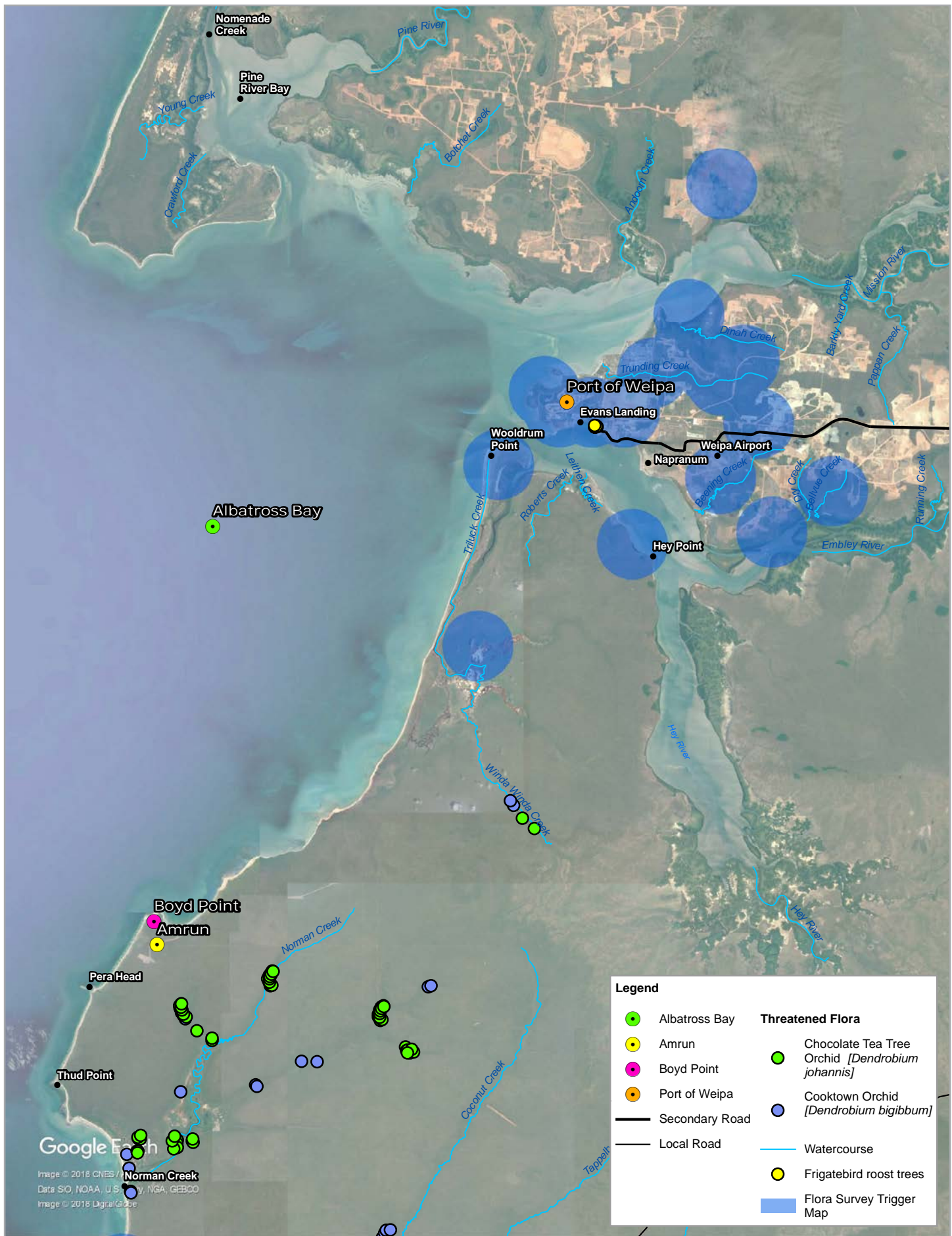
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	✓ Contains habitat for <i>Dendrobium bigibbum</i> , <i>Dendrobium johannis</i> and <i>Solanum dunalianum</i> (listed under the EPBC Act).	
MSES	✓ Project area contains habitat for <i>Dendrobium bigibbum</i> , <i>Dendrobium johannis</i> , <i>Acacia ommatosperma</i> and <i>Solanum dunalianum</i> listed under NC Act.	
Critical habitats/ecosystems	✓ Contains critical habitat for a number of terrestrial flora species, including <i>Acacia ommatosperma</i> (NC Act –near threatened) and <i>Solanum dunalianum</i> (NC Act and EPBC Act – vulnerable) only known to occur within approximately 200 km from the Project area.	X
Regional significance	✓ <i>Dendrobium biggibum</i> has been the Queensland state flora emblem since 1959.	X
Social and cultural	✓ <i>Pandanus spiralis</i> has cultural significance to the Project area.	X

Statement of significance

Overall, terrestrial flora is rated as being a not significant EV for the Project area (inclusive of both study areas). However, the *Dendrobium bigibbum* and *Dendrobium johannis* have been identified as being of local and regional significance. The species are unique due to spatial limited populations.

Confidence of finding

Based on what is currently known about the flora located within the study areas, the statement of significance is considered to have a high level of confidence. Further knowledge of species that may occupy the study areas are only likely to increase the level of importance to the region further validating the level of confidence in the significant importance.



North Queensland Bulk Ports
Port of Weipa Environmental Values Assessment

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High-potential habitat and
records of threatened flora species

FIGURE 4-15

4.4.5 Terrestrial fauna

Overall definition of EV

Description of EV

EPBC Act and NC Act listings

The EPBC Act PMST identifies the following terrestrial fauna species as known or likely to occur in the Project area:

- 6 birds (red knot, curlew sandpiper, red goshawk, eastern curlew, palm cockatoo and masked owl)
- 5 mammals (northern quoll, ghost bat, bare-rumped sheath-tailed bat and black-footed tree rat)
- 4 migratory marine birds (common noddy, fork-tailed swift, lesser frigatebird and great frigatebird)
- 5 migratory terrestrial birds (oriental cuckoo, black-faced monarch, spectacled monarch, satin flycatcher and rufous fantail)
- 13 migratory wetland birds (common sandpiper, sharp-tailed sandpiper, red knot, curlew sandpiper, Swinhoe's snipe, pin-tailed snipe, bar-tailed godwit, eastern curlew, little curlew, whimbrel, osprey, common greenshank and marsh sandpiper).

Wildnet Records identified 49 birds and one reptile (estuarine crocodile) as potentially occurring in the Project area (refer to Appendix A).

Surveys

Detailed surveys were undertaken as part of the South of Embley EIS in May and November 2007, May and December 2008 and May 2009. These surveys identified a total of 269 native terrestrial fauna species (Rio Tinto Alcan, 2011) consisting of: 18 amphibians, 45 reptiles, 184 birds, 23 mammals.

Freshwater turtles are very scarce in the Project area, with no individuals being recorded during the South of Embley EIS fauna surveys. It is believed that the low nutrient and mineral status of the groundwater-fed aquatic ecosystems do not provide the appropriate habitat for freshwater turtle species (Rio Tinto Alcan, 2011).

Studies were undertaken in 2012 and 2013 to determine the presence of bare-rumped, sheath tailed bats within the South of Embley Project Area. Whilst evidence of a large population of the bare-rumped sheath-tailed bat was absent, the study suggested that the *E.tetrodonta* woodlands within the Amun-Boyd Point study area were highly utilised and important habitats for the Cape York sheath-tailed bat, yellow-bellied sheath-tailed bat and Papuan sheath-tail bat (Specialised Zoological, 2013 and Rio Tinto Alcan, 2015).

Surveys undertaken as part of the Port of Weipa Environmental Constraints Assessment in October 2016 identified 68 fauna species within five lots of the Port of Weipa area. This comprised of 60 birds, 3 mammals, 1 amphibian and 4 reptiles. The following threatened fauna species were confirmed present:

- Beach stone curlew
- Palm cockatoo
- Estuarine crocodile

Migratory Species

The South of Embley EIS identified 44 migratory bird species as potentially inhabiting the Amrun – Boyd Point study area. This included:

- 19 species were confirmed present during site surveys;
- 3 were determined as likely to occur;

- 17 species determined as possible to occur; and
- 5 species determined as unlikely to occur.

Location of EV

Port of Weipa Specific

Surveys undertaken by GHD in 2017 identified beach stone curlew individuals along the shoreline of the Port of Weipa, particularly along the narrow beaches and sand flats. Whilst no palm cockatoo individuals were observed during this survey, multiple accounts of sightings by Rio Tinto-Alcan and NQBP staff of frequent palm cockatoos within the vegetation surrounding buildings within the Port of Weipa have been recorded. The Estuarine crocodile was also not observed during this survey, however multiple accounts of an adult male occurring along the coastline have been noted.

Frigatebird surveys undertaken by GHD in 2017 confirmed the presence of a frigatebird roost within the Port of Weipa, with the area of roosting being approximately 2 ha in size and represented only a small portion of a much larger roost. The survey identified 14 currently-used roosting trees with approximately 210-240 frigatebirds observed roosting. The population consisted of approximately 70% great frigatebirds and 30% lesser frigatebirds.

Amrun Specific

Previous surveys have identified that smaller mammals were generally restricted to the moister refugial habitats (Rio Tinto Alcan, 2011). Estuarine crocodile, palm cockatoo and rufous owl were also recorded along Norman Creek and Ward River. Surveys for the bare-rumped sheath-tailed bat indicated small numbers of the species, alongside larger populations of the Cape York sheath-tailed bat and yellow-bellied sheath-tailed bat

The Estuarine Crocodile is commonly encountered in the Project area. The Atlas of Living Australia identifies six recordings of the species within the Project area. The South of Embley EIS also recorded the species as occurring in the Norman Creek, Winda Winda Creek, near Boyd Point and in the Hey/Embley River inlet.

The migratory species confirmed as occurring during the South of Embley EIS surveys were identified in the following habitats:

- **Darwin stringybark open forest:** fork-tailed swift, white-throated needletail, rainbow bee-eater and osprey.
- **Riparian gallery forest:** fork-tailed swift, white-bellied sea eagle, white-throated needletail, satin flycatcher, osprey and rufous fantail.
- **Vine forest on bauxite:** for-tailed swift, white-throated needle tail, rainbow bee-eater, satin flycatcher and rufous fantail.
- **Paperbark woodland and wetland swamps:** clamorous reed-warbler, fork-tailed swift, great egret, white-bellied sea eagle, white-throated needle tail, rainbow bee-eater, satin flycatcher, osprey, glossy ibis, rufous fantail, common greenshank and marsh sandpiper.
- **Foreshores, tidal flats and beaches:** common sandpiper, fork-tailed swift, lesser sand plover, eastern reef egret, great frigatebird, lesser frigatebird, white-bellied sea eagle, white-throated needle tail, eastern reef egret, rainbow bee-eater, eastern curlew, whimbrel, osprey, little tern, common greenshank, marsh sandpiper and terek sandpiper.
- **Coastal vine forest:** fork-tailed swift, white-throated needle tail, rainbow bee-eater, satin flycatcher, osprey and rufous fantail
- **Mangrove and estuary:** fork-tailed swift, great egret, lesser sand plover, eastern reef egret, great frigatebird, lesser frigatebird, white-bellied sea-eagle, white-throated needletail, rainbow bee-eater, satin flycatcher, eastern curlew, whimbrel, osprey, glossy ibis, rufous fantail, little tern, common greenshank and marsh sandpiper.

Regional context

A large group of birds that are known to occur in the Project area are listed in international agreements and conventions such as Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreements and the Conservation of Migratory Species of Wild Animals (Bonn Convention) and are all covered by the EPBC Act (Rio Tinto Alcan, 2011). The western Cape York coastline is known as a major entry corridor for many migratory species travelling to eastern Australia (Rio Tinto Alcan, 2011).

Culturally important fauna

A number of culturally important fauna occur within the Project area, including wallabies and kangaroos. The species are favoured for hunting and are abundant throughout the Project area (Rio Tinto Alcan, 2011). The Emu and magpie goose are also key hunting species, however they are not as wide spread throughout the Project area.

Other species of conservation significance

Other species that are not formally listed under state or federal nature conservation legislation but are considered to be of conservation significance includes the Spotted Whistling Duck. The species is known to occur in the Ward River Estuary (downstream) and is particularly significant due to its restricted sightings to only a handful of locations within Cape York, including the settling ponds at the Weipa Sewage Treatment Plan. The occurrence of the species in the Ward River estuary represents the largest recorded aggregation of the species on Australia.

The Weipa roost of the great and lesser frigatebird is a critical ecological feature likely to have national ecological importance. This local roost is the only known mainland roost for both species.

Vulnerability

Most of the southern extent of the Project area is significantly affected by bushfire and therefore, species that are poorly adapted to fire, are restricted to the moister refugial habitats where fire infrequently reaches. Changed fire regimes have meant that a number of least concern species have become rare within the region. Any impact on confirmed breeding sites for the common brushtail possum or brown treecreeper could contribute to the local disappearance of these species.

The lack of sightings of the common brushtail possum suggests that the current land management regime is adversely impacting on arboreal mammals (Rio Tinto Alcan, 2011).

Six introduced species were recorded during South of Embley EIS surveys, three of which are listed under the Biosecurity Act. These include: feral cat, wild dogs/dingo hybrid, feral pig, cane toad, feral horse and feral cattle.

There is significant ground disturbance as a result of wallowing and foraging feral pigs within the Project area which has impacted on the quality of habitat available for terrestrial fauna (Rio Tinto Alcan, 2011).

Nesting habitats of many species, particularly those that nest within the *Eucalyptus tetradonta* woodland, are particularly threatened by clearing, as a result of bauxite mining.

Information gaps

The previous surveys were undertaken a number of years ago so there could be changes in species that occupy the area.

Confidence criteria assessment

Information on the frigatebird provides a high level of confidence in the reliability of information due to extensive direct monitoring undertaken over several survey extents. For other species, there is sufficient information on a majority of the species identified within the Project area to make a reliable assessment of risk. However, some species, such as the bandy bandy have little information on their distribution and use of habitats, which reduce the reliability of assessment of the risks.

Measure of importance

Terrestrial fauna species that are likely to be of high importance are those that are reliant on local habitats or resources that are unique and support species that are regionally uncommon. Important species include the red goshawk, great and lesser frigatebird, palm cockatoo, masked owl and the Cape York bandy bandy. Table 4-23 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-23 Statement of importance for terrestrial fauna

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	<p style="text-align: center;">✓</p> <p>Project area contains habitat for <i>Crocodylus porosus</i> (Estuarine Crocodile, Cape York sheath-tailed bat and yellow-bellied sheath-tailed bat (listed under EPBC Act).</p>	<p style="text-align: center;">✓</p> <p>Project area contains habitat for <i>Crocodylus porosus</i> (Estuarine Crocodile) (listed under EPBC Act).</p>
MSES	<p style="text-align: center;">X</p>	<p style="text-align: center;">✓</p> <p>Project area contains habitat for <i>Esacus magnirostris</i> (Beach stone curlew) (listed under NC Act)</p>
Critical habitats/ecosystems	<p style="text-align: center;">✓</p> <p>Foraging habitat present for <i>Dasyurus hallucatus</i> (northern quoll).</p>	<p style="text-align: center;">✓</p> <p><i>Fregata minor</i> and <i>Fregata ariel</i> (Great and lesser frigatebird) roost in Weipa is a critical ecological feature likely to have national ecological importance.</p> <p>Foraging habitat present for <i>Dasyurus hallucatus</i> (northern quoll).</p> <p>Nesting habitat present for <i>Probosciger aterrimus</i> (Palm cockatoo), <i>Tyto novaehollandiae kimberli</i> (Masked Owl (northern)), <i>Erythrorchis radiatus</i> (red goshawk) and <i>Vermicella parscauda sp nov.</i> (Bandy bandy).</p>

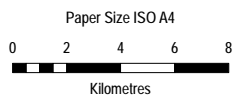
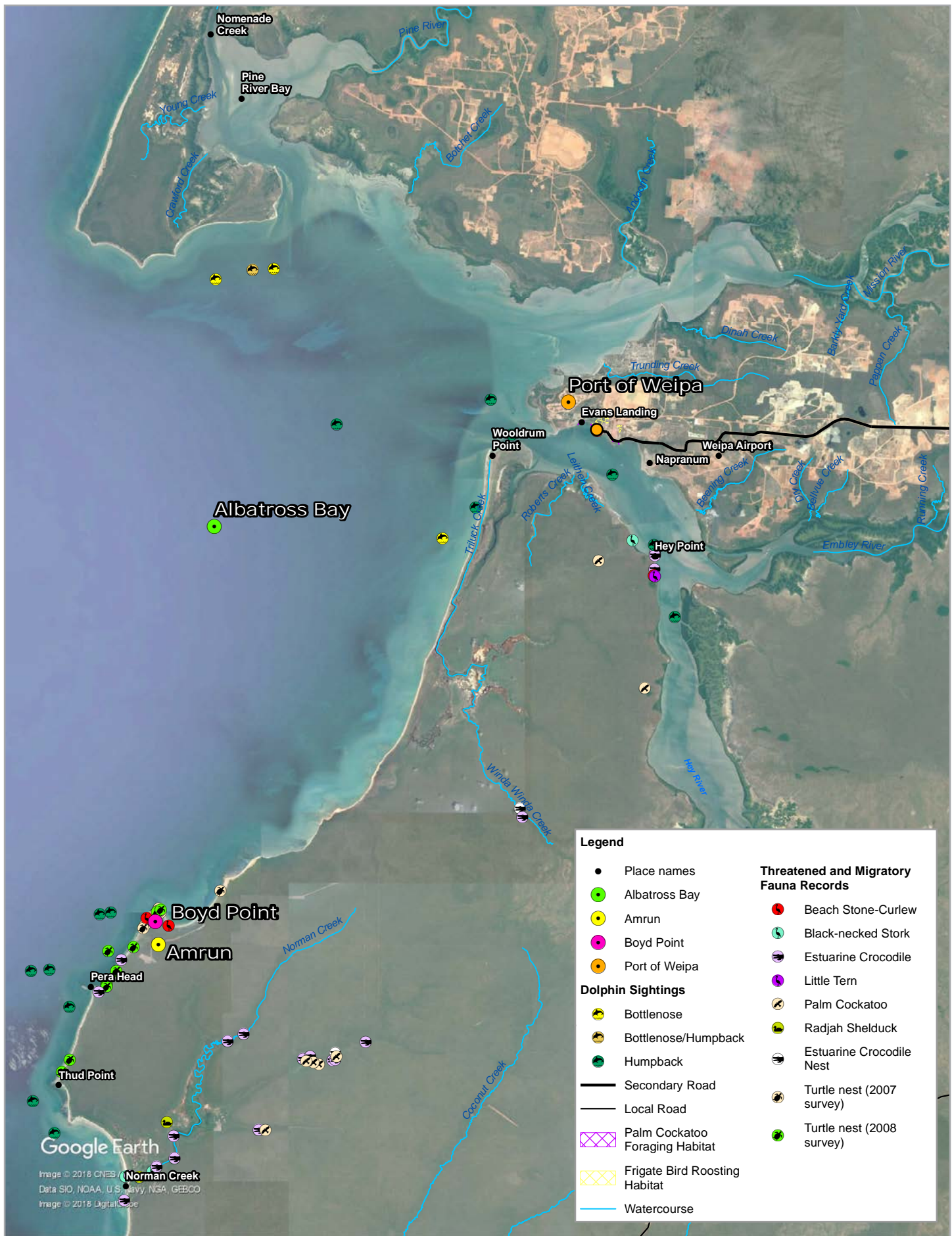
Regional significance	<p style="text-align: center;">✓</p> <p>Critical area for shorebird migrations</p> <p>Important foraging resources along the East Asian-Australasian Flyway</p> <p>Distribution of the palm cockatoo is restricted to the north of Cape York Peninsula, with the species being relatively common within the Project area.</p>
Social and cultural	<p style="text-align: center;">✓</p> <p style="text-align: center;">Supports culturally important species.</p>

Statement of significance

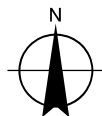
Overall, terrestrial fauna is rated as being a not significant EV for the Project area (inclusive of both study areas). However, certain species including the great and lesser frigatebirds, red goshawk, palm cockatoo, masked owl and the Cape York bandy bandy are considered to be of local and regional significance.

Confidence of finding

The statement of significance is considered to have a low to moderate level of confidence. A number of important species have a low confidence rating due to a lack of information on the distribution and use of habitats within the study area (i.e. the recently discovered Cape York bandy bandy and water mouse). Additional survey effort may alter the significance of the importance of these species. Other species such as the great and lesser frigatebird, masked owl, red goshawk and northern quoll have a moderate confidence rating on the basis of increased knowledge on the spatial and temporal distribution of populations and key habitats within the study area.



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54

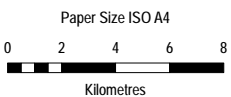


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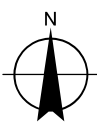
Project No. 41-31822
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 Date 3/09/2018

Potential habitat and
 records of threatened fauna species

FIGURE 4-16



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 54



North Queensland Bulk Ports
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Project No. 41-31822
 Revision No. C
 Date 3/09/2018

Essential Habitat

FIGURE 4-17

4.4.6 Protected areas

Overall definition of EV

Description of EV

There are no World or National Heritage Areas (WHA) listed as occurring within the Project area.

There are five protected areas located within the northern Cape York area, however none of these areas are located in the Project area. They include:

- Batavia National Park located approximately 60 km east of the Project area
- Oyala Thumotang National Park located approximately 60 km south east of the Project area
- Heathlands Resources Reserve located approximately 100 km north east of the Project area
- Jardine River National park located approximately 130 km north east of the Project area
- Kutini-Payamu (Iron Range) National park is located approximately 120 km east of the Project area

The Steve Irwin Wildlife Reserve is a 'strategic environmental area' under the *Regional Planning Interests Act 2014* and is located approximately 20 km north east of the Project area.

The South of Embley EIS identified in 2010, the following natural values associated with 670 ha of land located near Pera Head:

- The coast near Pera Head comprises of an extensive and prominent landscape that comprises of bauxite cliffs
- 60% of the area is considered of 'very high wilderness quality'

The South of Embley EIS also identified in 2010, that the Hey and Embley Rivers as having the following natural values:

- 70% of the Hey and Embley Rivers area considered 'very high wilderness quality'
- A large extent of the area surrounding the Hey and Embley Rivers is covered by vegetation that is predominant within the Project area, this consists of *Eucalyptus tetradonta* woodlands.

RTAW Land Use Management Plan

The RTAW designates land use zones (refer to Section 4.4.2) into conservation management zones (CMZs). CMZs were derived by layering environmental values over land use zones to identify areas with similar conservation values and land use situations. A total of 21 Conservation Management Zones have been delineated across the five land use zones. Each CMZ represents a unique combination of land use zone and environmental values with specific management intent and a tailored suite of desired management actions to manage the environmental values present (RTA 2014).

Location of EV

There are no protected areas located within the Project area.

RTAW recognises CMZs in their Land Use Management Plan prepared for their Environmental Authorities for mining leases ML 7024, ML7031 and ML 6024. The location of the CMZs are shown in Figure 4-19.

Regional context
There are no protected areas located within the Project area, however, the South of Embley EIS does identify a portion of land near Pera head, as well as the Hey and Embley Rivers which contain a number of natural values.
Vulnerability
There are no protected areas located within the Project area.
Information gaps
No notable gaps in the available information have been identified for protected areas.
Confidence criteria assessment
Further information would be required to determine any future areas of conservation, however, there is high confidence in the information used to determine the impacts to protected areas.

Measure of importance

There are no protected areas within the study area. Table 4-24 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-24 Statement of importance for protected areas

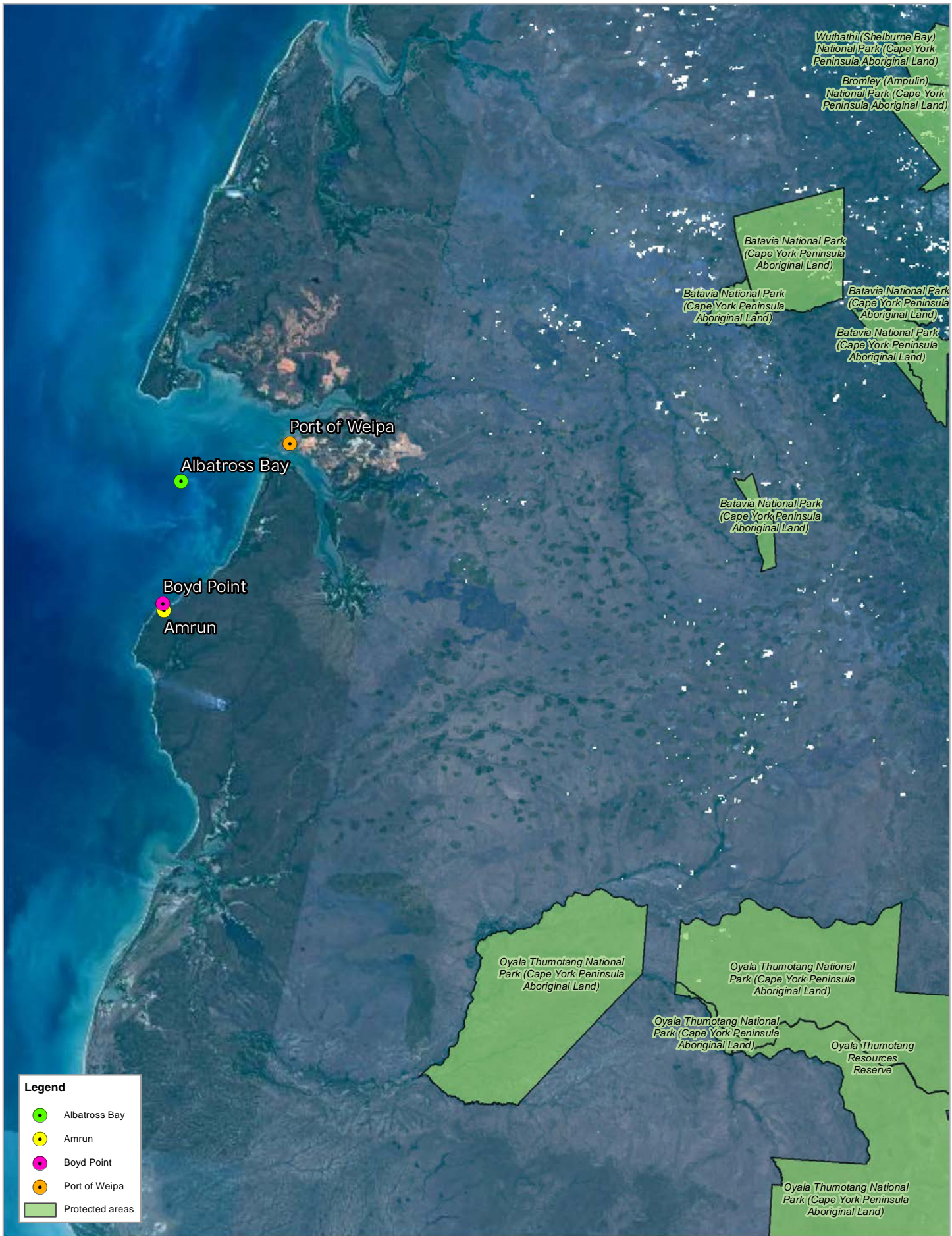
Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	X	X

Statement of significance

Protected areas are not rated as being a significant EV for the Project area (inclusive of both study areas).

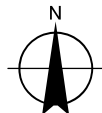
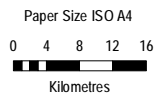
Confidence of finding

The statement of significance is considered to have a high level of confidence. This high confidence rating is on the basis of significant spatial and temporal data that informs the distribution of protected areas within the Project area and within the broader Cape York region.



Legend

- Albatross Bay
- Amrun
- Boyd Point
- Port of Weipa
- Protected areas



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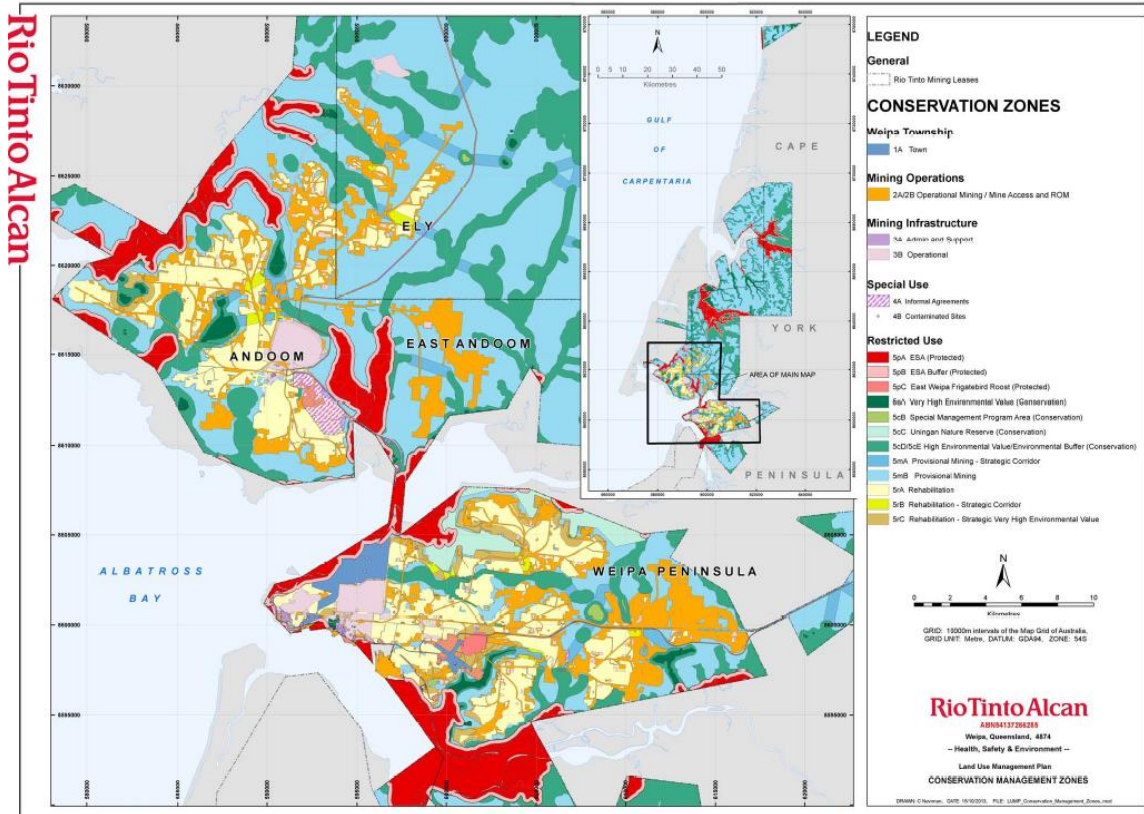
Project No. 41-31822
Revision No. A
Date 3/09/2018

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

Protected Areas

FIGURE 4-17

Figure 4-19 RTWA Conservation Zones



4.5 Air Quality

4.5.1 Dust management

Overall definition of EV

Description of EV

Sources of particulate emissions

The Project area is situated in a relatively remote part of Cape York and encompasses the townships of Weipa and Napranum. Potential sources of particulate emissions within the Project area could include:

- Unsealed roads
- Existing mining and processing operations
- Bushfires

Air quality monitoring

Ambient air quality was originally monitored within the Weipa and Napranum regions as part of the South of Embley EIS in 2009 and South of Embley Supplementary report to the EIS in 2012. The results indicate:

- Annual average PM10 concentration measures was 26.3 µg/m3;
- Maximum PM2.5 (24-hour) concentration measures was 8 µg/m3;
- Typical maximum PM10 (24-hour) concentrations was measured 40 µg/m3 at the Scherger RAAF base and North Napranum;
- For 99% of the time, the 24-hour average PM10 concentration was below 60 µg/m3;
- Annual average TSP measures were 5 µg/m3; and

- Highest month dust deposition was 86 mg/m²/day.

The *Queensland 2017 air monitoring report* (DES, 2018b) states that the annual mean NO₂ is between 0.004 ppm and 0.007 ppm for various industrial locations in Queensland. For SO₂, the annual mean is between 0.000 ppm and 0.005 ppm. However, these values relate to highly industrial locations and therefore are likely to be higher than the levels represented in the Project area.

Location of EV

The Project area is situated in an area that contains a number of active mines, as well as the Weipa town, other than this, majority of the site is vegetated. Potential sources of particulate emissions in the Project area comprise:

- Unsealed roads;
- Un-vegetated areas;
- Smoke from bushfires;
- Existing mines and processing plants; and vehicles.

The 2009 monitoring of air quality was undertaken at various sites near the now decommissioned calcination plant which was determined to be a large contributor to dust emissions.

Regional context

The *Environmental Protection (Air) Policy 2008* outlines the environmental values relevant to air, these include:

- The qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems;
- The qualities of the air environment that are conducive to human health and wellbeing.

Vulnerability

The Project area is known to be prone to high dust emissions due to the numerous mining operations that occur in the region. Increased dust emissions can impact on a number of other EVs.

Information gaps

There is limited knowledge on recent air quality monitoring that's occurred, particularly now that the land use in the southern extent of the Project area has changed considerably since the last air quality monitoring event. There is also an absence of NO₂ and SO₂ measurements for the Project area.

Confidence criteria assessment

Limited knowledge on air quality in the Project area due to a lack of publically available data, however, it is known that due to the extensive mining activities undertaken within the Project area, there is likely to be high levels of dust emissions. Further air quality sampling would most likely support this.

Measure of importance

The air quality within the Project area is considered to be of moderate importance due to the amenity and health values associated with dust emissions. Table 4-25 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-25 Statement of importance for dust emissions

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	✓ Protected under the <i>Environmental Protection (Air) Policy 2008</i> .	
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	✓ Supports amenity of the Project area.	

Statement of significance

Dust management is not rated as a not significant EV for the Project area (inclusive of both study areas).

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. Although there is a lack of available air quality monitoring information available for review, the Project area is known to succumb to increased levels of dust emissions due to extensive mining activities.

4.5.2 Noise management

Overall definition of EV
<p>Description of EV</p> <p><i>Sources of noise emissions</i></p> <p>Majority of the Project area is undeveloped land, with the exception of the existing mining activities and townships of Weipa and Napranum. The most notable noise producing activities within the Project area are emitted from mining related, recreational and industrial activities.</p> <p><i>Noise monitoring</i></p> <p>Noise monitoring was undertaken over two - seven day periods at Evans Landing and Nanum in 2008 as part of the South of Embley EIS (Rio Tinto Alcan, 2011) and revealed background noise levels and overall noise levels for the area. The median background noise level at Evans Landing ranged between 38-41 dB (A) with overall noise levels ranging between 47-53 dB (A) (Rio Tinto Alcan, 2011). The median background noise level at Nanum ranged between 37-40 dB (A) with overall noise levels ranging between 42-48 dB (A) (Rio Tinto Alcan, 2011).</p> <p>The Commonwealth EIS for the South of Embley Project conducted further noise monitoring in 2012 which identified that noise levels in Napranum matched those produced at Evans Landing (Rio Tinto Alcan, 2013).</p>
<p>Location of EV</p> <p>Monitoring of noise occurred in the northern extent of the Project area at Evans Landing and Nanum.</p>

Regional context

The *Environmental Protection (Noise) Policy 2008* outlines the environmental values relevant to noise, these include:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems;
- The qualities of the acoustic environment that are conducive to human health and well-being, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, and recreate; and
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Vulnerability

Sensitive receptors in the Project area include residents of the town of Weipa and fauna that inhabit the area. Increased noise can cause discomfort and avoidance of certain areas (Rio Tinto Alcan, 2011).

Information gaps

There is limited knowledge on recent noise monitoring that's occurred, particularly now that the land use in the southern extent of the Project area has changed considerably since the last noise monitoring event took place.

Confidence criteria assessment

The current findings would not be expected to change significantly if future noise monitoring were to take place. There has not been any recent substantial changes within the Project area that would increase background and/or overall noise levels since monitoring was undertaken in 2008.

Measure of importance

Noise within the Project area is considered to be of moderate importance due to the amenity values associated with noise impacts. Table 4-26 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-26 Statement of importance for noise

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	✓ Protected under the <i>Environmental Protection (Noise) Policy 2008</i> .	
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	✓ Supports amenity of the Project area.	

Statement of significance

Noise management is rated as being a not significant EV for the Project area (inclusive of both study areas).

Confidence of finding

The statement of significance is considered to have a moderate level of confidence. Although there is a lack of available noise monitoring information available for review, the Project area is known include a number of land uses that may contribute to noise pollution. There are also areas within the Project area that undeveloped, therefore an increase in noise producing activities may impact the EVs within these undeveloped areas.

4.5.3 Lighting Management

Overall definition of EV
Description of EV
The main sources of artificial lighting within the Project area are associated with developed, residential and industrial areas. The ports are required to use lighting for navigational and operational safety and therefore would contribute artificial light to areas around the Amrun Export Facility and within Port of Weipa. Most of the southern coastline is undeveloped (other than the areas occupied by Weipa) and therefore have little artificial lighting influencing them.
Location of EV
The main sources of artificial lighting in the Project area occur in the northern extent and result from lighting associated with the Weipa town centre and Port of Weipa. Infrastructure within Amrun will also contain artificial light sources.
Regional context
The Project area has relatively little sources of artificial lighting. Currently, the southern extent of the Project area has limited development, however, due to construction of mining and port related infrastructure, increased artificial lighting could affect this.
Vulnerability
Light spill on beaches can interfere with nesting turtles and other marine fauna (Rio Tinto Alcan, 2012). Artificial lighting onto beaches, particularly around Boyd Point, can discourage female turtles from nesting on the surrounding beaches, whilst also disorientating emerging hatchlings. Artificial lighting can also disorientate nocturnal birds that roost or nest near the source of light.
Information gaps
No notable gaps in the available information have been identified for lighting. Lighting from existing infrastructure could have impacts on turtle nesting due to the location of known turtles nest in relation to existing infrastructure within the Project area.
Confidence criteria assessment
The Project is largely undeveloped and therefore there is limited light pollution, except in places of existing infrastructure and development, in particular, around Weipa township and the Port of Weipa. There is high confidence in the existing information in regards to lighting within the Project area to make a reliable assessment of risk.

Measure of importance

Lighting within the Project area is considered to be minimal and restricted to the existing townships, Port of Weipa and areas of mining activities. Lighting is not an EV in itself, however, it can cause impacts to other EVs as a result of excessive light pollution. Table 4-27 identifies the assessment criteria that the EV was assessed against to determine its importance, as well as providing supporting evidence.

Table 4-27 Statement of importance for lighting

Assessment criteria	Applicability and supporting evidence	
	Amrun-Boyd Point study area	Port of Weipa study area
MNES	X	X
MSES	X	X
Critical habitats/ecosystems	X	X
Regional significance	X	X
Social and cultural	X	X

Statement of significance

Lighting management is rated as being a not significant EV for the Project area (inclusive of both Study Areas).

Confidence of finding

The statement of significance is considered to have a high level of confidence. Known land uses within the Project area allow for a confident assessment of the likely lighting sources within the Project area.

5. Summary and Conclusions

The Port of Weipa EVA has involved a review of available desktop information about the EVs in the Project Area. Measures of importance were used as criteria to identify important EV's on a national, regional and local level. Assessment was undertaken on important EV's to determine those that contribute significantly to the project area. These identified EV's were then classified as according to criteria defining 'significant environmental values' and were supported by confidence of robustness to maintain integrity with this values assessment.

The findings of this EVA can be used to assist in identifying potential environmental constraints and opportunities when considering and ultimately deciding sediment management options for the port, as well as provide an important input into broader port planning and decision-making.

The EVs were defined as important at a National, State/Regional or Local level by using set criteria, including:

- Matters of National and State Environmental Significance;
- critical habitats and ecosystems;
- regional significance;
- national/state heritage registers; and
- Traditional owner considerations.

Those values that were found to be important for the Project area were further assessed to determine if they contributed significantly to the expression of social, cultural, environmental or economic values of the Project Area.

It is important to note that some values that were considered locally and regionally significant, such as terrestrial flora and fauna, were included as subsets of broader EV categories that were assessed overall as not being significant and therefore not included as significantly important values for the Project Area.

Those values determined to be significant for the Project area are summarised below:

Traffic management

Transport infrastructure in the Project Area is highly valued and is regionally significant as it provides broader connections in the region and increases access to employment and essential social services. The EVA determined transport to be of high social significance in the Project Area as there are limited traffic options given the remoteness of the area and the road and air network is vital to the economic survival of the region

Fisheries

Commercial fishing in the Project Area is highly valued as it is an important component of the economic landscape that is largely reliant on mining. Commercial fishing is recognised in the Cape York Regional Plan as being an important economic value of the region as providing for a more diverse economy. The EVA determined commercial fishing to be of high social significance and the species (barramundi, mackerel, grunter) that attract fishers needs to be considered in future port decision making.

Waste management

Waste management is considered to be of high regional significance to the Project Area as there are limited waste management facilities in the region and there is also limited capacity to manage waste resources in the region.

Indigenous cultural heritage

Indigenous cultural heritage has been determined in the EVA to be a significant EV as the area is home to shell middens, stone axes and a number of the woomera scarred trees with high archaeological significance.

Seagrass

Seagrass communities are considered to be of high local and regional importance in the Project area. Seagrass has been determined to be a significant EV for the Project area as it provides critical ecosystem functioning, important nursery ground for fisheries, and ultimately supports the commercial and recreational fisheries in the Gulf.

Mangroves

Mangroves have been determined to be a significant EV for the Project Area as they provide for nursery and feeding grounds for important species and provide for critical ecosystem functioning.

Catchments & streams (estuarine)

Catchment and streams are considered to be of high local and regional importance in the Project Area as they provide for permanent aquatic refuge in a highly seasonal environment and provide for critical habitat for conservation significant species. Catchment and streams that are located downstream (estuarine environment) are specifically rated as being a significant EV for the Project area as they play a vital part of the economic and environmental productivity in the Gulf.

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Appendices

Appendix A – Field Verified Regional Ecosystems for Amrun-Boyd Point study area

RE	Description	VMA Status	Mapped extent (ha) in Amrun-Boyd Point Project area (ha) ²	Mapped area on Weipa Plateau (ha)	Mapped area within the Caper York Bioregion (ha)
Land Zone 1 – Marine deposits					
3.1.1a	<i>Rhizophora stylosa</i> and/or <i>Brugioera</i> spp. closed forest occurring in tidal zones	Least Concern	482	29,051	68,365
3.1.1c	<i>Rhizophora stylosa</i> and/or <i>Brugioera</i> spp. closed forest occurring on the landward side of mangrove communities	Least Concern	123	155	170
3.1.3	<i>Ceriops tagal</i> and/or <i>C.australis</i> +/- <i>Avicennia marina</i> low open forest	Least Concern	473	22,076	50,351
3.1.5	<i>Sporobolus virginicus</i> closed tussock grassland on coastal plains	Least Concern	4	2,345	11,536
3.1.6	Sparse herbland or bare salt pans on salt plains and saline flats	Least Concern	669	16,336	84,687
Land Zone 2 – Coastal sand dunes and swales					
3.2.2	Semi-deciduous vine thicket to vine forest on beach dunes and ridges	Least Concern	381	510	510
3.2.3	Open forest of <i>Melaleuca dealbata</i> or open forest of <i>Lophostemon suaveolens</i> on dunefields	Of Concern	230	2,631	9,270
3.2.5a	<i>Acacia crassicarpa</i> is a consistent and usually dominant component of the sparse and discontinuous canopy.	Least Concern	171	7,780	58,087
3.2.6a	<i>Casuarina equisetifolia</i> is the only tree species in a canopy that can vary from very sparse to sparse (1-30% PFC) and	Of Concern	145	420	1,499

² Pre-Amrun clearing works

RE	Description	VMA Status	Mapped extent (ha) in Amrun-Boyd Point Project area (ha) ²	Mapped area on Weipa Plateau (ha)	Mapped area within the Caper York Bioregion (ha)
	range from 8-20 metres in height.				
3.2.10c	<i>Eucalyptus tetradonta</i> predominates forming a sparse canopy. <i>Corymbia clarksoniana</i> is often present and sometimes codominant to dominant in the canopy. <i>Erythrophleum chlorostachys</i> is also frequently present in both the canopy and the very sparse to sparse sub-canopy tree layer	Least Concern	526	9,065	11,227
3.2.25	Sparse herbland of mixed herbaceous species on foredunes and beach ridges	Least Concern	33	2,384	9,040
Land Zone 3 – Alluvial plains and piedmont fans					
3.3.5a	Evergreen to semi-deciduous notophyll vine forest on alluvia on major watercourses.	Least Concern	43	22,603	58,227
3.3.9	Lophostemon suaveolens open forest on streamlines, swamps and alluvial terraces.	Least Concern	1,595	24,815	47,323
3.3.14a	<i>Melaleuca saligna</i> +/- <i>M. viridiflora</i> , <i>Lophostemon suaveolens</i> woodland on drainage swamps.	Least Concern	434	12,118	27,970
3.3.21	<i>Corymbia clarksoniana</i> +/- <i>Syzygium eucalyptoides</i> woodland on lower slopes of sand ridges and in drainage depressions.	Least Concern	1,601	11,688	38,360
3.3.50a	<i>Melaleuca viridiflora</i> low open woodland on low plains.	Least Concern	1,302	2,435	42,455

RE	Description	VMA Status	Mapped extent (ha) in Amrun-Boyd Point Project area (ha) ²	Mapped area on Weipa Plateau (ha)	Mapped area within the Caper York Bioregion (ha)
3.3.60a	<i>Themeda arguens</i> , <i>Dichanthium sericeum</i> closed tussock grassland on marine plains.	Least Concern	191	9,117	57,030
3.3.61	<i>Panicum spp.</i> and <i>Fimbristylis spp.</i> tussock grassland on inland and coastal alluvial plains.	Least Concern	7	825	825
3.3.64	<i>Baloskion tetraphyllum</i> <i>subsp. meiotachyum</i> open sedgeland in drainage swamps in dune fields.	Least Concern	185	185	185
3.3.65	Ephemeral lakes and lagoons on alluvial plains and depressions.	Least Concern	66	3,960	22,019
Land Zone 5 – Sand deposits forming gently undulating plains (includes laterite plateau)					
3.5.2	<i>Eucalyptus tetradonta</i> and <i>Corymbia nesophila</i> tall woodland on deeply weathered plateaus and remnants.	Least Concern	87,446	671,476	794,330
3.5.4	Semi-deciduous notophyll vine forest in small patches on northern plateaus.	Least Concern	54	5,575	14,479
3.5.11	<i>Eucalyptus tetradonta</i> and <i>Corymbia nesophila</i> woodland on lower slopes of plains and rises.	Least Concern	601	101,769	179,972



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