# Table of Contents

7 Introduction ........................................................................................................... 7-1

7.1 Title of the Action ............................................................................................... 7-2

7.2 Proponent ............................................................................................................ 7-2

7.3 Environmental Health and Safety Policy ......................................................... 7-2

7.3.1 Ecological Protection Objectives and Performance Outcomes .................. 7-3

7.4 The Bauxite Hills Project .................................................................................... 7-4

7.4.1 Project Justification ....................................................................................... 7-4

7.4.2 Project Benefits ............................................................................................. 7-6

7.4.3 Alternatives to the Project ............................................................................ 7-7

7.4.4 Project Description ....................................................................................... 7-11

7.4.5 Relationships to Other Projects .................................................................. 7-15

7.4.7 Project Area .................................................................................................. 7-18

7.4.8 Project Consultation ..................................................................................... 7-20

7.5 Legislative Background ..................................................................................... 7-25

7.5.1 Other Approvals and Conditions .................................................................. 7-26

7.6 Environmental Context ..................................................................................... 7-26

7.6.1 Land Systems ............................................................................................... 7-27

7.6.2 Freshwater Resources .................................................................................. 7-32

7.6.3 Marine Systems ........................................................................................... 7-43

7.7 MNES Assessment Methods ............................................................................. 7-49

7.7.1 Terrestrial and Freshwater Ecology .............................................................. 7-49

7.7.2 Marine Ecology ............................................................................................ 7-61

7.8 MNES Results .................................................................................................. 7-63

7.8.1 Terrestrial Assessment Results .................................................................... 7-63

7.8.2 Marine Assessment Results .......................................................................... 7-80

7.9 MNES Impact Assessment – Terrestrial ......................................................... 7-90

7.9.1 Listed Threatened Species ........................................................................... 7-90

7.9.2 Listed Migratory Bird Species ..................................................................... 7-111

7.10 MNES Impact Assessment - Marine Species .................................................. 7-120

7.10.1 Commonwealth Marine Area ...................................................................... 7-120

7.10.2 Potential Impacts and Mitigation Measures ............................................... 7-123

7.10.2 Impact Assessment ...................................................................................... 7-133

7.10.3 Impact Assessment – Commonwealth Marine Area .................................. 7-146

7.11 Cumulative Impacts ......................................................................................... 7-148

7.11.1 Cumulative Impacts – Terrestrial Species ................................................... 7-148

7.11.2 Cumulative Impacts – Marine .................................................................... 7-153

7.12 Summary of Impacts to MNES ....................................................................... 7-157

7.13 Environmental Offsets Strategy ...................................................................... 7-158

7.13.1 MNES Confirmed within the Project Area .................................................. 7-161

7.13.2 MSES Confirmed within the Project Area .................................................. 7-161

7.13.3 Financial Settlement .................................................................................... 7-165

7.13.4 Land-based Offsets ..................................................................................... 7-165

7.13.5 Next Steps .................................................................................................. 7-168

7.14 Qualitative Risk Assessment .......................................................................... 7-169

7.15 Conclusion ......................................................................................................... 7-173

7.16 Commitments ................................................................................................... 7-175

7.17 ToR Cross-reference ......................................................................................... 7-177
List of Figures

Figure 7-1 Alumina output by country ................................................................. 7-5
Figure 7-2 Regional Project location .................................................................. 7-16
Figure 7-3 Project infrastructure layout .............................................................. 7-17
Figure 7-4 Electronic update example ............................................................... 7-23
Figure 7-5 IAP2 public participation spectrum and levels of engagement .......... 7-24
Figure 7-6 Average monthly rainfall and evaporation ...................................... 7-32
Figure 7-7 Ducie Basin catchment map - watercourses, drainage features and wetlands ........................................................................................................... 7-34
Figure 7-8 Groundwater dependent-ecosystems .............................................. 7-39
Figure 7-9 Proposed water management network ............................................. 7-42
Figure 7-10 Skardon River seagrass habitats .................................................... 7-46
Figure 7-11 Bathymetry of Skardon River (September 2009) with bed features noted .............................................................................................................. 7-47
Figure 7-12 Flora survey points and current DNRM RE mapping in the Project area .............................................................................................................. 7-53
Figure 7-13 Fauna and aquatic ecology survey locations and DIWA wetland mapping ................................................................................................. 7-60
Figure 7-14 Revised vegetation mapping for the Project area ............................ 7-65
Figure 7-15 Vegetation clearing for the Project area .......................................... 7-95
Figure 7-16 North Marine Region area ............................................................... 7-122
Figure 7-17 Significant development projects surrounding the Project area .......... 7-150

List of Tables

Table 7-1 Metro Mining and consultant details .................................................. 7-2
Table 7-2 Project tenure ..................................................................................... 7-19
Table 7-3 Mining tenements in the immediate vicinity of Project .................... 7-20
Table 7-4 Formal communication and engagement activities as of June 2015 .... 7-20
Table 7-5 Potential groundwater dependent areas ........................................ 7-38
Table 7-6 Benthic habitat surveys undertaken from the Skardon River (1986-2015) ........................................................................ 7-44
Table 7-7 Fauna survey site locations and dominant vegetation ..................... 7-54
Table 7-8 Fauna trapping methods ..................................................................... 7-55
Table 7-9 Total survey effort (trap nights) for SRBP fauna ecology surveys .... 7-57
Table 7-10 Survey effort relative to guidelines ................................................... 7-58
Table 7-11 Field survey personnel – terrestrial ecology .................................... 7-61
Table 7-12 Field survey personnel – marine ecology ........................................ 7-62
Table 7-13 Ground-truthed vegetation community descriptions ..................... 7-63
Table 7-14 Predicted EPBC Act listed species ................................................... 7-66
Table 7-15 Likelihood of occurrence of EPBC Act listed threatened species .... 7-68
Table 7-16 Likelihood of occurrence of EPBC Act listed Migratory species ........ 7-75
Table 7-17 Predicted EPBC Act listed species – marine fauna ......................... 7-80
Table 7-18 Likelihood of occurrence of EPBC Act threatened marine species .... 7-81
Table 7-19 Likelihood of occurrence of EPBC Act migratory marine species .... 7-83
Table 7-20 Number of turtle nesting tracks at four beach regions along western Cape York ................................................................. 7-85
Table 7-21 Incidental Snubfin Dolphin sightings ................................................. 7-89
Table 7-22 Key data on threatened species ....................................................... 7-91
Table 7-23 Predicted impact on extant vegetation communities and MNES habitat ................................................................................................. 7-92
Table 7-24 Assessment against significant impact criteria: Chocolate Tea Tree Orchid ................................................................. 7-105
Table 7-25 Assessment against significant impact criteria: Black-footed Tree-rat ................................................................................................. 7-107
Table 7-26 Assessment against significant impact criteria: Palm Cockatoo .... 7-109
Table 7-27 Key data on listed migratory species ................................................. 7-111
Table 7-28 Assessment against significant impact criteria: Little Tern and Gull-billed Tern ................. 7-116
Table 7-29 Assessment against significant impact criteria: Whimbrel and Common Sandpiper .......... 7-117
Table 7-30 Assessment against significant impact criteria: Eastern Osprey ................................... 7-118
Table 7-31 Assessment against significant impact criteria: Eastern Cattle Egret and Great Egret ...... 7-118
Table 7-32 Assessment against significant impact criteria: Rainbow Bee-eater ................................. 7-119
Table 7-33 Assessment against significant impact criteria: Rufous Fantail .................................... 7-120
Table 7-34 Key data on threatened species or species groups ......................................................... 7-133
Table 7-35 Assessment against significant impact criteria: Flatback Turtle .................................... 7-136
Table 7-36 Assessment against significant impact criteria: Green Turtle ........................................ 7-137
Table 7-37 Assessment against significant impact criteria: Hawksbill Turtle ................................. 7-137
Table 7-38 Assessment against significant impact criteria: Loggerhead Turtle ................................. 7-138
Table 7-39 Assessment against significant impact criteria: Olive Ridley Turtle ................................. 7-139
Table 7-40 Assessment against significant impact criteria: sawfish species and Speartooth Shark .... 7-141
Table 7-41 Assessment against significant impact criteria: Dugong ............................................... 7-142
Table 7-42 Assessment against significant impact criteria: Estuarine Crocodile ................................. 7-143
Table 7-43 Assessment against significant impact criteria: Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin .............................................................. 7-144
Table 7-44 Assessment against significant impact criteria: Narrow Sawfish ................................... 7-144
Table 7-45 Assessment against significant impact criteria: Coastal Manta Ray ............................... 7-145
Table 7-46 Assessment against significant impact criteria for Commonwealth Marine Area ............. 7-147
Table 7-47 Impacts to MSES through clearing for the Project ....................................................... 7-162
Table 7-48 Potential offset actions .................................................................................................. 7-166
Table 7-49 Qualitative risk assessment – MNES ............................................................................. 7-169
Table 7-50 Commitments – MNES .............................................................................................. 7-175
Table 7-51 ToR cross-reference – MNES ....................................................................................... 7-177

List of Plates

Plate 7-1 Port of Skardon River infrastructure ............................................................................. 7-19
Plate 7-2 Palm Cockatoo .............................................................................................................. 7-72
Aldoga Minerals Pty Ltd (Aldoga), a 100% owned subsidiary of Metro Mining Limited (Metro Mining), proposes to develop the Bauxite Hills Project (the Project) located on a greenfield site on the western coastline of Cape York, Queensland, approximately 35 kilometres (km) northeast of Mapoon. The Project will include an open cut operation, haul roads, Barge Loading Facility (BLF), Roll on/Roll off (RoRo) facility, barging and transhipping and will produce and transport up to 5 million tonnes per annum (Mtpa) of ore over approximately 12 years. The mine will not be operational during the wet season.

The construction of the mine is due to commence in April 2017 and is expected to take seven months to complete. The first shipment of bauxite is planned for October 2017. The Project will be 100% fly-in fly-out (FIFO) due to its remote location. The Project will operate over two 12 hour shifts per day for approximately eight months of the year and is expected to employ up to 254 employees during peak operations. In addition to the workforce, it is expected that the Project will result in the employment of additional workers through local and regional businesses servicing the accommodation camp and the construction and operation of the mine.

This chapter of the Environmental Impact Statement (EIS) describes the potential impacts associated with the Project on Matters of National Environmental Significance (MNES) as set out under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act). The referral for this Project was submitted to the Department of the Environment (DotE) on 11 August 2015 (EPBC 2015/7538).

This chapter of the EIS has been prepared in response to a decision made under Part 3 of the EPBC Act by DotE on 18 September 2015 to declare the Project a controlled action. Controlling provisions include:

- Listed threatened species and communities (ss18 and 18A);
- Listed migratory species (ss20 and 20A); and
- The Commonwealth marine area.

The EPBC Act provides for the protection of the environment, in particular MNES. Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any MNES without approval from the Commonwealth Government Environment Minister or the Minister’s delegate.

For this Project, the EIS process is accredited under the bilateral assessment agreement between the Commonwealth and Queensland Governments. As such, the EIS process under the EPBC Act will run concurrently with the Queensland EIS process.

The following information in this chapter addresses the requirement for a stand-alone MNES assessment as detailed in Appendix 2 of the Project’s Terms of Reference (ToR) published by the Queensland Department of Environment and Heritage Protection (EHP) in February 2016. The chapter summarises the results of desktop and field-based assessments of the Project area as part of the terrestrial, aquatic and marine ecological studies, and surface and groundwater assessments using the results to define the potential impacts to the MNES of concern.
7.1 Title of the Action

The title of the action is the Bauxite Hills Mining and Barging Project (EPBC ref 2015/7538).

7.2 Proponent

The proponent for the Project is Aldoga Minerals Pty Ltd (Aldoga), a 100% owned subsidiary of Metro Mining. The mining tenements are held by Aldoga (99%) (ABN 87 102 192 585) with the remaining 1% held by Cape Alumina Pty Ltd (Cape Alumina) (ABN 88 107 817 694), a 100% owned subsidiary of Metro Mining.

Metro Mining is referred to throughout this document rather than Aldoga or Cape Alumina for convenience as Metro Mining is the ultimate holding company for the Project and is readily recognised as a public company listed on the Australian Securities Exchange.

Metro Mining was formed after MetroCoal Ltd undertook a takeover of Cape Alumina Ltd, which was completed in mid-December 2014. Both companies were listed on the Australian Securities Exchange (ASX) in 2009 and have been focussed on developing projects in Queensland over the past six or more years. Metro Mining’s major shareholders are Balance Property Group (19.1%), Dadi Engineering and Development Group (16.4%), and China Xinfa Group Corporation Ltd (5.7%).

The relevant details regarding Metro Mining, including website and contact details, are summarised in Table 7-1.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Metro Mining – Project Director</th>
<th>Metro Mining – Manager Environment and Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Mike O’Brien</td>
<td>Colleen Fish</td>
</tr>
<tr>
<td>Address</td>
<td>GPO Box 10955, Brisbane, QLD,4000</td>
<td>GPO Box 10955, Brisbane, QLD,4000</td>
</tr>
<tr>
<td>Phone</td>
<td>(07) 3009 8000</td>
<td>(07) 3009 8000</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:mobrien@metromining.com.au">mobrien@metromining.com.au</a></td>
<td><a href="mailto:Cfish@metromining.com.au">Cfish@metromining.com.au</a></td>
</tr>
</tbody>
</table>

7.3 Environmental Health and Safety Policy

Metro Mining is a responsible corporate citizen that is working collaboratively with all stakeholders to deliver a sustainable, profitable bauxite mining project that will also have positive social, economic and environmental outcomes for the local community and broader Australian public.

This Project is being developed in accordance with the principals of ecologically sustainable development and in accordance with Metro Mining’s Environmental Policy. As part of our commitment to the environment, Metro Mining is looking at new approaches, based on proven technology, to minimise the costs and environmental impacts of shallow, surface mining operations. Metro Mining have developed a draft Environmental Management Plan (EMP) for the Project (Appendix K) and have committed to developing an Environmental Management System prior to the commencement of construction works for the Project.

Metro Mining believes that a fundamental requirement of a successful business is the support and approval of the communities in which it operates, and that a properly managed mining operation
will bring significant benefits to Traditional Owners and individuals along with the local and regional communities. Metro Mining’s Community and Social Responsibility Policy outlines the commitments to creating employment and genuine economic and social benefits for local communities, including Indigenous communities, near our project sites. To give effect to this, Metro Mining has recently entered into a formal agreement with the trustee of the land, Old Mapoon Aboriginal Corporation (OMAC) and the recognised Native Title holders, the Ankamuthi People and the Northern Cape York Group #1 covering, amongst other things employment, compensation, rehabilitation and environmental and cultural heritage management.

Metro Mining has the following environmental, health, safety and community policies in place which will apply to this Project:

- Policy 4.1 – Occupational Health and Safety Policy approved on the 26 May 2015;
- Policy 5.1 – Community and Social Responsibility Policy approved 26 May 2015;
- Policy 6.1 – Environmental Policy approved on the 26 May 2015;
- Policy 7.1 – People Policy approved on the 26 May 2015; and

These policies provide clear objectives for Metro Mining to achieve the expected high levels of performance in the environmental, health and safety and community areas.

Metro Mining, including Aldoga and Cape Alumina, have been operating in Australia since 2008 and have not had any environmental enforcement or non-compliance issues to date. The directors have put in place strategies and procedures to ensure that the consolidated entity manages its compliance with environmental regulations. These strategies and procedures apply to all Metro Mining controlled companies including Aldoga and Cape Alumina.

As part of this process Metro Mining is nominated as responsible for endorsing and approving all mitigation measures and environmental monitoring programs outlined in this document.

The directors have not been convicted of any environmental crimes within Australia or elsewhere.

7.3.1 Ecological Protection Objectives and Performance Outcomes

7.3.1.1 Protection Objectives

As per the Terms of Reference (ToR) issued by the State Government and as a requirement to be granted State-issued Environmental Approval conditions to carry out Project operations, the protection objectives for ecological matters is to ensure that the:

- Activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna;
- Choice of the site, at which the activity is to be carried out, minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places;
- Location for the activity on a site protects all environmental values relevant to adjacent sensitive land uses;
- Design of the facility permits the operation of the site, at which the activity is to be carried out, in accordance with best practice environmental management; and
- Project avoids significant residual impacts to matters of national and state environmental significance; mitigates impacts where they cannot be avoided and offsets any residual impacts.

7.3.1.2 Performance Outcomes

The performance outcomes for the Project are:

- Activities are managed so that any adverse effects on terrestrial, freshwater and marine ecology are minimised;
- The ecology of terrestrial, aquatic and marine biotic communities are maintained post-mining and into the future;
- Vegetation communities are re-established to the approved level and fauna species are able to utilise rehabilitated and retained habitats adjacent to the Project area post-development;
- No disturbance of flora or fauna occurs outside what has been specifically approved in the Project’s licence conditions; and
- Compliance with all applicable legislation, and specifically the Project’s approval conditions.

7.4 The Bauxite Hills Project

7.4.1 Project Justification

Australia has the second largest reserves of bauxite and is the largest producer of bauxite in the world. The majority of this production is from five long term established mines at Weipa, Gove, Huntly, Boddington and Willowdale. Indonesia was a major producer, until legislation changes introduced in 2009 and extended in 2015, prevented the export of bauxite ore. In recent times, new bauxite production from Malaysia has come online to replace Indonesia’s supply, albeit of a low quality. Due to environmental concerns, the Malaysian government has recently announced a three month ban on bauxite exports beginning 15 January 2016. This creates uncertainty over Malaysia as a future steady supplier of bauxite, which would push the bauxite price in the short to medium term.

Traditionally, Australia has had an integrated bauxite-alumina-aluminium industry but the rise of Chinese alumina refineries and smelters, along with the industry changes in Indonesia, has created new market opportunities for direct export of bauxite ore. China is the world’s largest producer of alumina accounting for approximately half of global production (see Figure 7-1). The emergence of alumina smelters and refineries in China has paved the way for a direct export market of bauxite.
In the past decade, there has been a transformation of the global third party bauxite market, brought about by the emergence of Chinese merchant alumina refining capacity treating imported bauxite. The majority of these refineries were configured to process ‘low temperature’ Indonesian bauxite. However with the change in legislation in Indonesia banning mineral exports, Chinese merchant refineries have been forced to look for other supply sources.

The Indonesian ban on exports pushed imported bauxite prices into China to record highs. However, since these peaks, the emergence of low cost Malaysian bauxite has seen a reduction in these imported bauxite prices.

Since the Indonesian bans, the major Chinese merchant refineries have been working to develop new global bauxite sources in Fiji, Australia, Guinea, Ghana and other countries. This strategy has been implemented to diversify the supply base and avoid the potential replication of the concentrated supply base that is prominent in the iron ore sector.

Despite concerns over the Chinese economy, the demand for aluminium is forecast to remain strong with much of the industry forecasting 8 to 10% growth over the decade ahead. The demand for imported bauxite is expected to remain strong due to a number of factors:

- Growth in the demand for aluminium;
- Existing demand from merchant refineries; and
- Depleting reserves and grades for domestic producers forcing domestic supply to be replaced by imported supply.

Further detail justifying the Project is provided in Chapter 2 – Description of the Project.
7.4.2 Project Benefits

Australia is the world’s largest producer of bauxite, accounting for about one-third of global output. Bauxite production in Australia is estimated to reach 82.0 Mt in 2014-15, up from 67.8 Mt in 2009-10. Demand for Queensland bauxite remains strong, with exports from the state reaching a record new high of approximately 15.146 Mt valued at $546 million in 2013–14 up from 12.567 Mt valued at $382 million in 2012–13. Using the 10% royalty rate for export this equates to approximately $54 million in royalties to the Queensland Government for the 2013-14 year alone. Additionally domestic usage of bauxite has continued to increase and is demonstrated through alumina exports increasing from 18.914 Mt valued at $5,342 million in 2012–13 to 18.614 Mt valued at $5,711 million in 2013–14. Similarly Aluminium (ingot metal) exports increased from 1.569 Mt valued at $3,276 million in 2012–13 to 1.576 Mt valued at $3,477 million in 2013–14.

Economic modelling for the Project (see Chapter 16 – Social and Economic, and Appendix H – Economic Technical Report) indicates that the export revenue associated with the sale of bauxite from this Project will facilitate the payment of royalties to the Queensland Government in the order of $36 million once the mine is fully operational.

Throughout the construction and operation phases of the Project, Metro Mining will provide potential employment opportunities in local and regional areas. Development of the Project will add a further 75 and 254 staff during construction and operations respectively providing a further boost to Queensland’s and Australia’s economy, particularly at a time of global financial uncertainty and economic uncertainty in Australia driven by the downturn in the retail sector. In addition to the permanent workforce, it is expected the Project will result in the employment of additional workers locally and regionally through businesses supporting the construction and operation of the mine. Initial estimates anticipate a capital cost of approximately $35 million will be required to bring the Project to full production. Operational expenditure is estimated to be $15 million per annum for the life of the Project.

A significant proportion of this investment will flow directly into the regional economy from the goods and services required during the construction and operation phases. For example, goods and services expected to be sourced locally and from the region include:

- Consumables for the camp (food, beverages etc.);
- Fuel supply and transport;
- Engineering support services;
- Professional and technical services;
- Shipping transport services for consumables, equipment and supplies;
- Tools and equipment;
- Specialised environmental rehabilitation services e.g. local seed supply;
- Training and personnel management services; and
- Vehicle hire or purchasing.
7.4.3 Alternatives to the Project

During the Project design process a number of scenarios were considered to evaluate the relative social, economic and environmental advantages and disadvantages of different Project alternatives. Results from this analysis were used to select the final Project scope in the context of fixed locations for the Bauxite resource and Mining Lease Application (MLA) areas. This process ensures the Project design has been underpinned by relevant environmental, social and economic drivers.

Alternative scenarios considered were those that are practicable, feasible and available to Metro Mining. These included locality, technological and conceptual alternatives. The particular scenarios assessed as part of the EIS included the following alternative actions:

- No development scenario;
- Locality alternatives:
  - Mine pit location
  - Mine Infrastructure Area (MIA)
  - BLF and RoRo facility
- Conceptual alternatives:
  - Operational schedule
  - Shared and co-developed infrastructure
  - Mining pit configurations
  - Product beneficiation
  - MIA
  - Product reclaim
  - BLF
  - RoRo facility
  - Barging
  - Transhipment.

The following subsections discuss each of the aforementioned alternative scenarios.

7.4.3.1 No Development

This scenario would also have a significant impact socially and economically in the region and broader Queensland. The construction phase of the Project is anticipated to occur over a seven month period, making estimated contributions to the Far North Queensland Region and rest of Queensland economies that would not be realised under this scenario are as follows:

- Output contribution of $53.57 million, comprising $38.96 million of direct contribution and $14.61 million of indirect contribution;
Household income contribution of $10.92 million, comprising $7.51 million of direct contribution and $3.41 million of indirect contribution;

Employment contribution of 118 Full Time Equivalents (FTEs), comprising 66 direct FTEs and 52 indirect FTEs; and

Value added contribution of $19.11 million, comprising $13.27 million of direct contribution and $5.84 million of indirect contribution.

The average annual economic contribution of the Project during the operational phase that would not be realised in the FNQ region under the no development scenario is anticipated to be:

Output contribution of $87.74 million, comprising $67.17 million of direct contribution and $20.57 million of indirect contribution;

Household income contribution of $20.23 million, comprising $15.37 million of direct contribution and $4.86 million of indirect contribution;

Employment contribution of 254 FTEs, comprising 181 direct FTEs and 72 indirect FTEs; and

Value added contribution of $38.61 million, comprising $29.78 million of direct contribution and $8.82 million of indirect contribution.

The region would not benefit from employee opportunities, potential financial donations to community groups, training programs or receive local business support.

In regard to royalties to the Queensland Government, the no development scenario would result in a loss of approximately AUD $36 million in royalties per annum at full production.

Furthermore, the Project will make a significant contribution to the economic strength of the Northern Cape region through the provision of employment and training opportunities for traditional owners, as well as business development and contracting opportunities for Ankamuthi and other local businesses and payment of mining benefits to the Ankamuthi People, the Northern Cape York Group #1 (CYG#1) and the OMAC for the life of the Project. The mining benefits are based on a percentage of the Free on Board (FOB) price received per tonne of bauxite and could exceed $60 million over the life of the Project. These funds will be used to fund long term programs and benefits to a broad cross section of the Mapoon community and the Ankamuthi People and their organisations. The capacity building opportunities for the Ankamuthi People, the Northern Cape York Group #1 and OMAC would not be realised under the no development scenario.

**7.4.3.2 Project Design Alternatives**

The following provides a description of the Project design alternatives considered by Metro Mining as they relate to environmental matters and MNES. Some design alternatives (such as MIA and RoRo facility locations) provided no discernible difference to predicted environmental impacts. Further detail is provided in Chapter 2 – Description of the Project.

The climatic conditions which the Project is subject to involves a wet season (typically December – March) and a dry season (typically April – November). Metro Mining considered the options of operations to take place over the entire year or only during the dry season.
Metro reviewed historical rainfall data and when considering its operations, deemed it would be prudent to operate only in the dry season for the following reasons:

- Inefficiencies of operating in the wet, particularly with respect to product handling of the bauxite;
- Greater risk of environmental issues such as control of water inundation; and
- Persistent cyclone/evacuation risk.

Once ruling out operations in the wet, Metro Mining considered the duration of each operating year during the dry season. Review of historical rainfall data showed that the dry season would generally last for up to nine months a year, and the rainfall at the start and end of each wet season was probably not heavy enough to warrant a shutdown of operations. However, the commencement and end of the wet season is unpredictable and as such, Metro Mining decided on an eight month operating window to ensure its operational targets could be met each year. A longer operating window to achieve the same volume may result in issues associated with the export of product in the event of a shortened dry season.

**Mine Pit Configurations**

The mining pit locations are determined by the targeted bauxite deposits and the existing and proposed MDLs. The Bauxite deposits at Bauxite Hills 1 (BH1) and Bauxite Hill 6 (BH6) are very shallow and do not require detailed pit development design. Based on the varying grade throughout the deposits, as predicted by Metro Mining’s geological model, an optimisation software was utilised to develop pit shells that resulted in the most favourable economic results. Overlayed on this mine pit design were the identified environmental, cultural and operational buffer zones. The entirety of Big Footprint Swamp was excised from the proposed MLAs to provide surety to all stakeholders that this significant cultural and environmental location would not be directly impacted by any mining operations.

Mining Lease boundaries were given a 50 metre (m) clearance offset to allow for adequate haulage space and provide an environmental buffer. In addition, areas defined as Matters of State Environmental Significance (MSES) were treated with 100 m of clearance where possible. Some minimal impacts to MSES are unavoidable for the MIA, BLF and haul roads. Where these impacts are predicted, an appropriate offsets package has been proposed (see Chapter 5 – Terrestrial and Freshwater Ecology and Appendix C – Offsets Strategy).

**Product Beneficiation**

The option to beneficiate the bauxite was considered during the pre- and definitive feasibility studies. Beneficiation of the bauxite would realise increased returns to the Project; however, the costs associated with the processing infrastructure and the long-term cost associated with the management and remediation of a tailings storage facility. In addition to the increased environmental risks with the processing facility needing to be located close to the Skardon River, and a lack of usable area for the tailing storage facility prevented this option from being considered further.
Barge Loading Facility

Two potential structural forms were considered for the approach to the BLF: causeway and short relieving span; and piled approach jetty. Comparative cost estimates show that the causeway option would be substantially less expensive than a piled approach jetty. However, the construction of a long causeway (approximately 550 m), much of which is below the Highest Astronomical Tide (HAT), would potentially introduce less desirable environmental outcome, due to the following issues:

- Potential effects on river flow, particularly during floods, due to the solid nature of a causeway;
- Potential creation of turbidity during construction;
- Potential creation of "mud waves" (including acid sulphate soil issues) of displaced mangrove mud during construction; and
- Lack of suitable armour rock supply on site.

Due to the issues outlined above, the long causeway was discounted in favour of a piled approach jetty. A causeway has been selected as part of the adopted solution, but its extent has been confined to the part of the outloading conveyor alignment that is below +6.0 m Lowest Astronomical Tide (LAT) and above the HAT. This means that the relatively short causeway that forms part of the adopted solution will be constructed on dry land from locally won core materials and can be armoured with a small volume of imported durable rock.

Two potential options were considered for the siting of the outloading berth. These potential locations were:

- Option 1 - On the river bend at the downstream extent of the lease, in a pocket of what appears to be naturally deep water, requiring a relatively long approach jetty; and
- Option 2 - Further upstream, adjacent to the proposed stockpile location, requiring a deepened channel from the river bend.

Comparative capital cost estimates were produced for these options. It was found that the cost of levelling the relative small volume of material (approximately 53,000 cubic metres (m³)) for Option 2 would be substantially less than the cost of the additional length of approach jetty required for Option 1 (approximately an additional 288 m of jetty). The required works for Option 2 would; however, have greater potential environmental risks associated with bed-levelling and for the subsequent disposal of the bed material. For this reason, Option 1, which is a higher cost option, but with less potential risk to environmental values has been selected for development.

Barging

Various barge design options were considered during the Definitive Feasibility Study. The final barge consist was developed to remove the need for dredging and/or bed-levelling. This incorporated the use of shallow draft tugs, barges and work boats in addition to 24 hour barge operations over the approximate eight month operational schedule. The use of shallow draft vessels removes the need to undertake bed-levelling and/or dredging of the barge channel as the shallow draft permits a longer operational duration. In addition to operational enhancement, the removal of the need to bed level and/or dredge ensures a better environmental outcome for the Project.
Transhipment

Several ocean going vessels (OGV) anchorage areas have been considered for the offshore transhipment activities. The most cost effective anchorage area option is located to the west of the mouth of the Skardon River. This option provides an easier and shorter access from the Skardon River to the anchorage and thereby reducing to transit time to and from the anchorage. During fieldwork investigations it was found that this anchorage area included scattered reef assemblages that would potentially be at risk from impacts relating to anchoring activities. This option was not considered further due to the potential environmental risks to the isolated reef assemblages. A 1 km buffer area was applied to the reef assemblages. A second area to the south of the preferred anchorage was also found to contain isolated reef assemblages and was not considered further due to environmental concerns. A 1 km buffer area was also applied to these areas.

The option for the OGV anchorage area being progressed for the Project is located to the north of the reef assemblages and to the north west of the Skardon River mouth. Whilst this area requires a longer and less direct transit route it was progressed as the favoured option as it affords a lesser risk of environmental harm then the previous options.

7.4.4 Project Description

The Project is located on the western coastline of Cape York, Queensland, approximately 35 km northeast of Mapoon (Figure 7-2). The Project is expected to have a life span of 12 years at the maximum production rate of 5 million tonnes per annum (Mtpa). It is characterised by several shallow open cut pits that will be connected via internal haul roads, which in turn, will be connected to a main north-south haul road linking the MIA and BLF located on the Skardon River (Figure 7-3). Key components of the Project design are summarised below. Further detail is provided in Chapter 2 – Description of the Project.

Key components of the Project include:

- Shallow open cut pits (Bauxite Hills 1 (BH1), Bauxite Hill 6 (BH6) east and west pits). Waste material (overburden) associated with the pit development and mining (including sub-soils and weathered rock) will be used for construction of the MIA and other infrastructure, where practicable, with the remainder of overburden material being replaced into the pits following mining. The Project does not propose to have any out-of-pit overburden dumps;

- Haul road routes are required to transport product ore to the MIA for stockpiling and loading to barges. Haul roads will be constructed from BH6 to the MIA and BLF, and from BH6 to BH1. Haul roads will be constructed using local materials (i.e. ironstone, laterite or low grade bauxite) taken from within the proposed haul road corridor, with borrow pits located adjacent to the haul roads or from the mining pits;

- The proposed BLF will be located adjacent to the MIA containing the product stockpiles. The proposed berth is to be located at the river bend at the downstream extent of the MLA in the deep water to achieve an alongside depth of 4.5 m at LAT. The BLF consists of the following components:
  - A causeway of approximately 100 m in length, with a 6 m wide crest will be constructed along the alignment of the outloading conveyor
  - A jetty consisting of a 6 m wide concrete deck, supported on steel girders, which are in turn supported by steel headstocks, each on two driven steel tubular piles. The piled headstocks are at 12 m centres along the alignment of the jetty
- A 12 x 12 m loading head deck to support the barge loader, to provide a small working deck for maintenance access to the barge loader, to provide access to berthed vessels, and to allow turn-around space for vehicles

- Berthing dolphins to act as a series of structures to berth the vessel against and to provide mooring points for the vessel. Four berthing dolphins are provided on either side of the loading head, to provide an extended quay line

- MIA including the product stockpile, bauxite stockpiles, barge loading conveyor load point, earth moving equipment hard park, administration offices, workshops and fuelling facilities. The MIA will comprise a level site of approximately 5.5 ha;

- A RoRo facility will be constructed adjacent to the MIA. The facility includes a concrete barge ramp designed for Logistics Support Barges, to facilitate the unloading of cargo. The ramp will be located at approximately mean sea level to allow access at high tide by barges;

- An accommodation camp with up to 100 rooms to provide accommodation needs for the workforce, any contractors required from time to time and any other visitors to the site (such as Metro Mining staff);

- Raw and potable water supplied via shallow and/or deep aquifer bores to meet a total annual demand of 420 ML. Assuming 240 days of operation per year and 20 hours of daily pumping time, a total yield of 22 litres per second is required from the combined bores. Polyethylene storage tanks are proposed to act as a buffer between supply from the bores and operational demand; and

- A sewage treatment plant is proposed to be located near the accommodation camp. Effluent and sludge waste streams will be appropriately treated and irrigated to an area set aside for irrigation or used as mulching and/or composting media, respectively.

Power requirements will be sourced from onsite generators located at the MIA and the accommodation camp.

The operations of the Project is expected to require 254 employees at its peak, with additional contractors as needed. The mine will operate two 12 hour shifts per day for eight months of the year, shutting down operations during the wet season. Contractors will most likely work a two week on, and one week off roster; however, this will be decided by the selected mine operator. The Project workforce, comprising all staff and contractors throughout the life of the Project, will be required to follow Project workforce management plans and strategies to ensure environmental and social impacts are minimised.

Access to the Project area will be by air, with secondary access via sea transport. Metro Mining is currently in discussions with Gulf Alumina with regards to consent to utilise the Skardon River Bauxite Project (SRBP) airstrip. Employees and contractors will be flown in to the SRBP airstrip and accommodated onsite. The existing Skardon River airstrip, approximately 1 km from the Project’s southern boundary will be used to transfer staff to and from the Project site.

Construction is planned to commence in April 2017, following the receipt of all necessary environmental approvals. Detailed design and construction is estimated to take seven months. The construction of the BH6 open cut pit, materials handling infrastructure, haul roads, accommodation camp and other associated mine infrastructure is planned to commence simultaneously in year one. The development of BH1 open cut pit will commence in year two. All materials associated with the construction of the Project will be barged to site using shallow draught barges from either the Port
of Cairns or the Port of Weipa. The Port of Karumba may also be used to load equipment to support construction activities.

The mining method for the Project will be open cut mining utilising front end loaders and trucks for hauling. The material does not need any drilling and blasting; however, some ripping by dozers is likely to be required. Front end loaders will be used for loading due to their high manoeuvrability.

Bauxite will be hauled to the product stockpile using road train trucks. Overburden material will be initially stored ex-pit. In-pit overburden storage is expected to commence within the first six months of production. The overburden volume is low for this deposit and it is not expected to represent an issue in terms of waste storage or required capacity of mining equipment. All mine plant and equipment will be delivered and removed from site by barge through the RoRo facility proposed as part of the Project.

The following summarises the operational process for mining and shipping the bauxite:

- **Removal of vegetation.** This will occur progressively ahead of operations to ensure that the disturbed areas are minimised prior to each wet season. Prior to clearing, any trees that are suitable for reuse as nesting or tree hollow sites, will be marked and individually felled and stored. Once cleared, vegetation will be inspected by environmental staff to identify vegetation suitable to be placed directly onto rehabilitated areas to provide initial habitat and assist with soil erosion control purposes. Some vegetation may also be wood-chipped to provide base organic material for a trial composting process (see Chapter 14 – Waste Management). Vegetation that is not used in the rehabilitation or waste management processes will be windrowed and burned, with the burnt material incorporated into topsoil stockpiles.

- **Removal and storage of topsoil.** Following clearing, topsoil will be collected where available and either used directly for rehabilitation purposes or placed into clearly marked topsoil stockpiles. This material will then be progressively replaced onto the post-mining rehabilitation landform. The mine plan will be designed to maximise the amount of topsoil that can be placed directly, without stockpiling.

- **Removal of overburden.** Overburden thickness varies between 0.2 to 0.6 m over the majority of the deposit. Select areas of BH1 have overburden thickness of between 0.8 to 1.5 m and in some areas in BH6, the thickness varies between 0.6 to 1.0 m. The overburden is generally low in nitrogen, phosphorus and total organic carbon. Total iron concentrations are high and give the rich red soil colour observed during onsite surveys. Soil salinity is low and pH was generally within the neutral range. The soils were typically not dispersive as the exchangeable sodium percentage was below the limit of reporting (<0.1 %). For the initial operation, overburden material will be stored in temporary stockpiles, before being pushed back into the post-mined area. All overburden that is removed before mining will then be progressively deposited in the mined out areas.

- **Bauxite excavation.** Final equipment details will be determined by the contract mine operator; however, excavation of the bauxite is expected to utilise CAT992K front end loaders with 12 m³ bucket capacity. The excavated ore will be hauled using “Pit Hauler” trucks that have three trailers with a total capacity of 200 tonnes (t). No drilling or blasting is required and most of the ore will be free dug. Some ripping may be required in areas of cemented bauxite.

- **Screening.** In-pit screening of the bauxite before transporting to the product stockpile is required to eliminate oversize material and remove organic material. Organic material will be retained at the mining area and either burned with the stripped vegetation or returned into the rehabilitated areas.
- **Transport of product material.** Once in-pit screening is completed, ore will be transported by haul truck to the product stockpile located at the MIA.

- **Stockpiling.** Product bauxite will be stockpiled to a maximum height of 18 m using stackers with dozer push out if required. Two product stockpiles will be within a 120 m x 150 m area holding a maximum of approximately 240,000 t at any time.

- **Barge loading.** Barges will be moored to piles in the river and loaded via a conveyor. The conveyor gantry from the barge to shore will be supported by piles. The total length of the conveyor will be approximately 550 m of which approximately 200 m will be causeway and the remaining 350 m consisting of the jetty and loading head/berthing area.

- **Barge transport.** Barges will be towed by tugs from the loading point to the transhipment location, approximately 12 km from the mouth of the Skardon River. Bauxite transportation will be via barge through the Skardon River and will occur 24 hours per day during the eight to nine month operational period. It is expected that transit at the river mouth will be limited for approximately seven hours a day during low tide.

  - Year 1 - There will be approximately 333 barge movements loaded and the same return giving an approximate total of 666 barge movements to deliver 1 Mtpa. This equates to approximately six barge movements (including both out and return) daily over the initial operational period of 100 operational days in the first operating year after construction (i.e. three to four months of operation prior to wet season).

  - Year 2 - There will be approximately 667 barge movements loaded and the same return giving an approximate total of 1,334 barge movements to deliver 4 Mtpa. This equates to approximately six barge movements (including both out and return) daily over the 240 operational days (i.e. eight months per year operations).

  - Years 3 to 12 - There will be approximately 833 barge movements loaded and the same return giving an approximate total of 1,666 barge movements to deliver 5 Mtpa this equates to approximately seven barge movements (including both out and return) daily over the 240 operational days (i.e. eight months per year operations).

Six temporary mooring buoys (four for barge and tugs and two for the floating shiploaders (commencing from year three)) will be located in the river, downstream of the BLF (see Figure 7-3). A single day mooring will be located offshore immediately to the west of the river mouth to assist barges in transit.

- **Transhipment.** OGV will anchor within 12 km offshore from the Skardon River mouth in a designated area. Under-keel depth in the transhipment area will be between 10-12 mLAT to enable loading during all tidal stages. During years 1 and 2 barges will be unloaded using cranes on board the OGVs. During years 3 to 12 two floating cranes will be moored at the transhipment location and will transfer bauxite from barges to the OGVs.

- **Sediment control in mining areas.** Sediment control requirements will be ongoing and integrated into mine planning. Sediment control will include measures to keep surface water flow out of the mining areas as well as control runoff from the areas. With mining operations carried out only in the dry season, the risk of significant water flow into or around the mining operations is minimised. Pits will be designed to ensure that suitable containment measures are in place at the start of the wet season.

- **Dust control.** Dust will be maintained using water trucks on the haul roads and in pit. Water trucks and sprays will be deployed in the stockpiling, conveying and industrial area as required.
• **Rehabilitation of mined out areas.** Mined areas will be progressively rehabilitated to meet agreed final land use criteria. Overburden material will be placed and shaped, before being covered with topsoil and any available composted material. Selected cleared vegetation may be placed back onto the area to provide initial habitat and assist with soil erosion controls. Rehabilitation will also involve some direct seed placement. Where possible, locally sourced seed will be spread across the rehabilitation area at rates that will be determined based on similar rehabilitation projects with the selected species.

• **Final landform preparation.** Final landform is dictated by the bauxite floor and the amount of overburden replaced in the pit. In most areas this is expected to be stable with good drainage. Where necessary additional excavation/earthworks will be carried out to achieve a suitable land profile or drainage outcome. These additional works are standard for mining operations and will be readily achieved using existing mining equipment.

The mine plan will be reviewed from time to time and may be subject to change. Changes may require progressive approval and will be identified in the Plan of Operations process.

Further detail including schematic design drawings of various components is provided in Chapter 2 – Description of the Project.

### 7.4.5 Relationships to Other Projects

Gulf Alumina’s SRBP is located generally directly to the south of the Project, with a component that dissects BH6 West (MLA 20689) and BH6 East (MLA 20688). The SRBP is in the planning phase and the EIS went to public comment that ended on 11th December 2015.

Metro Mining is in active discussions with Gulf Alumina, the proponent for the SRBP; to enter into an arrangement to share existing and co-develop proposed infrastructure. Ideally Metro Mining and Gulf Alumina would utilise existing infrastructure and look to co-develop new infrastructure. This approach has both environmental benefits through a reduction in the area to be disturbed by the Project and cost advantages for both Project proponents through a reduction in capital expense and synergies that would be obtained through more efficient use of infrastructure.

If such arrangements can be agreed a number of aspects of this Project would not be required (i.e. BLF, RoRo, several haul roads and potentially water supply infrastructure). Similarly a number of the proposed infrastructure requirements could be co-developed for use by both operations (i.e. MIA, accommodation camp). Given the tangible benefits to both proponents and the receiving environment, Metro Mining will continue to engage with Gulf Alumina to try and advance an agreement.
7.4.7 Project Area

7.4.7.1 Regional Context

The Project is located within the Cook Shire Regional Council local government area (Cook Shire). The Cook Shire extends from Bloomfield River in the south to just north of the Jardine River. The Cook Shire spans an area of 100,000 km² and covers 80% of the Cape York Peninsula.

The Cook Shire has a small population of approximately 5,000 people. Cooktown is the largest town with approximately a population of 2,300 in 2011. There are no major towns in close proximity to the Project. Weipa, which is not in the Cook Shire, being the closest town and located approximately 95 km south of the Project.

7.4.7.2 Local Context

The Project area is remote from any township with the nearest town Mapoon (population 300), located approximately 35 km in a direct line to the southwest of the proposed MIA. Access to Mapoon from the BLF is approximately 40 km by sea and approximately 350 km by four wheel drive (via Weipa) from the accommodation camp. There are no reserves, stock routes, easements or public road reserves within the Project area.

The Project is located on bauxite plateaus that surround the Skardon River. The plateaus are non- undulating and exhibit moderate slopes with steeper slopes along the fringes of the Skardon River. The BH1 boundary is surrounded to the north and south by tidal zones of the Skardon River and main tributary, respectively. To the east, a ridge rises between these major drainage lines and is characterised by tributary gully formations that feed the main channels.

The BH6 West is divided by a ridgeline running parallel to the main tributary of the Skardon River. The western boundary is characterised by a series of swamps, coastal dunes and low lying coastal zones that are tidally influenced. The eastern boundary rises up a ridge that forms the divide between the Skardon River and Namaleta Creek catchments.

The Project is located entirely within Lot 11 on SP204113 and Lot 13 on SP204113, both of which are freehold tenures, being Aboriginal freehold land. These are held by the Old Mapoon Aboriginal Corporation with whom the company has a Conduct and Compensation Agreement for exploration and has successfully negotiated a Conduct and Compensation Agreement for mining in January 2016.

The land is intermittently used by Traditional Owners for cultural activities, hunting and fishing. The land is not used for agriculture or logging. There are no pastoral properties in the vicinity of the Project. Road access to the Project area is possible via the Telegraph Road and a 90 km, unmaintained bush track, allowing a small number of tourists to camp on the beach near the mouth of the Skardon River. Any access must currently be approved by the OMAC land owners, who charge a nominal camping fee. The area is only accessible via four wheel drive during the dry season. The land use is discussed in further detail in Chapter 4 – Land.

The Project area overlaps waters within the Port of Skardon River. The Port of Skardon River covers an area of 2,489 ha and was established in 2002 with the objective to facilitate regional trade, specifically relating to the proposed kaolin mine operations at the time. The Port facilities are privately owned and are located downstream of the proposed barge loading area and include a barge loading and unloading ramp, diesel transfer pipeline and storage tank and ancillary support buildings (see Plate 7-1).
Approval is sought for the construction, operation and decommissioning of Project activities and all works anticipated to be associated with the six existing MLAs applications outlined in Table 7-2.

**Table 7-2 Project tenure**

<table>
<thead>
<tr>
<th>Tenure</th>
<th>Project activity</th>
<th>Applicant</th>
<th>Application submission date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLA 20676</td>
<td>Open cut BH1 Internal access roads</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>19 October 2012</td>
</tr>
<tr>
<td>MLA 20688</td>
<td>Open cut BH6 East Accommodation camp</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>19 October 2012</td>
</tr>
<tr>
<td>MLA 20689</td>
<td>Open cut BH6 West Internal access roads</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>19 October 2012</td>
</tr>
<tr>
<td>MLA 100051</td>
<td>MIA, BLF and RoRo facility</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>10 July 2015</td>
</tr>
<tr>
<td>MLA 100047</td>
<td>Port haul road</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>10 July 2015</td>
</tr>
<tr>
<td>MLA 100048</td>
<td>BH1 haul road</td>
<td>Aldoga Minerals Pty Ltd</td>
<td>10 July 2015</td>
</tr>
</tbody>
</table>

The Metro Mining tenements are adjacent to MLs held by Gulf Alumina (MLA 40082 and MLA 40069) and Rio Tinto Alcan (MLA 7024 and MLA 7031) and Exploration Permits for Minerals (EPM) held by other companies. The Project will not overlap with any other mineral tenements. Details of the existing Exploration Permits for Coal (EPC), Mineral Development Licences (MDL) and MLs are provided in Table 7-3. Metro Mining is currently in discussions with Gulf Alumina regarding obtaining their consent to construct two haul roads connecting BH6 West (MLA 20689) and the Port Haul Road (MLA 100047). These would simplify access within the Project but are not essential to the operation of the Project.
### Table 7-3 Mining tenements in the immediate vicinity of Project

<table>
<thead>
<tr>
<th>Tenure</th>
<th>Authorised holder name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration Permit for Minerals other than Coal</td>
<td></td>
</tr>
<tr>
<td>EPM 18384</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>EPM 19001</td>
<td>Oresome Australia Pty Ltd</td>
</tr>
<tr>
<td>EPM 4068</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>EPM 16899</td>
<td>Cape Alumina Pty Ltd</td>
</tr>
<tr>
<td>EPM 15376</td>
<td>Cape Alumina Pty Ltd</td>
</tr>
<tr>
<td>EPM 18242</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>EPM 16755</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>Mineral Development Licence</td>
<td></td>
</tr>
<tr>
<td>MDL 423</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>MDL 425</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>Mining Licence</td>
<td></td>
</tr>
<tr>
<td>ML 7024</td>
<td>Rio Tinto Alcan</td>
</tr>
<tr>
<td>ML 7031</td>
<td>Rio Tinto Alcan</td>
</tr>
<tr>
<td>ML 40082</td>
<td>Gulf Alumina Ltd</td>
</tr>
<tr>
<td>ML 40069</td>
<td>Gulf Alumina Ltd</td>
</tr>
</tbody>
</table>

### 7.4.8 Project Consultation

Project consultation commenced in 2014, continued through 2015 and will be ongoing through the EIS process in 2016 and 2017, with all interested and affected stakeholders, particularly Traditional Owners and the land owner, neighbouring land owners and tenement holders, representatives from government agencies, service providers and businesses from the local community. Metro Mining and its subsidiary Cape Alumina Ltd have been active in the Cape York region since 2008 and have established both formal and informal communication processes with many of the stakeholders which will continue to occur. Formal Project specific communication and engagement activities undertaken are detailed in Table 7-4.

### Table 7-4 Formal communication and engagement activities as of June 2015

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website Update</td>
<td></td>
</tr>
<tr>
<td>Metro Mining website updated with information regarding the Project</td>
<td>Jan 2015</td>
</tr>
<tr>
<td>ASX and Media Releases in relation to the Environmental Approval process</td>
<td>Jan, Apr, Jul, Sep, Oct 2015 Jan, Feb 2016</td>
</tr>
<tr>
<td>Draft Terms of Reference for public comment</td>
<td>Dec 2015 – Feb 2016</td>
</tr>
<tr>
<td>EA Application Documents</td>
<td>Jan 2016</td>
</tr>
<tr>
<td>Bauxite Hills Project Newsletter #1</td>
<td>Jan 2016</td>
</tr>
<tr>
<td><strong>Bauxite Hills State and Commonwealth Government Site Visit</strong></td>
<td></td>
</tr>
<tr>
<td>Email Presentation</td>
<td></td>
</tr>
<tr>
<td>Federal Minister for Indigenous Affairs - Senator the Honourable Nigel Scullion</td>
<td>Apr 2015</td>
</tr>
<tr>
<td>Government Meetings and Direct Project Updates</td>
<td></td>
</tr>
<tr>
<td>Honourable Billy Gordon, MP. Queensland member for Cook</td>
<td>Mar 2015, Mar 2016</td>
</tr>
<tr>
<td>Honourable Anthony Lynham, MP. Queensland Minister Department of Natural Resources and Mines</td>
<td>Apr 2015</td>
</tr>
<tr>
<td>Activity</td>
<td>Date</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Honourable Warren Entsch, MP. Federal member for Leichhardt</td>
<td>Apr 2015</td>
</tr>
<tr>
<td>Honourable Mark Bailey MP. Queensland Minister for Ports</td>
<td>May 2015</td>
</tr>
<tr>
<td>Honourable Curtis Pitt MP. Queensland Treasurer, Minister for Aboriginal and Torres Strait Islander Partnerships</td>
<td>Jun 2015</td>
</tr>
<tr>
<td>Honourable Robbie Katter, MP and Shane Knuth, MP. Queensland members for Mt Isa and Dalrymple respectively.</td>
<td>Jul 2015</td>
</tr>
<tr>
<td>Honourable Coralee O’Rourke, MP. Minister assisting the Premier on North Queensland</td>
<td>Oct 2015</td>
</tr>
<tr>
<td>Honourable Steven Miles, MP. Queensland Minister for the Environment</td>
<td>Mar 2016</td>
</tr>
<tr>
<td>DNRM Director-General Mr James Purtill</td>
<td>Oct 2015</td>
</tr>
<tr>
<td>Deputy Director-General Premier and Cabinet Mr Graham Fraine</td>
<td>Mar 2016</td>
</tr>
<tr>
<td>Department of the Prime Minister and Cabinet – Cairns Office</td>
<td>Apr 2015</td>
</tr>
<tr>
<td>Commonwealth Department of the Environment</td>
<td>Sep 2014, Mar, Jul, Aug 2015, Jan, Feb 2016</td>
</tr>
<tr>
<td>Cooktown Shire Council</td>
<td>Apr, Dec 2015</td>
</tr>
<tr>
<td>Mapoon Aboriginal Council</td>
<td>April 2015</td>
</tr>
<tr>
<td>Cairns Regional Council</td>
<td>Apr 2015, Jan 2016</td>
</tr>
</tbody>
</table>

**Stakeholder Meetings and Project Updates**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Mapoon Aboriginal Corporation</td>
<td>Feb, May, Jun, Dec 2015, Jan 2016</td>
</tr>
<tr>
<td>Ankamuthi People (or their legal representation)</td>
<td>Jan, Apr, Jun, Jul, Nov 2015, Jan 2016</td>
</tr>
<tr>
<td>Cape York Sustainable Futures / Tourism Cape York</td>
<td>Jun 2014, Apr 2015</td>
</tr>
<tr>
<td>Rio Tinto Alcan</td>
<td>Apr, Jul, Oct 2015, Feb 2016</td>
</tr>
<tr>
<td>Cairns Chamber of Commerce</td>
<td>Apr 2015</td>
</tr>
<tr>
<td>My Pathways Weipa Office</td>
<td>May 2015</td>
</tr>
<tr>
<td>Weipa Police</td>
<td>Apr 2015, Jan 2016</td>
</tr>
<tr>
<td>Cairns Airport</td>
<td></td>
</tr>
<tr>
<td>Skill 360</td>
<td>Apr 2015, Jan, Feb 2016</td>
</tr>
</tbody>
</table>
In addition to the above meetings, Metro Mining has sent out electronic updates (refer to Figure 7-4 for an example) of the Project to the following stakeholders:

- Department of Local Government, Community Recovery and Resilience;
- Cairns Airport;
- Cairns Public Safety Business Agency – Rural Fire Brigade and Emergency Services;
- Western Cape Chamber of Commerce;
- Weipa Town Office;
- Queensland Health;
- Gulf of Carpentaria Fishing Association; and
- Regional Development Australia – Canberra Office.

The major external stakeholders to the Project are the Ankamuthi People (Ankamuthi) and the Northern Cape York Group #1 (NCY#1) (both as the Traditional Owners and applicants to the two existing Native Title Claims) and OMAC, the Aboriginal trustee for the land. Metro Mining has held a number of formal and informal meeting with the Ankamuthi, the NCY#1 and OMAC, negotiating an Ancillary Agreement under the Right to Negotiate process. The Ancillary Agreement is a combined Native Title Agreement and Land Access Agreement between all parties. This agreement was executed on the 21 January 2016 and meets the legislated requirements of a Cultural Heritage Management Plan. Metro Mining has a separate Compensation Agreement with OMAC executed on the 9 December 2015.

7.4.8.1 Public Consultation Program

The Stakeholder Engagement Strategy developed for the Project is a management tool for use by the Project team aimed at building awareness, acceptance and ultimately, an understanding of the Project. It is designed to maximise community and stakeholder input into the Project through capacity building and two-way communication mechanisms which will be in place for the life of the Project. It also outlines the communication tools which will be used and the purpose of these tools. The Strategy will remain a dynamic document and will be updated as required throughout the Project’s duration.

The Strategy is based on the Social Impact Assessment Guideline – July 2013 issued by the Coordinator-General in conjunction with the Department of Environment and Heritage Protection. The Guideline has been prepared to assist proponents to assess the social aspect of their projects, promote a risk-based approach to social impact assessment and focus on outcomes to encourage innovative solutions to capitalise on social opportunities and mitigate detrimental impacts that may arise from the Project.

A core principal of the Guideline is to ensure communities of interest are engaged in a meaningful way during the development of the social impact assessment and community consultation phase of the EIS, recognising local knowledge, experience, customs and values. The Guideline encourages community participation across the Project lifecycle.

In addition to the Guideline the International Association for Public Participation’s (IAP2) Public Participation Spectrum has been considered in the community consultation program. The Spectrum includes opportunities to inform, consult, involve, collaborate with and empower stakeholders, including local communities and the wider public.
Metro Mining Limited (Metro Mining) is proposing to develop the Bauxite Hills Project.

Bauxite Hills will be a shallow open cut mining operation including haul roads and a barge loading facility and will produce and transport up to 5 million tonnes of bauxite per annum (Mtpa) over a predicted 15 year mine life.

Bauxite from the Project is a Direct Shipping Ore (DSO) product which means it is extracted and loaded directly to ships. No beneficiation or tailings dams are required, significantly reducing potential impacts to the surrounding environment.

Bauxite will be transported by barge along the Skardon River, through the existing Port of Skardon, to the transhipment site approximately 12 km offshore. Here it will be loaded into ocean going vessels and shipped to customers.

Mine construction is due to start early 2017, with the first shipment of bauxite planned for October 2017.

The proposed Bauxite Hills Project is located on western Cape York, approximately 35 kilometres northeast of Mapoon.
For the purposes of managing the level of engagement with stakeholders, stakeholders have been grouped as follows:

- Level 1: Landholders, registered Native Title claimants or body corporates, underlying tenure holders and local government;
- Level 2: Key stakeholders and local communities; and
- Level 3: General public, community and special interest groups, wider regional and state-wide Project communication.

For Level 3 stakeholders the level of participation for this Project is anticipated to be inform and consult, for Level 2 stakeholders inform, consult and involve, and for Level 1 stakeholders, collaboration is anticipated (Figure 7-5). The stakeholders’ ability to influence decisions depends on the decision type and what aspects of the Project are negotiable and what aspects are non-negotiable. The process is intended to be flexible and open to including all stakeholders to the maximum extent possible.

Where practicable, communication and engagement activities will be prioritised in the following order:

- Key stakeholders and directly affected landholders;
- Local communities, neighbouring landholders, and other stakeholders; and
- General public and wider regional community.

**Figure 7-5 IAP2 public participation spectrum and levels of engagement**

![IAP2 2014](source: IAP2 2014)
The Strategy informed the engagement program for the public notification period. This program includes activities across the IAP2 spectrum targeted towards the different stakeholders and includes already scheduled events and those planned for the remainder of the approvals period.

Activities include:

- Monthly Web Newsletter “Bauxite Insight”;
- Specific Project Newsletters at relevant stages of the EIS process;
- Ongoing meetings with Traditional Owner representatives and Aboriginal Land Trustees throughout 2014, 2015 and 2016; and
- Ongoing one-on-one meetings and other communications with key stakeholders and Project partners.

Engagement activities will continue for the duration of the Project with ongoing and regular engagement with stakeholders in accordance with the IAP2 Spectrum. The Strategy will be updated to reflect changes in the Project and in response to feedback, and issues raised during engagement activities. The Strategy will continue to inform and reflect the development of the Project.

### 7.5 Legislative Background

Under the EPBC Act, the following MNES are protected:

- World Heritage Properties;
- National Heritage Places;
- Ramsar wetlands of international importance;
- The Great Barrier Reef Marine Park (GBRMP);
- Listed threatened species and communities;
- Migratory species protected under international agreements;
- The Commonwealth marine environment;
- Nuclear actions (that may have significant impacts on the environment); and
- Water resources as related to coal seam gas and large coal mining developments.

Under Part 3 of the EPBC Act, the three relevant controlling provisions for this Project are:

- Listed threatened species and communities (ss18 and 18A);
- Listed migratory species (ss20 and 20A); and
- Commonwealth marine area (ss23 and 24A).
Actions that are likely to have a significant impact on MNES are subject to the assessment and approval process. The EPBC Act Policy Statement 1.1: Significant Impact Guidelines (DotE 2013) define the criteria used in this EIS against which an ‘action’ (i.e. the proposed works) may be judged as having (or not having) a significant impact.

7.5.1 Other Approvals and Conditions

A detailed description of the legislation, policy, and planning framework pertaining to the Project is provided in Chapter 1 – Introduction of this EIS.

A list of those related to biodiversity and water management are below:

- EPBC Approval for a Controlled action under the EPBC Act;
- EA under the *Environmental Protection Act 1994 (EP Act)*;
- Water licence under the *Water Act 2000 (Water Act)*;
- Riverine Protection Permit under the Water Act;
- Notification of Land – for Notifiable Activities under the EP Act; and
- Permit to Take Protected Plant or Interfere with a Breeding Place under the *Nature Conservation Act 1992*.

7.6 Environmental Context

Many of the potential impacts on the relevant MNES are respective to impacts that may occur on intermediary receptors of the environment e.g. land and water. In order to assess the potential impacts on MNES it is therefore necessary to assess the impacts on these intermediaries first. This following section provides a summarised overview of key aspects of the environmental context that will be relevant to the assessment of potential Project impacts on MNES and are based on desktop and onsite studies. More detailed assessments are located in the following chapters of the Project EIS:

- Chapter 4 – Land;
- Chapter 5 – Terrestrial and Freshwater Ecology;
- Chapter 6 – Marine Ecology;
- Chapter 9 – Water Quality;
- Chapter 10 – Water Resources; and
- Chapter 19 – Coastal Environment.
7.6.1 Land Systems

7.6.1.1 Existing Environment

Geology

The Project bauxite deposits are located within the Carpentaria Basin, a sub-basin of the Great Artesian Basin (GAB). The bauxite occurs on plateaus as the upper part of a Quaternary/Tertiary loose, pisolithic, laterite profile that is up to about 15 m thick. Quaternary alluvial deposits of silt, clay and minor sand occur in the valleys associated with the rivers. The alluvial deposits are derived from Palaeozoic basement rocks that sub-crop in the Eastern Highlands.

The bauxite is formed from weathering and leaching of shales and siltstones of the underlying Tertiary/Cretaceous Bulimba Formation and Lower Cretaceous Rolling Downs Group. This has resulted in a "classic" lateritic profile; an upper bauxite layer which is up to 5 m thick, grades over a narrow interval into ferricretes which in turn grade into mottled and silty clays, including kaolinite, with some sandy clay layers. The clays in turn grade into the parent rock at depth, being generally dark grey Cretaceous shales and siltstones.

The BH1 area is defined as a low-relief bauxite plateau located south of the Skardon River, approximately 10 km from the coast of the Gulf of Carpentaria. It covers an area of approximately 7 km² within MLA 20687. For the most part the plateau is soil covered. Scattered outcrops and float of cemented pisolithic bauxite occur in the central western part of the plateau.

The portions of the BH6 Plateau area held by Metro Mining cover a cumulative area of approximately 8.5 km² within MLA 20688 and MLA 20689. It is located immediately south of the Skardon River, approximately 8 km from the coast of the Gulf of Carpentaria. Much of the plateau is soil covered although there are scattered outcrops and float of cemented pisolithic bauxite and ironstone.

Topography

The Project mining is located on bauxite plateaus that surround the Skardon River. Mine pit areas are proposed across an elevation range of approximately 6 to 16 metres Australian Height Datum. The plateaus are non-undulating and exhibit moderate slopes of approximately 0.6 % (BH1) and 0.3 % (BH6 West). Steeper slopes are encountered along the fringes of the Skardon River.

The BH1 boundary is surrounded to the north and south by tidal zones of the Skardon River and main tributary, respectively. To the east, a ridge rises between these major drainage lines and the land is characterised by tributary gully formations that feed the main channels.

The BH6 West is divided by a ridgeline running parallel to the main tributary of the Skardon River. The western boundary is characterised by a series of swamps, coastal dunes and low lying coastal zones that are tidally influenced. The eastern boundary rises up a ridge that forms the divide between the Skardon River and Namaleta Creek catchments.

Soils

Soil profile description and classification identified the following soils within the Project area:

- Yellow Dermosols: deep gradational mottled yellow soils with nodules associated with the Rolling Downs Group and Laterised Bulimba Formation;

- Intertidal Hydrosols: associated with recent estuarine deposits under mangroves on the coastal margin;
- Othic Tenosols: deep to very deep coloured uniform sands formed in beach ridges on chenier and beach ridge plains;
- Redoxic Hydrosols: deep duplex or Gradational soils with dark loamy surface over mottled grey clays associated with drainage lines and swamps; and
- Red Kandosols: deep gradational or uniform red massive soils with aluminous concretions associated with the Rolling Downs Group and Laterised Bulimba Formation.

**Soil Chemical and Physical Properties**

The soils in the mining areas are considered to be chemically and physically poor, typical of those associated with the woodlands of the bauxite plateau. Soil depth varied significantly across the Project area, with the minimum recorded soil depth being 0.3 m and the maximum 1.2 m.

**Emerson Aggregate Test**

The Emerson aggregate test measures the dispersion potential of soils and has a direct effect on the erosion susceptibility of a soil. Samples from one site presented as Class 6, and another presented one Class 5 sample; however, also presented as Class 4 results from some horizons. Therefore Class 4 is adopted as worst case. Based on the Emerson aggregate test undertaken at the laboratory the soils therefore are considered to only have moderate dispersive tendencies. Soils can be remoulded and will not readily disperse in water.

**Sodicity**

Exchangeable Sodium Percentage (ESP) measures the sodicity of a soil which, along with the Emerson aggregate test, is directly related to a soils’ erosion potential. Sample sites within the Project area varied between non-sodic and strongly sodic with <0.1% to 36.4% ESP as identified by analytical test results. The variation in sodicity across the site is generally reflective of the topography across the site as historical wetting and periodic inundation will increase sodicity levels.

**pH**

Soil pH has a strong influence on the solubility and form of chemical compounds, the availability of ions in the soil solution as well as microbial activity. Soil pH measured from samples collected across the Project area were generally within the optimum pH range for plant growth (between 5.5 and 7.0) with the exception of some sample sites that were within a range of 4.6 to 7.2.

**Electrical Conductivity**

Electrical conductivity (EC) relates to the degree of salinity in the soil. The higher the EC value, the more soluble salt is in the soil. High EC results will generally mean poor root development except for areas where mangroves are the prime vegetative species. The soil salinity results indicated samples that were close to water sources were generally rated with soil salinity of very high and extreme, whereas samples that were terrestrial (the areas where the mining pits are located) were rated very low.

**Cation Exchange Capacity and Exchangeable Cations**

Cation Exchange Capacity (CEC) is a useful indicator of soil fertility as it indicates the soils ability to supply the important plant nutrients Ca, Mg, K, and Na. A low CEC indicates low fertility. The majority of soil samples across the Project area contain CEC levels that are considered to be very low (<6) and low (6 to 12), while a small number of the samples had CEC levels in the moderate range. Lower lying clayey soils taken from sample sites located near water bodies typically exhibited...
higher CECs, whereas tertiary soils with higher silt and sand contents exhibited lower CECs as expected.

**Soil Erosion Susceptibility**

The soil erosion hazards for soil families identified across the Project site are generally high. However, despite the sodic nature of a large portion of the soils, the classification of Emerson Class 4 for those sites within the Project area lowers the risk of dispersion to low to moderate.

**Acid Sulfate Soils**

Soils in the lower lying areas of the Project, outside of the proposed mining footprint, may have small areas disturbed for construction of haul roads, the RoRo and the BLF. These soils are of marine origin and may contain iron sulphides that on exposure to air and water react to produce acid i.e. Acid Sulfate Soils (ASS).

### 7.6.1.2 Landscape Context

The study area is located largely on the Weipa Plateau subregion of the Cape York Peninsula Bioregion and occupies part of the Skardon River catchment draining westward into the Gulf of Carpentaria. A small portion of the Project area lies within Jardine-Pascoes Sandstones subregion. The region experiences a hot climate where the majority of rainfall occurs during a pronounced wet season between November and April (Specht *et al.*, 1977; Godwin, 1985). Mean annual rainfall for the nearest BoM station at Weipa airport is 2,071.8 mm (BoM, 2014).

**Land Zones and Landforms**

The distribution of land zone subdivisions within the study area, includes:

- **Land zone 1** - quaternary estuarine deposits and tidal beaches. Found in all areas subject to tidal influence, and particularly extensive fringing the Skardon River. This land zone is attenuated inland along tidal creeks and forms some extensive flats on areas of infrequent tidal inundation;

- **Land zone 3** - quaternary alluvial deposits. Alluvial landforms are restricted to swampy drainage depressions including those associated with sinkholes, and alluvial sand sheets associated with broad drainage depressions. Swamp habitats are subject to seasonal inundation and are considered palustrine wetlands; and

- **Land zone 5** - remnant tertiary surfaces. Tertiary surfaces cover the aluminous laterite deposits of the Weipa Plateau, and extend eastwards across the erosional surface of the Merluna Plain. Land Zone 5 covers all landforms demonstrating a deeply weathered profile including exposed clay soils on the eroded margins of the Weipa Plateau.

The Project area has a limited diversity of geological features, and as such the array of habitat types is limited. The current mine footprints (BH1 and BH6) comprise only one vegetation community (RE3.5.2 - Darwin Stringybark woodland), and are elevated compared to the surrounding terrain. Areas in the north and west of BH1, and far north, west and east of BH6, slope down towards tributaries of the Skardon River catchment.

Remnant vegetation on the Project area remains contiguous with surrounding vegetation and is extensive in the wider area with over 97% remnant vegetation cover in the Weipa Plateau subregion, and over 98% cover in the adjacent Jardine-Pascoes subregion (EHP, 2012a).
7.6.1.3 Potential Impacts

The Project construction and operation activities will include earthworks for construction, clearing ahead of mining, removal of the bauxite ore, followed by topsoil placement, re-profiling, regrading, stockpiling, and installation of drainage and water storage structures.

Based on the proposed activities, the following potential impacts may result from the Project.

Erosion and Sediment Mobilisation

The clearing of vegetation and other earthmoving activities associated with the construction and operation of the Project has the ability to initiate soil erosion if not done in a controlled manner. Vegetation clearing can potentially release sediments into nearby aquatic systems. Some soils within the Project area have physical and chemical properties that make them more susceptible to erosion. Across the Project site there are some areas with subsoils (B horizons) displaying sodic or dispersive properties. These soil properties increase the potential of erosion following topsoil stripping if not properly managed.

Acid Sulfate Soils

Inappropriately managed ASS can have a substantial impact on the environment including altering pH levels in the local environment beyond baseline conditions, with associated flora and fauna impacts, and shortening the lifespan of built infrastructure due to the corrosion of metals and calcium substitution in concrete. Construction activities that may result in the disturbance and oxidisation of ASS and Potential Acid Sulfate Soils (PASS) are those proposed in the area of the Skardon River, away from the actual mining footprint. Compression of soils during pre-loading activities for haul roads, the RoRo and proposed BLF infrastructure, and placement of fill for haul roads and hard stands may also cause the displacement of ASS and potentially acidify groundwater.

Overburden, Acid Mine Drainage and Non Pollution

Typically bauxite deposits form as a result of a deep weathering and oxidation process. This process often results in the oxidisation of any present sulphide minerals in the subsoil layers. The results of soil analyses from across the site indicate the mining activities take place in areas with a low sulphur content and thereby with negligible Acid Mine Drainage (AMD) risk. Soils with higher sulphur content were located close to drainage lines and under mangroves. Where they occur in the Project footprint, the potential for AMD at these locations is greatly reduced based on the construction activity being undertaken. Haul roads will be built up and will involve minimal excavation and, in areas where excavation is required, it will be restricted to necessary areas only and short-term.

Overburden for the Project is shallow and will comprise material located in the top 300 mm of soil, overlying the bauxite deposits. This material will be set aside for rehabilitation or used as fill for above ground infrastructure works. Although some of this material will be temporarily stockpiled, it has very low acid forming potential. Consequently, there is a very low risk of AMD or heavy metal mobilisation occurring. Due to the shallow depth of the overburden, the risk of acidic water being brought to the surface during the mining of bauxite, causing AMD, is negligible. pH results from samples taken in the mining areas returned pH values of 5.6 or higher which is also consistent with the minimal risk rating.
7.6.1.4 Mitigation Measures

Erosion and Sediment Control

The main land disturbance areas, and therefore the areas identified as the predominant risk for increased erosion and release of sediments for the Project, result from land clearing, open cut mining excavations, mine infrastructure and haul roads and the construction of the BLF and RoRo. Mitigation measures to limit the impacts of land disturbance will include the following:

- As an overriding principal, minimising all land disturbance, including vegetation clearance, to only that immediately required to achieve the mine plan;
- Clearly delineating areas that are required the be disturbed and ensuring that the disturbance is limited to these areas and identifying No Go Zones;
- Where possible, vehicle movements will be restricted to nominated construction and haul roads to minimise ground disturbance;
- Works will be scheduled to minimise the area of active disturbance at any time, in accordance with construction timeframes; and
- Sediment fences or other appropriate erosion and sediment controls will be installed downslope of any disturbed lands. The implementation of effective erosion and sediment control measures will assist in minimising impact on the surrounding environment.

All works are proposed to occur over the dry season to minimise run-off and erosion potential. A Conceptual Erosion and Sediment Control Plan (ESCP) has been developed in accordance with International Erosion Control Association (IECA) Guidelines (see Appendix A3).

Acid Sulfate Soils

Risks associated with encountering and disturbing ASS is restricted to within the recent estuarine deposits associated with the Skardon soil unit located in the intertidal zone of Skardon River and its tributaries. ASS are not expected to occur within the Weipa soil unit where bauxite extraction is proposed.

Where a potential risk of encountering and disturbing ASS has been identified, appropriate management of potentially acid generating soils will be essential in ensuring that there are no adverse impacts to environmental values and Metro Mining infrastructure. Once final construction designs are approved, and final footprints for infrastructure such as the BLF are determined, an additional detailed ASS Assessment will be undertaken prior to construction. The results of the detailed ASS Assessment shall support the preparation of an ASS Management Plan as part of the Project’s Environmental Management Plan, with consideration of specific construction programs and methodologies associated with the Metro Mining infrastructure in accordance with the Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines v4.0 (2014).
7.6.2 Freshwater Resources

7.6.2.1 Rainfall

Rainfall records from the local area provided by the Bureau of Meteorology (BoM) were processed to fill gaps in data and produce a spatially complete dataset. Long term monthly averages of the data is summarised in Figure 7-6.

Some general trends observed from the data includes:

- A distinct wet season between the months December to March with between 200 mm to more than 450 mm monthly average rainfall;
- A distinct dry season between the months April to November with less than 25 mm mean monthly rainfall between the months May through October; and
- High evaporation rates showing an inverse trend to rainfall, reaching a trough in February and peaking in October.

7.6.2.2 Hydrology

The majority of the Project area is located within the Skardon River catchment, which forms approximately 350 km² of the Ducie drainage basin and is bounded by the Ducie River Catchment to the South and the McDonald River catchment to the north (see Figure 7-7). The Skardon River is tidally influenced and discharges to the Gulf of Carpentaria. A network of smaller ephemeral streams drain the upper reaches of the catchment. There are a series of swamps within the catchment; most notable with respect to the Project is Big Footprint Swamp, which is situated approximately 1.5 km west of the main haul road leading to the BLF.
The Project proposed pit locations are situated either side of the Skardon River on elevated bauxite plateaus. Partial pit areas (BH6) and the camp facilities are proposed within the adjoining Namaleta Creek catchment to the south. The barge facilities are proposed on the bank of the southern Skardon River branch.

The shallow groundwater system and its interaction with the mine, surface water and sensitive ecosystems at and within the vicinity of the mining areas are the key focus of this assessment. On this basis, the extent of the hydrogeological study area has been defined as encompassing the two mining areas and key surface water bodies such as Big Footprint Swamp. Where relevant, information from outside of this study area was sought to provide necessary regional context.
Gulf of Carpentaria

Legend
- Town
- Barge Loading Area
- Watercourse
- Mainland
- Pit Extents
- Mine Lease Area
- Ducie Drainage Basin
- Ducie Basin Sub-catchment Area
  - Ducie River
  - McDonald River
  - Skardon River

Figure 7-7 Ducie Basin catchment map - watercourses, drainage features and wetlands
7.6.2.3 Drainage, Waterways and Wetlands

The Project area is located in the Skardon River catchment, or drainage sub-basin, which covers approximately 439 km². While the Skardon River is perennial, many associated watercourses within the Project area are ephemeral and flow only after sustained or intense rainfall. Stream flows are highly variable, with flows typically occurring during the wetter months (November to April), with low to no flow the rest of the year. The Skardon River catchment is part of the broader Skardon River-Cotterell River wetland aggregation, which is listed under the Directory of Important Wetlands of Australia (DIWA). It covers a total area of approximately 632 km², of which approximately 211 km² (or ~33 %) comprise DIWA nationally important wetlands. In total 309 lacustrine/palustrine wetlands have been mapped throughout the aggregation; however, as the majority of the aggregation occurs north of the Skardon River (and hence north of the Project area), so do the majority of DIWA wetlands. The inclusion of this aggregation as a nationally important wetland is based on it being:

- A good example of a wetland type occurring within a biogeographic region in Australia;
- A wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
- A wetland that is important as a habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail; and
- A wetland that supports a diversity of native flora and fauna or communities which are considered endangered or vulnerable at a national level.

Wetlands associated with the Skardon River-Cotterell River aggregation mapping do occur in close proximity to the Project area and MLAs, and overlap some of the infrastructure footprint; however, they do not overlap the mining footprints of BH1 and BH6 (Figure 7-7).

The Port Musgrave Aggregation includes Namaleta Creek and is located to the south of the Project area and is also listed in the DIWA. The Port Musgrave Aggregation consists of the enclosed bay, estuaries and wetlands of the Wenlock and Ducie Rivers, and contains one of the largest known breeding populations of Estuarine Crocodiles (*Crocodylus porosus*) in Queensland.

In the west of MLA 20689 (within which is the BH6 west mining footprint), there are several palustrine wetlands, coastal and sub-coastal floodplains. Big Footprint Swamp is a large wetland area located adjacent to, but outside of, the western boundary of the MLA (Figure 7-7). The swamp is dependent on rainfall, runoff and groundwater recharge. In the dry season it is limited to a remnant, shallow pool and in some years it may dry up completely. An environmental buffer of 100 m has been placed around this wetland and there will be no direct impacts from the Project.

In the east of MLA 20688 (within which is the BH6 east mining footprint) there are estuarine wetlands (mangroves and salt pans) associated with an un-named drainage channel of the Skardon River. A drainage channel of the Skardon River and estuarine wetland system occurs to the west of MLA 20676 (within which is the BH1 mining footprint). While estuarine and palustrine wetlands also occur in the north and south of MLA 20676.

The north-south haul road and BLF overlap the DIWA wetland mapping with the majority of impact being on mangrove communities and fringing vegetation. The east-west haul road (between BH1 and BH6 east) will also cross two tributaries associated with DIWA wetland mapping (Figure 7-13).
7.6.2.4 Groundwater

Hydrostratigraphic Units

Hydrostratigraphic Units (HSUs) are geological components within a hydrogeological system that have similar hydrogeological properties. They are often chosen based on a geological model, but rock type is less important than resistance to flow and storage properties, as these properties ensure that the HSU behaves similarly from a groundwater flow point of view. The HSUs associated with the Project area are as follows:

- **Valley fill sands** - form thin, local aquifers that are readily replenished by rainfall-derived recharge and contain typically very fresh groundwater. Within the study area, the Valley Fill Sands form a narrow and shallow unconfined aquifer along and within the vicinity of the Skardon River and its tributaries;

- **Bauxite** - forms the uppermost HSU within mining areas BH1 and BH6. It is a partial aquifer that becomes locally saturated at the height of the wet season. Bauxite facilitates rapid infiltration during the wet season due to its high permeability;

- **Ironstone** - forms a partial aquifer of up to 10 m in thickness, becoming saturated during the wet season and fully drained during the dry season. A number of creeks and swamps are incised into the ironstone, receiving seasonal discharge of groundwater;

- **Kaolinite clay** - has been suggested that considerable macroporosity exists within the kaolinite clay that facilitates rapid recharge and lateral flow to rivers and creeks that are incised into this HSU and it is hydraulically well connected to the adjoining HSUs. On this basis, the kaolinite clay within the study area has been classified as an aquifer; and

- **Rolling Downs Formation** - comprising of around 500 m of mudstone, claystone and siltstone, is regarded as a regional aquitard forming an effective seal to the underlying Gilbert River Formation (Rio Tinto Alcan, 2013). It defines the effective hydraulic base of the shallow local/intermediate groundwater flow system with reported yields of less than 0.5 L/s. Groundwater is generally brackish to saline.

Within the study area, it is possible to delineate two groundwater flow systems associated with the HSUs described above:

- **Local groundwater flow system** that is represented by groundwater in the upper, unconfined part of the system and its interactions with surface water and potentially sensitive receptors. This system is associated with the valley fill sand, bauxite, ironstone, kaolinite clay and siltstone; and

- **Regional groundwater flow system** that is represented by groundwater at depth within the GAB aquifers, with groundwater flowing from the GAB recharge zone in the northern and eastern portions of the Western Cape region.

As the depth of mining of bauxite is shallow (approximately 3 m, but can be deeper than 6 m), descriptions of hydrogeology focus on the local groundwater flow system associated primarily with the shallow HSUs of the Bulimba Formation. The following information is the result of field sampling of a number of monitoring bores located across the site.
Great Artesian Basin Aquifer

The sandstone of the Gilbert River Formation forms a confined aquifer of the GAB, a regional groundwater flow system. At the western coastal margins, groundwater is under artesian conditions. It is locally unconfined in the eastern portion of the Western Cape region (the GAB intake beds on the eastern edge of the Carpentaria Basin) where it receives recharge and provides baseflow to several major rivers.

The sandstone of the Gilbert River Formation is the most extensive unit in the Carpentaria Basin (Radke et al., 2012) and is considered an excellent aquifer, providing the main groundwater resource in the region (CSIRO, 2009). Groundwater quality ranges from fresh in the unconfined outcropping areas to brackish where the aquifer is confined.

Recharge

Due to a combination of high rainfall, and high permeability of surficial bauxite the infiltration rates are high with minimal surface run-off even after high rainfall events. The mean annual runoff in the Western Cape region is estimated to be around 34% of rainfall (CSIRO, 2009) and rainfall-runoff modelling at the Project estimates mean runoff to be approximately 20% of rainfall (CDM Smith, 2015).

The groundwater level fluctuates in cycles, corresponding to wet and dry seasons, with the timing of rises in groundwater level matching closely with the onset of the wet season indicating rapid recharge i.e. the water table within the shallow aquifers rises and falls without significant lag indicating direct rainfall infiltration. The magnitude of seasonal variations in groundwater level is greater up gradient of the Skardon River i.e. the groundwater level varies the further away from the main body of the river. Modelling of the range of recharge rates suggests that close to one third of rainwater contributes to recharge during the wet season whilst the remainder is lost by runoff, plant interception and evapotranspiration.

Discharge Mechanisms

Groundwater discharges to the Skardon River and associated tributaries throughout the year, providing baseflow that helps maintain surface water flow. As the water table rises during the wet season, temporal discharge of groundwater occurs in other locations where the water table intersects the ground surface (e.g. at Big Footprint Swamp).

In local depressions and at Big Footprint Swamp, discharge of groundwater is sustained for a longer period until the water table drops below the ground surface. The dry season groundwater level at a local bore is approximately 2.5 m below the elevation of Big Footprint Swamp, indicating that the water table naturally becomes disconnected from the swamp during the dry season. No perennial springs with sustained groundwater seepage have been identified within BH1 and BH6 (WorleyParsons, 2011).

7.6.2.5 Surface Water – Groundwater Interaction

The Skardon River is a perennial river with flow all year round. Groundwater within the shallow aquifers drains towards the river and its tributaries, providing baseflow that helps to maintain the flow during the dry season (CSIRO, 2009). This is shown by the steady decline in the water table during the dry season and groundwater flow directions interpreted from the groundwater level contours (refer Chapter 10 –Water Resources). As the water table occurs within the kaolinite clay and siltstone HSUs during the dry season, groundwater from these HSUs maintains the dry season flow of the Skardon River.
Stream flow in rivers of the Western Cape region tends to exhibit a lagged response to rainfall with surface water flow typically increasing in mid-January, reaching peak flow in March. This coincides with the timing of rainfall-derived recharge and observed seasonal fluctuations in the water table. A stream flow analysis by Crees and Volker (1992a) showed that the first 600 mm of rainfall in the wet season produces negligible stream flow, consistent with the interpretation that much of the initial rainfall is taken up by the wetting of the unsaturated zone.

### 7.6.2.6 Groundwater Dependent Ecosystems

The National Atlas of GDEs (BoM, 2012) presents the current knowledge of ecosystems that may depend on groundwater across Australia. A search of the Atlas has revealed a number of areas where ecosystems potentially have some reliance on groundwater, rated from low to high potential for groundwater interaction. These areas are shown in Figure 7-8 and include the following ecosystem types:

- Coastal/sub coastal non-floodplain grass, sedge and herb swamps;
- Coastal/sub coastal floodplain tree swamps (Melaleuca and Eucalypt); and
- Riverine/riparian.

Based on the review of site specific data and available information, the potential groundwater dependent areas presented in Table 7-5 have been identified within the study area. These areas are potentially sensitive to changes in the hydrogeological regimes.

**Table 7-5 Potential groundwater dependent areas**

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skardon River, tributaries and its riparian zone</td>
<td>• Perennial river receiving groundwater discharge (baseflow);</td>
</tr>
<tr>
<td></td>
<td>• Aquatic ecosystems are likely to be seasonally dependent on discharge of</td>
</tr>
<tr>
<td></td>
<td>groundwater that maintains flow during the dry season (Type 2); and</td>
</tr>
<tr>
<td></td>
<td>• Vegetation within the riparian zone is supported by rainfall and surface</td>
</tr>
<tr>
<td></td>
<td>flows as well as groundwater, either via surface expression (Type 2),</td>
</tr>
<tr>
<td></td>
<td>particularly during the wet season, or proximity of the water table to</td>
</tr>
<tr>
<td></td>
<td>the plant root zone (Type 3) e.g. groundwater from the alluvial aquifers</td>
</tr>
<tr>
<td></td>
<td>(Valley Fill Deposits).</td>
</tr>
<tr>
<td>Big Footprint Swamp</td>
<td>• A freshwater swamp located near the northwest boundary of BH6;</td>
</tr>
<tr>
<td></td>
<td>• Registered in the Queensland Directory of Important Wetlands;</td>
</tr>
<tr>
<td></td>
<td>• Apart from supporting aquatic life, the swamp is also important for</td>
</tr>
<tr>
<td></td>
<td>migratory birds (SRK, 2014b);</td>
</tr>
<tr>
<td></td>
<td>• Coastal/sub coastal floodplain tree swamps (Melaleuca and Eucalypt); and</td>
</tr>
<tr>
<td></td>
<td>• High potential to rely on surface expression of groundwater.</td>
</tr>
<tr>
<td>Lunette Creek</td>
<td>• North to south trending drainage line to the west of Big Footprint Swamp;</td>
</tr>
<tr>
<td></td>
<td>• Discharge of groundwater along the drainage line occurs during the wet</td>
</tr>
<tr>
<td></td>
<td>season; and</td>
</tr>
<tr>
<td></td>
<td>• High potential to rely on surface expression of groundwater.</td>
</tr>
<tr>
<td>Lunette Swamp</td>
<td>• Adjacent to the southern boundary of BH6;</td>
</tr>
<tr>
<td></td>
<td>• Discharge of groundwater is possible, at least temporarily, as the water</td>
</tr>
<tr>
<td></td>
<td>table rises during the wet season; and</td>
</tr>
<tr>
<td></td>
<td>• Moderate potential for groundwater interaction.</td>
</tr>
<tr>
<td>Namaleta Creek and the riparian zone</td>
<td>• South of Lunette Swamp and BH6;</td>
</tr>
<tr>
<td></td>
<td>• Relies on surface expression of groundwater (Type 2); and</td>
</tr>
<tr>
<td></td>
<td>• High potential for groundwater interaction at low lying wetland along the</td>
</tr>
<tr>
<td></td>
<td>east-west trending portion of the creek.</td>
</tr>
</tbody>
</table>

Terrestrial vegetation experiences seasonal variations in root zone moisture content. At the onset of the wet season, infiltration and surface water inundation replenishes the soil moisture. As the water table rises, it reaches the root zone and, in some places, the ground surface providing a source of water to surface and subsurface GDEs temporarily. As the water table declines soil water left within the unsaturated zone is likely to be accessed by terrestrial vegetation.
7.6.2.7 Potential Impacts - Surface Water

There are no major stream diversions, regulated dams or regulated structures associated with the Project. For this reason the surface water flow patterns remain largely unaltered, with the exception of local catchment runoff diversions around some active pit areas.

The potential impacts to surface water resources include:

- Reduction in surface water runoff and increase in baseflow as a result of mine pit excavation;
- Alteration of existing drainage flow lines as a result of pit excavation, local catchment diversion and haul road construction;
- Reduction of surface runoff to Big Footprint Swamp, Skardon River and Namaleta Creek noting that groundwater discharges are predicted to increase;
- Sediment transport to receiving waters from runoff generated from the network of haul roads, active mine areas, and overburden and product stockpiles; and
- Contamination of clean water runoff by entering active mine areas, therefore increasing the volume of water required for treatment.

The greatest cumulative surface water impact associated with the joint development of the Project and Gulf Alumina’s SRBP arises from development within the Big Footprint Swamp catchment.

7.6.2.8 Potential Impacts - Groundwater

Mining will result in clearing of vegetation and the post-mining surface will be 1.5 to 2 m lower than the pre-mining surface (see Chapter 10 – Water Resources and Appendix E1 – Groundwater Technical Report). These landscape changes have the potential to affect the groundwater quantity in the following ways:

- Increased discharge and pool level in Big Footprint Swamp;
- Altered connectivity of Big Footprint Swamp to groundwater;
- Increased discharge to Skardon River tributaries and estuary; and
- Reversal in flow direction and local ingress of higher salinity water.

7.6.2.9 Management and Mitigation

Mining of bauxite is predicted to temporarily increase the volume of groundwater discharged to Big Footprint Swamp during the life of mine and, to a lesser extent, after rehabilitation. This has the potential to increase the inundation pool level by small amounts, which is considered unlikely to impact GDEs associated with the swamp. Similarly, relatively small additional volumes of water of the same quality discharged to the Skardon River and tributaries during mining are not expected to adversely affect the health of the ecosystems that already depend on seasonal discharge of groundwater.

Ongoing monitoring and analysis will refine the understanding of the hydrogeological regime of Big Footprint Swamp and the Skardon River and the sensitivity of the associated ecosystems to small variations in pool levels/groundwater discharge rates. If the outcome of further monitoring and investigation identifies unacceptable risks, direct intervention, such as redirection of excess water,
may become necessary i.e. minimise the extent of the dry season inundation zone to facilitate aeration of the root zone and maintain the existing extent of *Melaleuca* trees.

**Groundwater Monitoring and Management Plan**

The implementation of a Groundwater Monitoring and Management Plan (GMMP) as part of the EMP and collection of additional data, will ensure an ongoing refinement of the understanding of the recharge dynamics during the course of mining. The GMMP will outline a groundwater monitoring program, including details of management and mitigation of unacceptable groundwater related risks of the Project. The GMMP will consider the final mine operation schedule which, together with the findings of the impact assessment, will be used to confirm the monitoring requirements and the need to refine the existing monitoring network where relevant. This will be a dynamic plan that will be updated based on the monitoring results.

**Surface Water Management**

The period of mining within the Big Footprint Swamp catchment is restricted to three years (2025, 2026 and 2027), after which time the pits will be rehabilitated and the catchment diversions removed to restore the existing flow paths as far as is practicable. Diverting clean water runoff around mine pit areas within the Big Footprint Swamp would not significantly increase the surface runoff entering the swamp, but could increase the baseflow seeping through the pit walls, potentially recharging Big Footprint Swamp and sustaining dependent ecosystems.

**Flood Modelling**

Hydrodynamic modelling has been undertaken for the Project as detailed in the Surface Water technical report (Appendix E2), with results showing that the proposed pit locations are not at risk from riverine flooding, even under the Probable Maximum PMF event. This is largely because the pits are generally situated on the bauxite plateaus with buffer distances between the pit shell and watercourse boundaries. Construction of the pits is not likely to interfere with the current floodplain processes, and will therefore cause no significant hydraulic impacts to the river in terms of changes to flows, water levels, or velocities. The main impact of riverine flooding is potentially to the haul road crossings.
Mine Water Management

A schematic of the proposed water management network for the Project is shown in Figure 7-9.

Figure 7-9 Proposed water management network

Stormwater Management

All stormwater runoff capturing devices, namely sediment ponds and drainage sumps, will be sized based on the 10 year Average Recurrence Interval (ARI), 24 hour rainfall event in accordance EHP’s Stormwater Guideline (2014);

Runoff from the network of haul roads will be captured in table drains and turned out to vegetated areas via spoon drains at regular intervals. Where haul roads cross watercourses either a culvert or causeway arrangement will be provided.

Mine pit areas are generally located on plateaus and thus are naturally inward draining. Due to the depth of the mine pits and fast infiltration rates through the bauxite layer, the mine pit areas act as a self-draining sediment trap for runoff from disturbed mine areas. Water quality impacts and management measures are discussed in further detail in Chapter 9 – Water Quality.
7.6.3 Marine Systems

The Gulf of Carpentaria is a large and relatively shallow body of water which is enclosed on three sides by the Australian mainland and bounded on the north by the Arafura Sea. The Gulf of Carpentaria can be subject to seasonal fluctuations in sea level (up to 0.5 m) as a result of trade winds (e.g. during the monsoon) and forcing from the Arafura Sea (Wolanski, 1993). These seasonal sea level fluctuations can result in large areas being inundated by tides in the summer months (during the monsoon).

The Skardon River and adjacent inshore and off-shore areas encompass several marine habitats, including: extensive tracts of saltmarsh and mangroves, small patches of seagrass, estuarine rock and oyster reefs, offshore coral reef and broad areas of intertidal and sub tidal soft substrates that are either bare or variably colonized by macroinvertebrates and macroalgal communities.

Ryan et al., (2003), describes Skardon River as a tidal creek as it has a low freshwater input with low-gradient and seaward-sloping coastal flats. The mudflats which surround the creeks tend to be high relative to the tidal planes, with seawater being mainly confined to the tidal channels except during high tide on spring tides. Tidal creeks are usually highly turbid due to the strong tidal currents generated by the macro-tidal ranges allowing fine sediments to remain in suspension during spring tides. The tidal action results in the transport of sediment into the estuary, where the sheltered conditions eventually allow the coarser sediment fractions to settle. The currents within the creek will be influenced by the channel depth and orientation along with the difference in tidal range through the creek.

The configuration of the Skardon River ranges from a relatively narrow 300 m width at the river entrance, quickly expanding to approximately 1 km upstream. The site of the BLF is located approximately 10 km upstream of the mouth of the river and off the main arm of the river and width is approximately 350 m at this point.

The mangrove vegetation of the Skardon River is in good condition, with little evidence of disturbance and a well distributed range of life stages from juveniles to flowering adults. Historical clearing of a thin mangrove fringe has been undertaken at the nearby existing Skardon River barge ramp. Isolated minor impacts from feral pigs and cattle was also been observed over the saltpan, saltmarsh and landward fringe of the mangrove community within the study area. A community of fringing mangrove habitat exists along the shores of the Skardon River, extending from just inside the mouth to the upper estuary/freshwater interface. The Long-styled Stilt Mangrove (*Rhizophora stylosa*) dominates the mangrove community fringing the waterways of the Skardon River. Northern Grey Mangrove (*Avicennia marina* ssp. *eucalyptifolia*) and Yellow Mangrove communities are commonly established behind the mangrove fringe, nearest the saltpan/saltmarsh. Saltpan and fringing saltmarsh habitats are present throughout the Skardon River system. These habitats exist as a fringe between the dominant open woodland and *Melaleuca* vegetation and mangrove habitats. The distribution of mangrove and saltpan habitat is presented within in Figure 7-10.

7.6.3.1 Bathymetry

Due to the narrow entrance of the Skardon River combined with the complex and relatively shallow bathymetry of the ebb tidal delta and the offshore channel, swell waves are not expected to propagate inside the Skardon River. The area upstream of the entrance will therefore only be influenced by locally generated wind waves.

The dominant wind direction does not align with the estuaries main axis. This feature combined with the river configuration causes the locally generated wind waves to be small and have a short
wave period. Based on this, along with the dominance of tidal currents within the river, wind generated waves in the estuary are not considered to be a significant process.

The bathymetry of the main channel in Skardon River along with areas of indicative bed forms are shown in Figure 7-11 and the results of the 2015 bathymetry survey are detailed in Appendix J. The highest tidal current speeds in an estuary tend to occur close to the entrance. Due to the configuration of the Skardon River, the peak speeds are expected to occur at the constriction of the entrance where a flatbed occurs. The flatbed indicates that the flow velocity exceeds the speed at which ripples and mega ripples form, with peak current speeds potentially exceeding 1 m/s. Offshore of the entrance, mega ripples and sand waves occur in the main channel where current speeds remain high due to the constrained channel focusing the flow.

7.6.3.2 Benthic Habitats

Seagrass

Several surveys for the distribution and abundance of seagrass and associated benthic habitats have been undertaken within the Skardon River since 1986 (Table 7-6). The present known distribution of seagrass habitats within the Skardon River is presented within Figure 7-10.

Table 7-6 Benthic habitat surveys undertaken from the Skardon River (1986-2015)

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coles et al.,</td>
<td>1986</td>
<td>Entrance</td>
</tr>
<tr>
<td>Roelofs et al.,</td>
<td>2002</td>
<td>Whole river dry season</td>
</tr>
<tr>
<td>Roelofs et al.,</td>
<td>2003</td>
<td>Whole river wet season</td>
</tr>
<tr>
<td>Rasheed et al.,</td>
<td>2007</td>
<td>Whole river</td>
</tr>
<tr>
<td>Chartrand and Thomas</td>
<td>2010</td>
<td>Entrance</td>
</tr>
<tr>
<td>PaCE</td>
<td>2014</td>
<td>Metro Mining BLF and RoRo</td>
</tr>
<tr>
<td>PaCE</td>
<td>2015</td>
<td>Downstream of the BLF to the Skardon River entrance</td>
</tr>
</tbody>
</table>

Initial surveys by Coles et al., (1986) identified two isolated patches of seagrass near the Skardon River estuary entrance. Further baseline investigations were undertaken during 2002 (wet season) and 2003 (dry season) (Roelofs et al., 2004). Seagrasses were recorded within a tributary of the main river channel during both these events - Narrowleaf Seagrass (Halodule uninervis). Another species, Paddle Grass (Halophila dicepiens), was reported only during the dry season (2003) survey. This included three small meadows located within 500 m of the existing barge ramp at the then kaolin processing area. Subsequent surveys were undertaken in 2006 adjacent to the barge ramp facility (Rasheed et al., 2007). These surveys extended the distribution of seagrass nearer to the existing BLF, adding another small meadow which fringed the mangrove banks upstream to the extent of the port limits. Distribution of Narrowleaf Seagrass was also extended, reporting a low density meadow adjacent to the BLF.

Rasheed et al., (2007) described that seagrass distribution during 2006 (approximately 9.1 ha) was double that of the previous surveys in 2003 (approximately 4.4 ha). The variability in the distribution of these meadows is not unusual (Rasheed et al., 2007). Paddle Grass is a colonising species that can rapidly form meadows in the right conditions (i.e. lower rainfall, and greater benthic irradiance) (Rasheed et al., 2006).

During 2010, a detailed survey encompassing the then proposed barge access area was undertaken through the Skardon River entrance (Chartrand and Thomas, 2010). A Narrowleaf Seagrass meadow recorded earlier by Coles et al., (1986) was identified during this survey covering an area of approximately 1 ha. Although a total of 230 seagrass habitat characterisation sites were surveyed within the river entrance and surrounds, no additional seagrass communities were identified.
(Chartrand and Thomas, 2010). The majority of the survey locations within the entrance reported open substrate, sand or sand and shell.

During the 2014 surveys, nine small paddle grass meadows were located in thin (<5 to 10 m) patchy bands adjacent to the mangrove banks upstream of the existing BLF (PaCE, 2014). These extended up to and immediately beyond the proposed BLF. The seagrass meadows encountered during the surveys of areas upstream, the proposed jetty location and downstream in the vicinity of the existing SRBP jetty averaged 19.9 % cover, ranging between 0.5 and 57.8 % cover. The bed forms of the area were dominated by silty sands rather than silts and clays. Typical marine muds were located on the intertidal banks and within the fringing mangroves.

Deeper locations, central to the channel, did not appear to provide suitable conditions for seagrass colonisation. This follows the findings of previous investigations in the area (Rasheed et al., 2007) where seagrasses occurred nearest to the river banks where light conditions remain favourable. The proposed jetty is located within a deeper area of the river to optimise operations, but also to avoid potential seagrass meadows. The alignment of the conveyor infrastructure may potentially cross seagrass habitat.
Figure 7-10  
Skardon River seagrass habitats

**Legend**  
- Barge Loading Area  
- Haul Road  
- Metro Mining Mine Lease Area  
- Saltpans  
- Mangrove  
- Seagrass Mapping
  - DPI Seagrass 1986 and 2010  
  - DPI Seagrass 2003  
  - DPI 2006 Meadow  
  - PaCE 2014 Meadow

**Seagrass Mapping**
- DPI Seagrass 1986 and 2010  
- DPI Seagrass 2003  
- DPI 2006 Meadow  
- PaCE 2014 Meadow

**DISCLAIMER**
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

**DATA SOURCE**
- MEC Mining:  
- QLD Government Open-Source Data:  
- Australian Hydrological Geospatial Fabric (Geofabric) PRODUCT SUITE V2.1.1
Figure 7.11

Bathymetry of Skardon River (September 2009) with bed features noted
Nearshore rocky reef habitat containing significant coral and soft coral cover has been identified approximately 5 to 7 km southwest of the entrance to the Skardon River. These habitats provide substantial resources for turtles and other marine species of conservation significance. The extent of this habitat has not been fully defined. Given its shallow depths and risk of grounding, operational activities are not proposed within this near shore zone. It is anticipated that impacts to this habitat will be negligible; however, care would be taken to minimise interaction during vessel transit.

**Sub Tidal Habitats**

The majority of sub tidal benthic habitats within the Skardon River estuary are dominated by open bare substrates of silt, silty/sand, sand and rock (approximately 77%). Only a very limited live benthic cover has been recorded within the Skardon River. Of the live cover recorded, macroalgae was dominant (17%). Macroinvertebrates were greatest within rocky shoals and rubble fields which provide stable substrate for colonisation. These habitats include a range of macroinvertebrates dominated by sponges and ascidians, and brown macroalgae. Several intertidal areas of oyster rock/reef have been identified adjacent to mangrove banks.

The proposed anchorage areas were surveyed using video techniques. Benthic habitat within the preferred anchorage area was dominated by bare coarse shell and sandy substrates (96%). A sparse cover (of sea whips, sponges, gorgonian fans, ascidians and hard corals (Turbinaria spp.) were identified within the northern most anchorage. These biota appear to have created a scattered low profile sponge, soft coral and minor hard coral reef (profile <0.5 m), observed from two of the five survey locations. In addition to the benthic video locations, side scan sonar transects identified a single patch of benthic structure within the footprint of around 0.5 ha (potentially rock or mixed reef as identified in the video imagery).

The benthic habitats within the remaining anchorage areas presented reduced benthic cover compared to the preferred option. This included scattered macroalgae and macroinvertebrates such as sea whips, sponges, ascidians and mobile epifauna, including feather stars and starfish. Side scan transects identified a small patch of potential rocky reef (0.15 ha) which was not observed within the video locations.

**Intertidal Habitats**

Intertidal habitats surrounding the entrance to the Skardon River are dominated by sand beaches, exposed to prevailing wind and waves from the Gulf of Carpentaria. As the shoreline progresses into the estuary and river system, silty sands and muds begin to dominate the intertidal substrate. This is accompanied by an increasing mangrove habitat, and decline in exposed sandy shores, ironstone banks and Casuarina sp. habitat. The distribution of intertidal mud and sand banks at the entrance and inner estuary system is quite extensive; however, as the river progresses upstream the width of the primary waterway narrows. The edge of the banks become steeper, particularly on the outer bank curves, favoring the establishment of mangroves such as the Rhizophora sp. Further upstream within the small tributaries, the channels may dry completely or almost completely at low tide. These intertidal habitats are predominately bare mud and silty/sand with the presence of some isolated patches of filamentous algae and oyster beds having been recorded (Roleofs et al., 2002 and PaCE, 2015).
Reef Habitats

Two additional offshore locations were surveyed using underwater video and side scan transects. These were selected based on elevations mapped within the existing bathymetry charts for the study area. Both locations contained rock/reef substrate as identified from side scan sonar transects. The nearest of these locations to the Skardon River mouth (approximately 5 to 7 km southwest) presented a high cover of hard corals (37%), associated soft corals and benthic macroinvertebrates (6%). Biota was encrusting over an underlying rocky reef, interspersed by coarse sand patches, shell and soft corals, ascidians and other non-encrusting biota. The extent of the rocky reef habitat at this location was estimated by reviewing side scan sonar imagery. The complex extended over 600 m in length and 300 m in width resulting in approximately 18 ha of potential rocky reef habitat. The edges of the feature were not fully identified and there is potential for this habitat area to be greater than this estimate. While the Project activities will not operate within or near this feature, care would be taken to ensure that supply vessels and general shipping accessing the Project remain clear of this habitat.

7.7 MNES Assessment Methods

MNES were assessed using a combination of desktop assessment methodologies and field surveys. The desktop assessment reviewed existing ecological information pertaining to the Project area, including the Bauxite Hills mine and port area. Seasonal surveys for flora and fauna were subsequently carried out to obtain current ecological information relevant to the Project area and to ground-truth the desktop assessment results.

7.7.1 Terrestrial and Freshwater Ecology

7.7.1.1 Desktop Assessment

Desktop studies were undertaken prior to field assessments. The desktop reviews were used to obtain background information relating to the potential presence and distribution of species and ecological communities, including those listed under the EPBC Act and others listed under State legislation. The desktop review sourced information from:

- The Commonwealth EPBC Act Protected Matters Search Tool (25 km radius around a central point of the mine area – accessed 30/10/14 and updated February 2016);
- EHP Wildlife Online flora and fauna species database (25 km radius around the centre of the mine area) and Species Profile Search results – accessed 30/10/2014;
- Queensland Museum’s Zoology database;
- Birdlife Australia’s New Atlas database;
- Current Queensland RE mapping, essential habitat mapping for threatened flora and fauna species and sensitive area mapping from the Department of Natural Resources and Mines (DNRM);
- Wetland mapping to determine the classification, extent and significance of referable wetlands within the Project area (EHP); Aquatic conservation assessments for the riverine and non-riverine wetlands of Cape York catchments (EHP 2012b, 2012c); and
Additional reports with direct relevance to marine matters associated with the Project area include:

- Port of Skardon River: Marine habitat resources survey April/May 2002 (Roelofs et al., Marine Ecology Group, QFS, Northern Fisheries Centre, Cairns, 2002);
- Port of Skardon River: Marine Habitat Resources Survey, September 2003 (Roeloffs et al., Marine Ecology Group, QFS, Northern Fisheries Centre, Cairns, 2004);
- Port of Skardon River: Marine Habitat Resources Survey, December 2006 (Rasheed et al., Marine Ecology Group, QFS, Northern Fisheries Centre, Cairns, 2007);
- Benthic marine habitat of the Skardon River mouth, May 2010 (Chartrand and Thomas, Marine Ecology Group, QFS, Northern Fisheries Centre, Cairns, 2010);
- Skardon River Bauxite Project Marine Ecological Survey, November 2014 (RPS, 2014); and
- Reporting with regard to marine fauna for nearby Environmental Impact Statements for the Pisolite Hills Project (Port Musgrave area) and the Amrun (South of Embley) Project (Weipa area).

Desktop database search results are presented within the appendices of the technical reports in Appendix B1, B2 and B3.

### 7.7.1.2 Field Surveys

#### Terrestrial Surveys

A number of ecological field surveys were undertaken for the Project to ground-truth desktop information and identify any additional flora and fauna values not identified through the desktop study. Field surveys for the terrestrial fauna studies were led by Mark Sanders (dry season) and Richard Floyd (wet season) and terrestrial flora studies were led by David Fell, on behalf of Amec Foster Wheeler. Field surveys comprised:

- Detailed late dry season flora, fauna and aquatic ecology survey between 4 to 11 November 2014 by Amec Foster Wheeler; and
- Detailed early wet season flora, fauna and aquatic ecology survey from 31 January to 6 February 2015 by Amec Foster Wheeler.

Surveys were designed to encapsulate seasonal variation in species’ detectability, and survey sites were selected in representative locations in the key vegetation communities and habitat types present. Strong, hot, and humid east to east south east winds between 20 and 30 km/hr were observed during the late dry season surveys, along with a moderate downpour from a localised thunderstorm encountered during the afternoon of 6 November; however, this was not considered a significant rainfall event. Hot and humid conditions were experienced during both survey periods, with daily temperatures in excess of 35°C.

Extensive and concurrent surveys for the adjacent SRBP assist with the local ecological understanding for this area. Where considered appropriate information from these surveys has been referred to in this chapter. Flora and fauna survey species lists are presented in Appendix B1 – Terrestrial Ecology Technical Report.
**Flora Survey Methodology**

Field surveys were conducted over six days in November 2014, and six days in January/February 2015. The primary objective of these surveys was to identify and describe vegetation communities and terrestrial flora values, and ground-verify DNRM RE mapping for the Project area. Surveys were carried out in accordance with the Queensland Herbarium's Methodology for the Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Neldner et al., 2012).

Survey sites were selected based on certified DNRM RE mapping and available aerial imagery. Mapping was reviewed, and locations of threatened flora sourced from targeted searches of relevant databases. When considered in the context of the supplemental SRBP terrestrial flora surveys (that were conducted in late April 2010, late June 2010, late April 2011 and February 2015), broad coverage across the seasons and vegetation communities has been collectively achieved within the area. Full details of the SRBP surveys are provided in Appendix B1.

Baseline field data on vegetation structure and floristics was recorded in a format consistent with Queensland Herbarium quaternary and secondary site level intensity (Neldner et al., 2012). Information on landform, geology, and vegetation structure were recorded together with species lists and abundance of vascular flora species. Incidental flora observations recorded during field traverses complemented the formal survey sites. Flora species unable to be identified in the field were collected and pressed on site for subsequent identification in the laboratory with assistance from the Queensland Herbarium where adequate material could be collected.

The vegetation surveys also focussed toward confirming the presence/absence of listed flora species through observational assessments and targeted searches within key habitat types identified through desktop searches.

**Secondary Assessments**

Secondary assessments involve sampling plots of at least 50 m by 10 m in size, within each defined vegetation community. This methodology was; however, subject to the size of the vegetation community, with additional sites surveyed in vegetation communities covering large areas, and a reduction in the number of sites surveyed in small communities. A total of eight secondary sites were carried out over the two site surveys (Figure 7-12).

**Quaternary Assessments**

Quaternary site assessments were used to rapidly assess REs and vegetation communities, using linear transects. Data were collected at regular intervals along each transect and where REs and vegetation communities change in structure and composition. Eighty-three quaternary sites were assessed in the dry season survey period and a further twenty-nine sites were assessed during the wet-season survey period (Figure 7-12).

**Biocondition Assessments**

BioCondition assessment involves a rapid assessment of vegetation condition at the property scale for different REs. It is a site-based, quantitative procedure that provides a score from ‘functional’ through to ‘dysfunctional’ condition from a biodiversity perspective (Eyre et al., 2011), and is used for comparative purposes when assessing potential properties for offsetting purposes. The score is based on a comparison between measured site-specific attributes, and benchmark values for each of those attributes, specific to a particular RE. No bioregion specific BioCondition benchmark data was available and therefore scoring was not possible. However, the BioCondition assessment was
used to quantitatively assess key vegetative attributes. A total of eight BioCondition sites were assessed during the ‘wet season’ survey. These sites are not discussed further in this document, but are provided for reference in the Terrestrial Ecology Technical Report (Appendix B1).

**Field Data Analysis**

Ground-truthed data along with contemporary aerial imagery were used to determine:

- Presence/absence of Threatened Ecological Communities (TECs);
- Known or potential habitat for listed species (NC Act and EPBC Act);
- Accuracy of RE mapping (VM Act); and
- Potential presence of pest flora species (LP Act).
Fauna Survey Methodology

A detailed dry season fauna assessment of the mine area was carried out over six days between 4 and 11 November 2014. A wet season assessment, was carried out over five days between 31 January and 6 February 2015. In total eight trapping sites were established over the two survey periods.

Trapping sites were selected based on RE mapping, the Project impact footprint and the integrity of the habitat to support local fauna species. Seven trapping sites were established including Elliott, pitfall and funnel trap arrays. Trapping was carried out over three nights at each site. Observational assessments (including habitat searches), microbat recording, harp trapping and camera traps were carried out at several additional sites within the Study area. Locations of survey sites are depicted in Figure 7-13 and descriptions of the trapping sites are provided in Table 7-7. Further details of survey methodology techniques are provided in Table 7-8.

In total 15 survey locations across the Project area have been surveyed using a combination of survey techniques to provide adequate spatial coverage across the representative REs and the wider Project area. This included eight trapping locations, two separate locations for harp traps and anabat, and five observation sites which were selected outside of the dominant REs, based on presence of preferred habitats for targeted fauna species.

Although the fauna assessment program is considered robust, CDM Smith have adopted a conservative approach when considering conservation significant fauna species within the impact assessment for this Project. As such, all species with the potential to occur in the Project area have been assumed to be present unless evidence exists to suggest absence.

Table 7-7 Fauna survey site locations and dominant vegetation

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Vegetation Community</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trap sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR01</td>
<td>-11.817518</td>
<td>142.044447</td>
<td>Eucalyptus tetrodonta and Corymbia nesophila tall woodland on deeply weathered plateaus and remnants – RE 3.5.2.</td>
</tr>
<tr>
<td>TR02</td>
<td>-11.835055</td>
<td>142.052516</td>
<td></td>
</tr>
<tr>
<td>TR03</td>
<td>-11.860237</td>
<td>142.032273</td>
<td></td>
</tr>
<tr>
<td>TR04</td>
<td>-11.797384</td>
<td>142.087641</td>
<td></td>
</tr>
<tr>
<td>TR05</td>
<td>-11.803296</td>
<td>142.087132</td>
<td></td>
</tr>
<tr>
<td>TR06</td>
<td>-11.797275</td>
<td>142.100672</td>
<td></td>
</tr>
<tr>
<td>TR07</td>
<td>-11.797164</td>
<td>142.122321</td>
<td></td>
</tr>
<tr>
<td>Camp</td>
<td>-11.850118</td>
<td>142.037398</td>
<td></td>
</tr>
<tr>
<td><strong>Observational sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBS01</td>
<td>-11.801292</td>
<td>142.047161</td>
<td>E. tetrodonta and C. nesophila tall woodland on deeply weathered plateaus and remnants – RE 3.5.2.</td>
</tr>
<tr>
<td>OBS02</td>
<td>-11.757861</td>
<td>142.071177</td>
<td>Closed forest of Rhizophora stylosa ± Bruguiera gymnorrhiza. Occurs as outer mangroves/Ceriops tagal ± Avicennia marina low closed forest on intertidal areas – RE 3.1.1/3.1.3.</td>
</tr>
<tr>
<td>OBS03</td>
<td>-11.821375</td>
<td>142.05872</td>
<td>E. tetrodonta and C. nesophila tall woodland on deeply weathered plateaus and remnants – RE 3.5.2.</td>
</tr>
<tr>
<td>OBS04</td>
<td>-11.795721</td>
<td>142.036032</td>
<td>Sedgeland of Eleocharis sp. with scattered freshwater couch – RE 3.3.65.</td>
</tr>
<tr>
<td>OBS05</td>
<td>-11.816402</td>
<td>142.063685</td>
<td>Sparse herbland or bare saltpans. Associated with salt plains and saline flats – RE 3.1.6.</td>
</tr>
<tr>
<td><strong>Camera traps</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM01</td>
<td>-11.817193</td>
<td>142.044235</td>
<td>E. tetrodonta and C. nesophila tall woodland on deeply weathered plateaus and remnants – RE 3.5.2.</td>
</tr>
<tr>
<td>CAM02</td>
<td>-11.83485</td>
<td>142.052533</td>
<td></td>
</tr>
<tr>
<td>CAM03</td>
<td>-11.860706</td>
<td>142.032188</td>
<td></td>
</tr>
<tr>
<td>CAM04</td>
<td>-11.801198</td>
<td>142.047125</td>
<td></td>
</tr>
<tr>
<td>CAM05</td>
<td>-11.797643</td>
<td>142.087025</td>
<td></td>
</tr>
<tr>
<td>CAM06</td>
<td>-11.797549</td>
<td>142.100758</td>
<td></td>
</tr>
</tbody>
</table>
### Bauxite Hills Project ● Matters of National Environmental Significance

#### Site Table

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Vegetation Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM07</td>
<td>-11.797402</td>
<td>142.122428</td>
<td></td>
</tr>
<tr>
<td>CAM08</td>
<td>-11.80306</td>
<td>142.08738</td>
<td></td>
</tr>
</tbody>
</table>

**Table 7-8 Fauna trapping methods**

<table>
<thead>
<tr>
<th>Survey method</th>
<th>Description</th>
<th>Target listed species as identified in desktop surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trap sites (all)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Elliott trapping</strong></td>
<td>20 Elliott traps located 10 m apart along a single transect at each site.</td>
<td>▪ Chestnut Dunnart; and</td>
</tr>
<tr>
<td></td>
<td>Traps baited with peanut butter, oats, honey and macadamia oil mixture (Elliott A).</td>
<td>▪ Black-footed Tree-rat.</td>
</tr>
<tr>
<td></td>
<td>Trapping carried out at eight sites comprising 960 trap nights.</td>
<td></td>
</tr>
<tr>
<td><strong>Pitfall/funnel trapping array</strong></td>
<td>A pitfall line at each site comprising 4 x pitfall buckets (20 cm high x 40 cm deep), 40 cm high drift fence arranged in a ‘T’, and 6 x funnel traps paired at each end of fence line.</td>
<td>▪ Chestnut Dunnart; and</td>
</tr>
<tr>
<td></td>
<td>Trapping carried out at eight sites comprising 48 trap nights.</td>
<td>▪ Herpetofauna.</td>
</tr>
<tr>
<td><strong>General methods (across Project area including trap sites)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baited cage traps and infrared camera</strong></td>
<td>Cage trap baited with chicken necks and macadamia oil poured on ground surrounding cage. Single infrared camera set facing cage trap. Trapping carried out at eight sites comprising 48 trap nights.</td>
<td>▪ Northern Quoll; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Black-footed Tree-rat</td>
</tr>
<tr>
<td><strong>Diurnal bird census</strong></td>
<td>Bird surveys at each trap and observation site and opportunistically throughout study area. Surveys carried out at dawn and late afternoon – approximately 120 minutes per site. Birds identified by direct observation and/or by call.</td>
<td>▪ All bird species.</td>
</tr>
<tr>
<td><strong>Diurnal searches</strong></td>
<td>Searches for small mammals, frogs and reptiles under leaf litter, debris, logs and rocks. Carried out at each trap site and throughout study area where appropriate habitat factors occurred.</td>
<td>▪ Chestnut Dunnart; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Herpetofauna.</td>
</tr>
<tr>
<td><strong>Anabat microbat call recording and harp trapping</strong></td>
<td>Passive recording of microbat calls overnight using Anabat recording system. Also overnight use of paired harp traps to capture species. Survey locations dependent on appropriate habitat structure, particularly for harp traps. Anabat surveys carried out over 12 nights at 3 sites across Project area. 9 nights of harp trapping at 6 sites.</td>
<td>▪ Bare-rumped Sheathtail Bat.</td>
</tr>
</tbody>
</table>
**Survey methods**

<table>
<thead>
<tr>
<th>Survey method</th>
<th>Description</th>
<th>Target listed species as identified in desktop surveys</th>
</tr>
</thead>
</table>
| Spotlighting surveys | Minimum ½ hour (hr) spotlighting in early evening (two people) at each site for nocturnal mammals and herpetofauna. Also surveying tracks at night. | ▪ Northern Quoll;  
▪ Spectacled Flying-fox; and  
▪ Black-footed Tree-rat. |
| Incidental records | Fauna observations were ongoing throughout the site and survey period.       | N/A                                                             |

**Aquatic Survey Methods**

Aquatic ecology surveys were undertaken between 4 and 11 November 2014, corresponding to the late dry season. Follow-up surveys were undertaken between 31 January and 6 February 2015, corresponding to the early wet season. Surveys of freshwater aquatic ecology were carried out for the SRBP between 5 and 10 March 2015.

Survey methods including riparian habitat assessment, riparian and aquatic flora identification, water quality measurements, macroinvertebrate sampling, fish trap techniques (box traps, cast-netting and active dip-netting), and turtle traps (cathedral traps).

Three sites were selected for this survey period; two within wetland systems (including Big Footprint Swamp) and one on an ephemeral stream (Figure 7-13). It should be noted; however, that the paucity of suitable freshwater aquatic ecosystems within the Project area results in limited survey findings. The SRBP surveys consisted of six sites, four of which were located on Namaleta Creek to the south of the Bauxite Hills Project area. Two further sites were located on wetland areas including one on Big Footprint Swamp and another on a smaller wetland area located on the southern boundary of the Bauxite Hills Project area (BH6) called Lunette swamp (RPS, 2015b) (refer Figure 7-13).

The timing of dry season surveys was considered ideal for assessing the persistence of water in the aquatic ecosystems across the Project area and the communities they supported. Wet season surveys were undertaken following a period of heavy rainfall. The timing of the wet season surveys were dictated by the likelihood of reduced access to the sites and increased safety risks associated with higher likelihood of estuarine crocodile dispersal across the Project area later in the wet season.

A desktop review of available relevant literature and subsequent results of onsite surveys both resulted in no presence (potential or otherwise) of freshwater aquatic fauna or flora listed as MNES. As such, the results of the aquatic surveys are not referred to further in this chapter. These habitats are referred to where MNES species that may use freshwater habitats in the Project area (such as migratory waterbirds).

The majority of aquatic habitats in close proximity to the Project are classed as marine/estuarine and were therefore not assessed in this scope of works. Aquatic habitats are described where MNES species that may use freshwater habitats in the Project area occur (such as migratory waterbirds). The Aquatic Ecology Technical Report is located in Appendix B2.

**Species Assessments - Likelihood of Occurrence**

Four categories were used to classify the likelihood of a threatened flora and fauna species being present within the Project area based on the desktop research and onsite observations. Categories were defined as:

▪ Known (confirmed during field assessments);
- Likely (suitable habitat observed during field assessments and/or known distribution);
- Potential (possibility of suitable habitat or limited records of the species occurring within or around the Project area); and
- Unlikely (no suitable habitat or not known to occur within the local region).

**Survey Limitations**

During the late dry seasons, general access to and around the individual survey areas was good, allowing traps and survey sites to be scattered as required through dominant vegetation types in most areas likely to be impacted by mining operations. However, travel distances between the base camp and MLA 20676 were in excess of one hour, and to ensure compliance with animal ethics requirements, the survey method was modified, resulting in three trapping night’s effort at both MLA 20676 and MLA 20688/20689. This is not considered to compromise the survey data, as additional survey sites were established in areas with limited previous survey effort (particularly in MLA 20676). Surveys undertaken in MLA 20688/20689 and adjacent properties for the SRBP provides additional baseline knowledge of the terrestrial fauna of the survey areas.

During the late dry season surveys, of the two nights dedicated to spotlighting, the first night (6 November) took place during a light shower with dense cloud cover. The second night (8 November) was conducted the night prior to a full moon with very limited cloud cover increasing visibility. The early wet season surveys also coincided with the full moon. During the early wet season surveys, spotlighting was not possible in BH1 due to safety reasons relating to wet weather and potential presence of dangerous fauna (e.g. crocodiles).

### 7.7.1.3 Skardon River Bauxite Project Fauna Surveys

Fauna trapping surveys have also been carried out for the SRBP including:

- September/October 2014 targeted surveys for threatened species including intensive camera trapping surveys (50 cameras active for at least 10 days), bat call recording surveys and opportunistic searches for threatened birds and Spectacled Flying-fox (*Pteropus conspicillatus*) roosts; and

- February 2015 wet season general fauna trapping surveys carried out over six days.

A summary of the survey techniques and respective effort employed in each habitat during the early wet season surveys is presented in Table 7-9. The results from these surveys have been used as supplementary data to inform this chapter. Further detail on the survey methods and results is provided in Appendix B1.

**Table 7-9 Total survey effort (trap nights) for SRBP fauna ecology surveys**

<table>
<thead>
<tr>
<th>Habitat</th>
<th>No. of trap sites</th>
<th>Elliott trap</th>
<th>Pitfall/ funnel</th>
<th>Cage trap</th>
<th>SM2/ anabat</th>
<th>Harp traps</th>
<th>Junction camera</th>
<th>Remote camera</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. tetradonta</em> woodland</td>
<td>15</td>
<td>1,385</td>
<td>150</td>
<td>54</td>
<td>43</td>
<td>14</td>
<td>12</td>
<td>320</td>
</tr>
<tr>
<td>Open sedgeland in drainage swamps in dunefields</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casuarina woodland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mine Camp</td>
<td>1</td>
<td>40</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Moist eucalypt woodland</td>
<td>4</td>
<td>300</td>
<td>75</td>
<td>6</td>
<td>15</td>
<td>2</td>
<td>12</td>
<td>52</td>
</tr>
<tr>
<td>Fringing woodland to wetland and swamps</td>
<td>1</td>
<td>240</td>
<td>24</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td>54</td>
</tr>
<tr>
<td>South of Namaleta Creek</td>
<td>2</td>
<td>40</td>
<td>48</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.7.1.4 Survey Effort for EPBC Listed Fauna Species

State and Commonwealth survey guidelines have been designed for a number of EPBC listed fauna species that are predicted to occur in the Project area. There are no specific guidelines available for surveying EPBC listed flora species or TECs. EPBC survey guidelines are not mandatory, but rather are designed to provide a generic framework on how to assess the presence or absence of particular species or taxa (DSEWPac, 2011a). These guidelines were considered during the design and conduct of the fauna surveys undertaken for this Project.

Surveys undertaken as part of the Project were also tailored to site specific conditions, including those relating to habitat quality, distribution and abundance, as well as access, weather, and time constraints in order to maximise the detection of species that have the potential to occur within survey sites. As such, the fauna surveys undertaken as part of the Project provide a robust and tailored survey of fauna species present within the Project area. Table 7-10 summarises the survey effort compared to the generic EPBC non-mandatory guidelines.

Table 7-10 Survey effort relative to guidelines

<table>
<thead>
<tr>
<th>Bauxite Hills Field Survey Effort</th>
<th>Survey Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birds</strong> – predicted species in Project area: Red Goshawk; Palm Cockatoo (Australian); Golden-shouldered Parrot; Masked Owl (northern)</td>
<td>Survey guidelines for Australia’s threatened birds (DEWHA 2010a)</td>
</tr>
<tr>
<td>Bird surveys comprising random meander transect within 15 sites – approximately 26 hours carried out over two seasonal surveys. Opportunistic surveys carried out wherever appropriate habitat occurred.</td>
<td>Area searches of suitable habitat. Suitable for Golden-shouldered Parrot (10 hr over two days), Suitable for Red Goshawk. 10 days for a total of 80 hr. Targeted watches of waterholes during dry season. Suitable for Golden-shouldered Parrot (12 hr over four days). Targeted call playback, preferably in lead up to breeding. Suitable for Masked Owl (eight hr over four nights). No guidelines for surveying Palm Cockato as yet.</td>
</tr>
<tr>
<td><strong>Mammals</strong> – predicted species in Project area: Northern Quoll</td>
<td>Survey guidelines for Australia’s threatened mammals (DSEWPac 2011a)</td>
</tr>
<tr>
<td>Elliott trapping – trapping carried out at eight sites over six nights and two seasons comprising 960 trap nights. Additional 1,055 trap nights for SBRP surveys in wet season 2015. Cage trapping (baited with chicken necks) and remote cameras - trapping carried out at eight sites comprising 48 trap/camera nights. Additional intensive surveys for SRBP comprising approx. 500 camera nights in dry season 2014. Spotting surveys.</td>
<td>Northern Quoll: Cage/Elliott trapping in rocky denning habitat from May-August. Other methods: daytime searches for potentially suitable habitat (extensive rocky areas with permanent water) and latrine sites; baited sandtraps; hair tubes; remote cameras and spotlighting.</td>
</tr>
<tr>
<td><strong>Mammals</strong> – predicted species in Project area: Bare-rumped Sheathtail Bat; Spectacled Flying-fox</td>
<td>Survey guidelines for Australia’s threatened bats (DEWHA 2010b)</td>
</tr>
<tr>
<td>Bauxite Hills Field Survey Effort</td>
<td>Survey Guidelines</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Anabat surveys carried out at five sites over two surveys for total of 15 nights. Additional intensive surveys for SRBP comprising approx. 80 nights in dry season 2014. Additional 42 nights for SRBP surveys in wet season 2015.</td>
<td>Anabat detection (minimum 16 nights per 50 ha)</td>
</tr>
<tr>
<td>Harp trapping – paired traps placed out at six sites over two surveys for total of 15 nights. Additional 4 nights for SRBP surveys in wet season 2015.</td>
<td>Mist-netting near canopy level and at waterholes – 16 trap nights per 50 ha over a minimum of four days</td>
</tr>
<tr>
<td>Spectacled Flying-fox: Opportunistic searches for camps and flying fox individuals while spotlighting.</td>
<td>Roost searches</td>
</tr>
<tr>
<td></td>
<td>Spectacled Flying-fox: Desktop research on existing/historic flying-fox camps; daytime searches for camps and food plants; and flying fox individuals while spotlighting.</td>
</tr>
<tr>
<td>Mammals – predicted species in Project area: Water Mouse and Black-footed Tree-rat</td>
<td>Survey guidelines for Australia’s threatened mammals (DSEWPac 2011a)</td>
</tr>
<tr>
<td>Surveys focussed on Water Mouse were not carried out due to the inherent dangers of the presence of Estuarine Crocodile in the Project area.</td>
<td>Water Mouse: habitat assessment, daytime searches and Elliott trapping in appropriate mangrove habitat.</td>
</tr>
<tr>
<td></td>
<td>No guidelines for surveying Black-footed Tree-rat as yet; however, the species was detected during camera trap surveys.</td>
</tr>
</tbody>
</table>
Fauna and aquatic ecology survey locations and DIWA wetland mapping.

**Legend**
- Barge Loading Area
- Watercourse
- Fauna Survey Sites
- Fauna Trapping Site
- Opportunistic Fauna Observation Site
- Aquatic Ecology Site
- Haul Road
- Pit Extents
- Accommodation Camp
- Metro Mining Mine Lease Area

**Data Source**
- MEC Mining
- QLD Government Open Source Data
- Australian Hydrological Geospatial Fabric (Geofabric) PRODUCT SUITE V2.1.1

**Disclaimer**
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

**Scale**
1:45,000 Scale @ A3 - 1:45,000

**Project Details**
- DRG Ref: BES150115-002-R1_FAUNA_SURVEY_SITES
- GCS GDA 1994 MGA Zone 54

**Date**
- 16/07/15
- 03/05/16
- 03/05/16

**Notes**
- For Information Purposes
- Updated Pit Extents
- Details
- Date
- Notes
- DRG Ref: BES150115-002-R1_FAUNA_SURVEY_SITES

Fauna and aquatic ecology survey locations and DIWA wetland mapping.
7.7.1.5 MNES Suitably Qualified Personnel

The personnel involved in the Project terrestrial ecology surveys and associated reporting for the Project are listed in Table 7-11 along with their qualifications and relevant experience.

<table>
<thead>
<tr>
<th>Personnel and Project Involvement</th>
<th>Qualification/ Years' Experience</th>
<th>Summary of Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Fell</td>
<td>Assoc. Dip. - Applied Science</td>
<td>David’s extensive experience in vegetation assessment and land resource management has been gained throughout the tropics and sub-tropics of Australia. He has conducted rainforest survey work in the West Kimberley Region, in North-Eastern Arnhem Land, throughout northern NSW and in the Queensland bioregions of Cape York Peninsula, Wet Tropical Coast, Central Queensland Coast, Einsleigh Uplands and South-East Queensland. His work in the Cape York Peninsula with the Queensland National Parks Service included a comprehensive survey of the region’s rainforest vegetation. David carried out vegetation survey sites with Neldner and Clarkson throughout the Weipa sheet as part of the CYPLUS mapping project. David was based in Weipa for nine months as research ranger on a crocodile research program with QPWS working with the Napranum and Mapoon ranger program. David’s contribution of vouchers to the Queensland and other Herbaria has included a number of new species, with two taxa from the Cape York region being formally named Dallwatsonia felliana and Melicope fellii.</td>
</tr>
<tr>
<td>Mark Sanders</td>
<td>Bach. Adv. Science (hons) (Zoology)</td>
<td>Mark is a highly-respected and well-known ecologist with extensive field expertise and first-hand knowledge of more than 1,500 of Australia’s terrestrial vertebrate species. He has undertaken surveys within every state and territory within Australia, across environments such as native grasslands, dry and wet sclerophyll habitats, coastal swamps, brigalow, mangroves, rainforests, savannah woodland, arid hummock grasslands, heathlands. Of relevance to this Project, Mark has undertaken fauna surveys at Pisolite Hills (north of Weipa) for the Pisolite Hills Project, MMG Century near the Lawn Hill National Park, Yarrabah for the Mandingalby Yidinji IPA, Kajabbi in far north-west Queensland for Matrix Metals.</td>
</tr>
<tr>
<td>Richard Floyd</td>
<td>Bach. Science (Environmental Science)</td>
<td>Richard’s experience centres on the management and undertaking of ecological studies throughout Australia; primarily with mining and linear infrastructure projects. Richard’s industry experience spans surface and subsurface mining operations, coal seam gas, electricity generation and distribution, communications infrastructure development, urban development and transport infrastructure projects. Richard’s technical expertise is based on extensive flora and fauna surveys in NSW, Queensland, Victoria, Western Australia and the Northern Territory.</td>
</tr>
<tr>
<td>Tim Howell</td>
<td>Bach. Science, PhD (Aquatic Science)</td>
<td>Tim is a career aquatic ecologist with a PhD in fish ecology and river rehabilitation. Tim has worked on a broad range of projects for the industry, government agencies, universities, and in collaboration with multiple organisations. Tim has led aquatic ecology surveys for the Surat Gas Project, Wiggins Island Balloon Loop, Byerwen Coal, Sarsfield Gold Mine Expansion, Sunshine Coast Airport Expansion, Noosa Sewage Treatment Facility Upgrade, Northgate Coal Mine and Belvedere Coal Project.</td>
</tr>
</tbody>
</table>

7.7.2 Marine Ecology

7.7.2.1 Marine Surveys

The extensive marine ecology surveys and reporting undertaken as part of the baseline work for the previously proposed Pisolite Hills Project has been used as the predominant marine ecology document for the Project. This work was focussed on Port Musgrave, approximately 25 km south of the Skardon River. As Port Musgrave is recognised as having a significantly larger, protected estuarine area than Skardon River, has been mapped with relatively large seagrass meadows and is...
fed from the large perennial rivers of both the Ducie and the Wenlock systems, the findings in the Port Musgrave work are considered to represent a potentially wider range of species niches than would be available in the Skardon River. The Project has adopted the conservative approach of assuming any species found in the Port Musgrave study could also occur in the Skardon River, even where conditions may be less optimal than in Port Musgrave.

Project specific field surveys of benthic marine habitat and seagrass extent were undertaken by PaCE in 2014 and 2015. The surveys were conducted to better understand benthic habitats from upstream of the proposed barge developments to the Skardon River entrance. Offshore habitats, within three proposed transhipment locations, and several bathymetric ‘high spots’ were also surveyed.

PaCE (2014) surveyed the benthic habitats adjacent to the three BLF locations originally proposed by Metro Mining. A total of 48 locations were surveyed using benthic video techniques. The video surveys covered a distance of approximately 20 – 30 m of seabed over a two minute period at each location.

In addition to the survey undertaken around the proposed barge facility options for seagrass, data was also collected for other benthic habitats. The survey included 116 locations to extend the understanding of benthic habitats downstream to the Skardon River entrance and offshore at the proposed transhipment locations. Sites where distributed randomly within the river system or targeted given available bathymetric survey information (i.e. rocky reef). Video data was analysed and biota recorded within key classes including, total live cover, macroalgae, macroinvertebrates, coral and bare substrate cover.

### 7.7.2.2 MNES Suitably Qualified Personnel

The personnel involved in the Project marine ecology assessments and associated reporting for the Project are listed in Table 7-12 along with their qualifications and relevant experience.

**Table 7-12 Field survey personnel – marine ecology**

<table>
<thead>
<tr>
<th>Personnel and Project Involvement</th>
<th>Qualification/ Years’ Experience</th>
<th>Summary of Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom Koskela, Marine Ecology and Coastal Processes (lead)</td>
<td>Bach. App Science, 18 years’ experience</td>
<td>Tom Koskela is an environmental scientist with over 18 year experience in marine ecological investigations and monitoring within the ports, coastal development sectors, defence and oil and gas industry. Tom has extensive project experience in water quality, sediment condition assessment, benthic habitats, and coastal processes monitoring and management. Integration between water quality conditions, defining habitat tolerances and management triggers has been key to developing reactive monitoring programs to support development within sensitive coastal ecosystems, including seagrass and fringing coral reef (Great Barrier Reef, Gulf of Carpentaria, Christmas Island, Malaysia, Qatar and the Arabian Gulf).</td>
</tr>
<tr>
<td>Daryl McPhee, Marine Species of Conservation.</td>
<td>B.Sc(Hons) PhD, 20 years’ experience</td>
<td>Associate Professor McPhee has extensive experience in the assessment of marine species of conservation significance. He was a member of the Dugong Protected Areas Advisory Group which was charged with establishing the system of Dugong Protected Areas on the Queensland East Coast and a member of the team that prepared the first national Recovery Plan for marine turtles. He has undertaken extensive policy work and field assessments in relation to marine species of conservation significance, as well as mitigation of human impacts in regions including the Gulf of Carpentaria, the Great Barrier Reef, Moreton Bay, south Western Australia and NSW. He undertakes formal statutory assessments for projects in NSW on behalf of the NSW Department of Planning. He is a Director of the Commonwealth government’s Fisheries Research and Development Corporation which administers $27 million worth of fisheries research annually.</td>
</tr>
</tbody>
</table>
Personnel and Project Involvement | Qualification/ Years’ Experience | Summary of Experience
---|---|---
Dr Riku Koskela, Marine Ecology | BSc PhD | 20 years’ experience

Dr Riku Koskela is a specialist consultant in marine science to Ports, Industry, Resources and government sectors, with 20 years’ experience in ecological assessment and remediation in aquatic ecosystems. Riku’s experience as an Aquatic Scientist is diverse and includes fisheries science, habitat assessment, fauna survey, biochemistry, physiology, ecotoxicology and water quality. Riku’s primary focus is on habitat assessment, pollutant control and the development of environmental trigger values. In this capacity he has led numerous studies into dredging, industrial discharge, marine construction and operation. More recently, Riku has been a principal contributor to the development of integrated monitoring and management programs for marine construction and industrial process impacts.

7.8 MNES Results

7.8.1 Terrestrial Assessment Results

7.8.1.1 Desktop Results

Vegetation Mapping and Threatened Ecological Communities

The Protected Matters Search Tool and current DNRM RE mapping indicates no listed TECs occur in the Project area.

Assessment of current DNRM RE mapping identified 16 REs occurring on four land zones within the Project area: tidal creeks and salt pan areas (land zone 1), alluvial river and creek flats (land zone 3); remnant tertiary surfaces (land zone 5); and Cainozoic duricrusts (land zone 7) (Neldner et al., 2014). The majority of the Project area is composed of remnant vegetation and current DNRM mapping is shown in Figure 7-12.

Eight of the sixteen EHP certified REs mapped for the Project area were recorded during the field survey. Five REs not previously mapped for the Project area were also recorded and are included in the ground-verified RE mapping. Table 7-13 provides a brief description of all REs considered to occur within the Project area. These REs are used as the basis for the assessment of terrestrial MNES values of the Project area and revised mapping of the Project area is provided in Figure 7-14.

Table 7-13 Ground-truthed vegetation community descriptions

<table>
<thead>
<tr>
<th>RE</th>
<th>VM Act Status</th>
<th>EP Act Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.1a</td>
<td>Least Concern</td>
<td>No Concern</td>
<td>Closed forest of <em>Rhizophora stylosa</em> ± <em>Bruguiera gymnorrhiza</em>. Occurs as outer mangroves.</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Ceriops tagal</em> ± <em>Avicennia marina</em> low closed mangrove forest. Extensive on intertidal areas.</td>
</tr>
<tr>
<td>3.1.6</td>
<td>Least Concern</td>
<td>No Concern</td>
<td>Sparse herbland or bare salt pans. Associated with salt plains and saline flats.</td>
</tr>
<tr>
<td>3.3.9</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Lophostemon suaveolens</em> open forest. Occurs on streamlines, swamps and alluvial terraces.</td>
</tr>
<tr>
<td>3.3.12</td>
<td>Of Concern</td>
<td>Of Concern</td>
<td><em>Melaleuca quinquenervia</em> open forest. Associated with scattered coastal swamps.</td>
</tr>
<tr>
<td>3.3.14</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Melaleuca saligna</em> ± <em>M. viridiflora</em>, <em>Lophostemon suaveolens</em> woodland on drainage swamps.</td>
</tr>
<tr>
<td>3.3.22</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Corymbia clarksoniana</em> or <em>C. novoguineensis</em> woodland on alluvial plains.</td>
</tr>
<tr>
<td>3.3.32</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Melaleuca viridiflora</em> +/- <em>M. saligna</em> woodland in sinkholes and drainage depressions.</td>
</tr>
<tr>
<td>RE</td>
<td>VM Act Status</td>
<td>EP Act Status</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3.3.42</td>
<td>Least Concern</td>
<td>No Concern</td>
<td>Low woodland of <em>Melaleuca viridiflora</em> +/- emergent <em>Corymbia clarksoniana</em>.</td>
</tr>
<tr>
<td>3.3.49</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Melaleuca viridiflora</em> low open woodland on low plains.</td>
</tr>
<tr>
<td>3.3.51</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Melaleuca acacioides</em> +/- <em>Hakea pedunculata</em> tall shrubland on marine plains.</td>
</tr>
<tr>
<td>3.3.52</td>
<td>Least Concern</td>
<td>No Concern</td>
<td>Ephemeral lakes and lagoons on alluvial plains and depressions.</td>
</tr>
<tr>
<td>3.5.22</td>
<td>Least Concern</td>
<td>No Concern</td>
<td><em>Eucalyptus tetrodonta</em>, <em>Corymbia nesophila</em> tall woodland on deeply weathered plateaus and remnants.</td>
</tr>
</tbody>
</table>
Threatened and Migratory Species

Database searches identified five flora and 10 terrestrial fauna species listed as threatened (Critically Endangered, Endangered or Vulnerable) and 20 bird species listed as migratory under the EPBC Act (Table 7-14). These species were all considered as potentially occurring in the Project area prior to site investigations. These searches were used to inform the field and desktop investigations of species which could potentially occur in the Project area.

Table 7-14 Predicted EPBC Act listed species

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>EPBC Status</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calophyllum bicolor</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Cajanus mareebensis</td>
<td></td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Cepobaculum carronii</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Dendrobium bigibbum</td>
<td>Cooktown Orchid</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Dendrobium johannis</td>
<td>Chocolate Tea Tree Orchid</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erythrotiorchis radiatus</td>
<td>Red Goshawk</td>
<td>V</td>
<td>X</td>
</tr>
<tr>
<td>Numenius madagascariensis</td>
<td>Eastern Curlew</td>
<td>CE,M</td>
<td>X</td>
</tr>
<tr>
<td>Proboscidiger aterrimus macgillivrayi</td>
<td>Palm Cockatoo (Australian)</td>
<td>V</td>
<td>X</td>
</tr>
<tr>
<td>Psephotus chrysopterygius</td>
<td>Golden-shouldered Parrot</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Tyto novaehollandiae kimberlii</td>
<td>Masked Owl (northern)</td>
<td>V</td>
<td>X</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasyurus hallucatus</td>
<td>Northern Quoll</td>
<td>E</td>
<td>X</td>
</tr>
<tr>
<td>Mesembrionmys gouldii rattoides</td>
<td>Black-footed Tree-rat (north Queensland)</td>
<td>V</td>
<td>X</td>
</tr>
<tr>
<td>Pteropus conspicillatus</td>
<td>Spectacled Flying-fox</td>
<td>V</td>
<td>X</td>
</tr>
<tr>
<td>Saccolaimus saccolaimus nudicliniatus</td>
<td>Bare-rumped Sheathtail Bat</td>
<td>CE</td>
<td>X</td>
</tr>
<tr>
<td>Xeromys myoides</td>
<td>Water Mouse</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td><strong>Migratory bird species</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apus pacificus</td>
<td>Fork-tailed Swift</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Ardea alba</td>
<td>Great Egret</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Bubulcus coromandus</td>
<td>Eastern Cattle Egret</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Pandion cristatus</td>
<td>Eastern Osprey</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Fregata ariel</td>
<td>Lesser Frigatebird</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Gallinago hardwickii</td>
<td>Latham’s Snipe</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Numenius phaeopus</td>
<td>Whimbrel</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Limosa lapponica</td>
<td>Bar-tailed Godwit</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Tringa nebularia</td>
<td>Common Greenshank</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Actitis hypoleucus</td>
<td>Common Sandpiper</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Sterna albifrons</td>
<td>Little Tern</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Cuculus optatus</td>
<td>Oriental Cuckoo</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Merops ornatus</td>
<td>Rainbow Bee-eater</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Monarcha melanopsis</td>
<td>Black-faced Monarch</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Symposiachrus trivirgatus</td>
<td>Spectacled Monarch</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Myiagra cyanoleuca</td>
<td>Satin Flycatcher</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Rhipidura rufifrons</td>
<td>Rufous Fantail</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Hirundo rustica</td>
<td>Barn Swallow</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Cecropis daurica</td>
<td>Red-rumped Swallow</td>
<td>M</td>
<td>X</td>
</tr>
</tbody>
</table>

1: Status: Ex = Extinct; E = Endangered; CE = Critically Endangered; V = Vulnerable; M = Migratory; 2: Database source: WN = Wildlife online (accessed from EHP 2015); BA = Birdlife Australia; QM = Queensland Museum; PM = EPBC Protected Matters online search tool.
A historical account of the presence of conservation significant fauna species within the wider area surrounding the Project was conducted with the use of the Atlas of living Australia, Queensland Museum, Birds Australia and EHP Species Profile Search databases. EHP Records indicate Palm Cockatoo (*Probosciger aterrimus macgillivrayi*) has been recorded in the local area previously. The nearest records of Northern Quoll (*Dasyurus hallucatus*) occur approximately 22 km southwest of the Project area near Mapoon. There are no other mapped records for threatened species within a 25 km radius of the Project area.

Onsite terrestrial ecological studies have also been carried out for the adjacent SRBP (RPS, 2015a) in April and June 2010, April 2011, September 2014 and February 2015. The surveys included targeted techniques for Northern Quoll and Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatius*). The surveys recorded two threatened species: Palm Cockatoo and Black-footed Treerat (*Mesembriomys gouldii rattoides*).

### 7.8.1.2 Field Assessment Results

#### Landscape Context – Field Observation

The vegetation of the wider Project area is a complex mosaic of open forest, woodland, extensive swamplands, gallery forests on seasonal streams and rivers, mangroves and saltlan communities abut estuarine waterways. The lateritic surface of the Weipa Plateau is characterized by *Eucalyptus* and *Corymbia* woodlands with the deep aluminous laterites of the Weipa area supporting the best development of Darwin Stringybark (*Eucalyptus tetrodonta*), Melville Island Bloodwood (*C. nesophila*) and Cooktown Ironwood (*Erythrophloeum chlorostachys*) dominant tall woodland and open forest on Cape York Peninsula. Areas of shallow silty soils with impeded drainage characteristics are scattered across the lateritic surface, supporting low woodland communities with dominant eucalypt and *Melaleuca* species. Shallow drainage depressions provide a seasonal wetland habitat and are dominated by woodlands and open forests with characteristic *Melaleuca, Lophostemon, Xanthostemon* and *Asteromyrtus* species. These swamp forests display a complex variety of vegetation communities on their margins, compositionally zoned in response to local variations in the persistence of water through the dry season.

The majority of the Project area was found to support remnant Darwin Stringybark and Melville Island Bloodwood tall woodland (RE 3.5.2) which is consistent with current RE mapping. Darwin Stringybark predominates forming a distinct but discontinuous canopy with Melville Island Bloodwood present as a sub-dominant canopy species. The very sparse to sparse sub canopy and shrub layers are dominated by *Eucalyptus* and *Acacia* spp., and Bushman’s Clothes Peg (*Grevillea glauca*). The ground layer is usually sparse to medium density and dominated by native grasses. Due to the relatively undisturbed nature of much of the Project area relatively few weeds are present. No Weeds of National Significance (WoNS) or weeds listed under the *Land Protection (Pest and Stock Route Management) Act 2002* were encountered during surveys.

#### Field Assessment Results - Threatened Species

**Threatened Flora**

Five terrestrial flora species listed as threatened under the EPBC Act have the potential to occur within the Project area and surrounds based on the results of the desktop EPBC Protected Matters Search Tool. No flora species listed as Endangered or Vulnerable under the EPBC Act was observed within the Study area during field assessments. Habitat requirements for flora species listed under the EPBC Act were considered during the flora surveys. One species was identified as having some potential to occur (refer Table 7-15). Orchid species were identified during surveys outside...
proposed clearing areas. The observed specimens were likely to be The Three Lamellas Dendrobium (*Dendrobium trilamellatum*); however, this species shares similar habitat and has similar habit to the vulnerable flora species Chocolate Tea Tree Orchid (*D. johannis*). These orchids were found in riparian and wetland habitats outside of proposed impact areas, their locations are illustrated within Figure 7-14. No suitable flowering material was present at the time of survey and species level identification was not possible. It is recommended further surveys be undertaken during optimal flowering periods between March to July (DotE, 2015).

**threatened Fauna**

A total of 151 fauna species have been encountered in the Study area in fauna surveys for the Bauxite Hills Project and the SRBP including 15 frog, 23 reptile, 89 bird and 24 mammal species.

Ten terrestrial fauna species listed as threatened under the EPBC Act have the potential to occur within the Project area and surrounds based on the results of the desktop EPBC Protected Matters Search Tool. Onsite surveys and habitat suitability assessments for the Bauxite Hills Project and SRBP confirmed the presence of Palm Cockatoo within the Project area (Table 7-15). Camera trapping surveys (targeted at Northern Quoll) for the adjacent SRBP recorded the Black-footed Tree-rat in September 2014 (refer Attachment F in Appendix B1).

Threatened species that are known or likely to occur are referred to in more detail in the following sections. A further two species of plant and five species of fauna species are considered as having a low potential to occur in the Project area based on available habitat (Table 7-15).

<table>
<thead>
<tr>
<th>Species Name</th>
<th>EPBC Act Status</th>
<th>Habitat Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Calophyllum bicolor</em></td>
<td>V</td>
<td>Small tree occurring in vine forest generally associated with springs on edge of lateritic escarpments. Unlikely. The species has not been recorded during surveys for Bauxite Hills Project or SRBP. There are no records in proximity to the Project. The nearest record is located approximately 225 km southeast of the site. At Musgrave, <em>C. mareebensis</em> has been photographed and collected from the verges of the Peninsula Developmental Road, where the creeper appears to favour edge situations on quartzose sandy or gravelly surfaces (Greencap, 2015). There are some areas of similar habitat in the vicinity of the existing haul road adjacent to the Bauxite Hills lease area.</td>
</tr>
<tr>
<td><em>Cajanus mareebensis</em></td>
<td>E</td>
<td>Perennial herb found in grassy woodlands. Unlikely. Atlas of living Australia shows no records in proximity to the Project. The nearest record is located approximately 225 km southeast of the site.</td>
</tr>
<tr>
<td><em>Cepobaculum carronii</em></td>
<td>V</td>
<td>Orchid species that grows in humid areas of open forest and low lying areas subject to periodic inundation. It often grows on the papery bark of <em>Melaleuca viridiflora</em>. Potential. The species is only known from the eastern side of Cape York. The Project site does contain suitable habitat of low-lying swamps of <em>Melaleuca</em> that are periodically inundated.</td>
</tr>
</tbody>
</table>
### Cooktown Orchid
*Dendrobium bigibbum*

- **EPBC Act Status**: V
- **Species Name**: Cooktown Orchid
- **Habitat Preference**: Orchid which occurs at altitudes between 0 – 400 m above sea level (Jones, 2006; Queensland Herbarium, 2008). It grows on trees and rocks with moderate light intensity in a range of habitats including coastal scrub, streambank vegetation, monsoon thickets, and gullies in open forest and woodland where fire cannot penetrate (Lavarack and Gray, 1985; Dockrill, 1992; Lavarack et al., 2000; Jones, 2006). It rapidly recolonises disturbed sites (Jones, 2006).
- **Likelihood of Occurrence in the Project Area**: Potential. Species have not been recorded during surveys for Bauxite Hills or SRBP. Suitable habitat occurs in the Project area in association with *Melaleuca* swamps and fringing habitats adjacent to the Project area.

There are records of the species near Aurukun. Cooktown Orchid is relatively well represented in coastal dune country in Cape York Peninsula, and is also found in large numbers in the dune vegetation west and outside the Project area. The species is most probably in more mesic vegetation types on land zone 2 (sand) such as beach scrubs (Greencap, 2015). These habitats do not occur in the Project area.

### Chocolate Tea Tree Orchid
*Dendrobium johannis*

- **EPBC Act Status**: V
- **Species Name**: Chocolate Tea Tree Orchid
- **Habitat Preference**: A common orchid species of open, humid habitats and is often found on trees growing in or close to swamps and in pockets of monsoon forest.
- **Likelihood of Occurrence in the Project Area**: Likely. During recent surveys individual orchids of similar habit to this species were identified in fringing paperbark woodlands and mangrove margins. All specimens were; however, infertile at the time of survey. It is likely these orchids are The Three Lamellas *Dendrobium* which has recently been split from Chocolate Tea Tree Orchid. To confirm the species identification flowering material in needed from March-July period (DotE, 2015). Given the similarities in these species it is likely Chocolate Tea Tree Orchid occurs within wetland and fringing habitats within the broader Project area. All orchid species observed were located outside of proposed Project disturbance areas.

### Birds

#### Red Goshawk
*Erythrotriorchis radiatus*

- **EPBC Act Status**: V
- **Species Name**: Red Goshawk
- **Habitat Preference**: Endemic to northern and eastern Australia in coastal and subcoastal areas with large home ranges of up to 200 km². Occurs in woodlands and forests and prefers mosaic habitats that hold a large population of birds and permanent water. Riparian areas are heavily favoured (Marchant and Higgins 1993).
- **Likelihood of Occurrence in the Project Area**: Potential. Eucalypt forest and woodlands adjacent to the Skardon River in the Project area afford foraging and potentially breeding habitat. This species was not detected during the surveys for Bauxite Hills or SRBP. Surveys did not identify any Red Goshawk nests which are distinctive large stick nests.

There is the potential for Red Goshawks to forage within the woodlands of the Project area, but their primary habitat is tall trees within 1 km of permanent water. Therefore primary habitat would be associated with the Skardon River and fringing riparian vegetation. The Project will have minimal impact on riparian vegetation and habitat for Red Goshawk. Large areas of riparian vegetation and foraging woodland for the species are being retained on site. No database records. EPBC online search only. Several ALA records in wider region but nearest record is approximately 100 km to the southeast.

#### Eastern Curlew
*Numenius madagascariensis*

- **EPBC Act Status**: CE
- **Species Name**: Eastern Curlew
- **Habitat Preference**: Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.
- **Likelihood of Occurrence in the Project Area**: Potential. Suitable habitat occurs to the north and west of the Project area associated with Skardon River and associated mudflats. However, the primary habitat is more associated with the mouth of the Skardon River and coastline which is downstream of the mine area. Two ALA records within 10 km of the Project area located to the west.
<table>
<thead>
<tr>
<th>Species Name</th>
<th>EPBC Act Status</th>
<th>Habitat Preference</th>
<th>Likelihood of Occurrence in the Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Cockatoo <em>Probosciger aterrimus macgillivrayi</em></td>
<td>V</td>
<td>Closed tropical forest and adjacent savanna and paperbark woodland on Cape York Peninsula. This species nest in large tree hollows, trunks or stumps.</td>
<td>Known. Detected during surveys for this Project and SRBP. The Project area provides potential foraging and breeding habitats in the woodland areas. Nests may be found in the larger hollow bearing trees. The species is also likely to utilise melaleuca woodlands within and adjacent to the Project site associated with Big Footprint Swamp and riparian vegetation of the Skardon River. One ALA record within 10 km of the site located to the southwest.</td>
</tr>
<tr>
<td>Golden-shouldered Parrot <em>Psephotus chrysopterygius</em></td>
<td>E</td>
<td>Preference for tropical savanna woodland. During the dry season, the choice of habitat appears to be based on the grass seed availability. Nesting appears to be more successful where grass has been invaded by woodland.</td>
<td>Unlikely. Currently two populations on Cape York Peninsula are known associated with a pastoral lease (Artemis Station, Musgrave) and protected estate (Staaten River NP) to the south of the Project area. The nearest ALA record is approximately 100 km to the southeast of the site.</td>
</tr>
<tr>
<td>Masked Owl <em>Tyto novaehollandiae kimberlii</em></td>
<td>V</td>
<td>Occurs in sclerophyll forests and woodlands often near grassy open areas. Generally roosts in tree hollows (although sometimes caves or dwelling are used) and feeds on mammals. (Debus 2012).</td>
<td>Potential. The Project area does provide some suitable habitat in the woodland areas, including tree hollows for nesting. No recent records exist for this species from western Cape York. The species has not been recorded on the Weipa Plateau despite recent surveys. The Action Plan for Australian Birds (Garnett et al., 2011) species account shows a single record occurring near Aurukun. No database records. EPBC Online search only.</td>
</tr>
<tr>
<td>Species Name</td>
<td>EPBC Act Status</td>
<td>Habitat Preference</td>
<td>Likelihood of Occurrence in the Project Area</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Quoll <strong>Dasyurus hallucatus</strong></td>
<td>E</td>
<td>Formerly occurred in a variety of habitats across northern Australia and Queensland including: eucalypt forest and woodlands, rainforests, sandy lowlands, shrublands and grasslands. Now most common in rocky eucalypt woodland and open forest within 200 km of the coast (Menkhorst and Knight 2004).</td>
<td>Potential. Has not been detected in studies for this Project or the SRBP. Suitable foraging habitat for this species occurs within the region; however, there is limited suitable denning habitat. There are three ALA records (1980s) located approximately 22 km south of the site near Mapoon. Populations of this species have been recently found in the Weipa area at Scherger Air Base (RPS, 2015a) and for the Amrun Project (McGoldrick, 2013). On the basis of this rediscovery, it is possible for Northern Quolls to recolonise their historical range, which includes the Project area (Greencap, 2015). The Project site has an absence of complex rocky outcrops for denning habitat. The species is known to generally forage in areas proximate to these rocky areas. The Project site does contain suitable foraging habitat across the Project site in eucalypt woodlands. As the species has a large foraging range there may be some limited potential the species will utilise the Project site.</td>
</tr>
<tr>
<td>Spectacled Flying-fox <strong>Petropus conspicillatus</strong></td>
<td>V</td>
<td>Restricted to tropical rainforest areas.</td>
<td>Unlikely. No records from surveys and no database records. EPBC Online search only. Lack of suitable habitat in the Project area and surrounds and no roost sites recorded during surveys for Bauxite Hills or SRBP. The nearest ALA record is approximately 110 km to the east of the Project area.</td>
</tr>
<tr>
<td>Bare-rumped Sheathtail Bat <strong>Saccolaimus saccolaimus nudicluniatus</strong></td>
<td>CE</td>
<td>Occurs primarily in tropical eucalypt woodland and possibly rainforest in the coastal lowlands of north-eastern Queensland and the Top End of the Northern Territory. It prefers open woodlands, particularly Poplar Gum (<strong>E. platyphylla</strong>) woodland, and tall open forest. The small number of confirmed roosts located in Australia has been in tree hollows. Most roosts are located in hollows at 10-15 m in height with a roost entrance 6-7 m above the ground.</td>
<td>Potential. Detected as possibly occurring from bat call pass files recorded from the Project area, although not considered to be a positive identification. Studies for the SRBP confirm the presence of both Yellow-bellied sheath-tailed Bat (<strong>S. flaviventris</strong>) and Papuan sheath-tailed Bat (<strong>S. mixtus</strong>) in the local area. Although no Poplar Gum woodlands are present within the Project area, suitable foraging habitat occurs throughout the Project area as well as larger hollow bearing eucalypts including Darwin Stringbark which the species has been associated with in other areas of Australia such as the Northern Territory. There are no confirmed records from the western Cape York. The nearest confirmed record is from Iron Range National Park ~ 130 km southeast of the Project area. Churchill (2008) does not have this species’ known range covering the western half of Cape York Peninsula; however, other field guides have mapped this area.</td>
</tr>
</tbody>
</table>
Species Name: Black-footed Tree-rat (North Queensland) *Mesembrionys gouldii rattoides*

EPBC Act Status: V

Habitat Preference: Habitats for the species consist of open eucalypt woodland and forests with a proximity to watercourses and low lying vegetated areas. Denning habitat consists of tree hollows and sometimes dense foliage such as *Pandanus* spp. Limited information is available on this sub-species; however, it is known to be arboreal and forage on the ground for fruits and seeds, some invertebrates and grasses (Greencap, 2015).

Likelihood of Occurrence in the Project Area: Known. Recorded on one occasion adjacent to Project area by RPS in October 2014 during intensive infrared camera trapping targeting Northern Quolls for the SBRP. The location and habitat was not specified. Not recorded on any other occasion despite abundant Elliott trapping, camera trapping and spotlighting. Possible habitat, including denning habitat consisting of Darwin Stringybark woodlands and tree hollows exist within the Project area and the SRBP area. The species may also utilise adjacent *Melaleuca* swamps to the Project such as Big Footprint Swamp. No database records. The nearest ALA record lies approximately 60 km southeast of the Project area.

Species Name: Water Mouse *Xeromys myoides*

EPBC Act Status: V

Habitat Preference: Known to utilise both intertidal and freshwater habitats. Most records have been from mangrove forests, saltmarsh, sedgelands, clay pans and freshwater *Melaleuca* wetlands.

Likelihood of Occurrence in the Project Area: Unlikely. Nearest known population occurs near Proserpine on the central Queensland Coast; however, suitable mangrove and saltpan habitat occurs on the margins of the Project area. Has not been observed in previous studies in the region although species is difficult to detect. EPBC Online search only.

*Known to Occur*

**Palm Cockatoo (Australian) - Vulnerable**

*Ecology and habitat:* Palm cockatoos in Australia are conventionally accepted as a distinct subspecies to those found in Papua New Guinea. The species inhabits closed forest and riparian systems, and open woodlands adjacent to these habitats. Pairs are thought to occupy permanent breeding territories (Murphy *et al.*, 2003). They feed mostly on the hard seeds of fibrous and woody fruits of woodland, littoral and closed forest species, taken from the canopy and the ground (Wood, 1988; Storch, 1996).
**Distribution and breeding:** This subspecies is distributed across the north of Cape York Peninsula, Queensland, from north of Pompuraaw on the west coast to Saltwater Creek, Princess Charlotte Bay on the east coast (Storch, 1996; Higgins, 1999). Palm cockatoos breed all year round, although a peak of egg-laying occurring in September has been found in Iron Range National Park (Murphy et al., 2003). Nest preparation has been observed to start between August and November, during the peak breeding period (September). Nests are mostly in large hollow trees, primarily large eucalypts in woodland, with an average distance of 320 m to the rainforest (Murphy et al., 2003). However, there have also been observations of nests in smaller trees, which may be related to limitations in the availability of hollows at certain times (Murphy, 2006).

**Threats:** Threats include land clearing for mining projects (in the vicinity of Weipa), inappropriate fire regimes which impact nesting habitat by destroying nest hollows or allowing rainforest to encroach on woodland habitat, and cyclones which also destroy nest hollows (Garnett et al., 2011).

**Occurrence in the Study Area:** Recorded infrequently during dry season fauna surveys (November, 2014) throughout the Project area refer Figure 7-14. Also observed during SRBP surveys in fringing woodland immediately to the north ofNamaleta Creek and in E. tetrodonta woodland. The species has been recorded in low numbers from one individual up to three in a flock. The E. tetrodonta woodlands and fringing Melaleuca forests on the Project site and surrounding area provide foraging and nesting habitat for this species. Hollow bearing trees provide nesting sites for this species.

**Black-footed Tree-rat (north Queensland) - Vulnerable**

**Ecology and habitat:** Little information is available on this nocturnal species. It is recorded mostly from eucalypt woodlands (often close to water) and dens mostly in tree hollows and sometimes in dense foliage (particularly of Pandanus species). It forages on the ground and in trees for a diet of fruit, seeds, invertebrates, flowers and grass (Rankmore and Friend, 2006). Individuals in the western subspecies have been recorded moving at least 500 m from den sites (Friend, 1992).

**Distribution and breeding:** Its distribution is poorly known and has been mostly recorded around Mareeba (Burnett, 2001). It has been sparsely recorded elsewhere in Cape York. Breeding may occur throughout the year, but was found to peak in August-September in the western subspecies (Friend 1992).

**Threats:** This species is threatened by habitat loss and fragmentation, inappropriate fire regimes and feral cat predation. Lesser threats include habitat degradation due to livestock and invasive grasses (DotE, 2015).

**Occurrence in the Study Area:** Recorded on a camera trap during intensive surveys for Northern Quoll in September/October 2014 for SRBP (Attachment F in Appendix B1). Not recorded elsewhere despite extensive surveys across the area. The exact location and habitat type of the record was not given although most camera locations were in Darwin Stringybark woodland. The nearest record to the Project area appears to be a 2004 EHP record located approximately 30 km east of Weipa.

**Likely to Occur**

**Chocolate Tea Tree Orchid (Dendrobium johannis) - Vulnerable**

**Distribution and habitat:** The species is known to occur on Cape York Peninsula from around Coen north to the tip. It prefers open, humid habitats and is often found on trees growing in or close to swamps and in pockets of monsoon forest (Queensland Herbarium 1997). It has been recorded
growing on Broad-leaved Tea-tree (*Melaleuca viridiflora*) in *Melaleuca* floodplain woodland and semi-evergreen vine thicket on a stabilised sand dune (DotE, 2015).

**Threats:** Threats include habitat degradation and collection by orchid enthusiasts.

**Occurrence in the Study Area:** During dry season vegetation surveys in November 2014 a number of suspected *Dendrobium* orchid species were identified adjacent to proposed clearing areas in *Melaleuca* on the edge of Big Footprint Swamp and fringing mangrove communities on the northern boundary of MLA 20676. All *Dendrobium* specimens were infertile at the time of survey therefore future identification will need to be confirmed during flowering periods. Based on the habit and form of the individuals encountered it is considered more likely these species were the common The Three Lamellas Dendrobium.

**Field Assessment Results - Migratory Bird Species**

**Previous Migratory Shorebird Surveys**

With the exception of incidental observations no site specific study has been made into the presence of migratory shorebirds within the Skardon River study area. However, surveys for wader birds have been undertaken during 2009 for the previously proposed Pisolite Hills Project. The survey was undertaken throughout the Port Musgrave estuary system located to the south of the Project area with substantial survey effort focussed at the:

- Mouth of Namaleta Creek and surrounding shores;
- Lower Ducie River in the vicinity of the proposed barge loading area, including Pargon Creek, Palm Creek and adjacent creeks and shores; and
- Mouth of the Wenlock River.

The results of the survey are summarised in the Marine Ecology Technical Report – Appendix B3. Port Musgrave meets the requirements for nationally important habitat for migratory shorebirds because 16 species of migratory shorebird were recorded. In addition, Port Musgrave qualifies as nationally important habitat for four species of shorebird because at least 0.1% of their estimated East Asian-Australasian flyway population were recorded.

The entrance to Skardon River presents a similar habitat layout to Namaleta Creek (although this a minor portion of the overall Port Musgrave shorebird habitat area), with adjacent creek systems and intertidal sandy shores and beaches. The relatively narrow river entrance presents a diverse system of sandbars and shoreline sand flats which are variably exposed during tidal movement. Upstream of the entrance the waterway expands and presents broad intertidal flats on the southern and northern edges of the river. The extent of these intertidal habitats reduce markedly as the river progresses upstream toward the Project area.
Field Assessment Results

A total of 20 bird species listed as Migratory under the EPBC Act were predicted to occur in the Project area through the EPBC Protected Matters search and database searches (refer to Table 7-16). Although listed as Migratory, Eastern Curlew has already been assessed in Section 7.9.2 and is not considered further in this section. During field assessments for the Bauxite Hills Project and SRBP nine species were recorded within the Project area:

- Great Egret (*Ardea alba*);
- Eastern Cattle Egret (*Bubulcus coromandus*);
- Eastern Osprey (*Pandion cristatus*);
- Whimbrel (*Numenius phaeopus*);
- Common Sandpiper (*Actitis hypoleucos*);
- Gull-billed Tern (*Gelochelidon nilotica*);
- Little Tern (*Sternula albifrons*);
- Rainbow Bee-eater (*Merops ornatus*); and
- Rufous Fantail (*Rhipidura rufifrons*).

A further six listed migratory species are considered to have a low potential to occur sporadically within the Project area (Table 7-16).

**Table 7-16 Likelihood of occurrence of EPBC Act listed Migratory species**

<table>
<thead>
<tr>
<th>Species Name</th>
<th>EPBC Act Status</th>
<th>Habitat Preference</th>
<th>Likelihood of Occurrence in the Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Egret (<em>Ardea alba</em>)</td>
<td>M</td>
<td>Shallow wetland habitats, including manmade dams and ponds and moist grasslands (Marchant and Higgins 1990).</td>
<td><strong>Known.</strong> Widespread and common species. Detected on a semi-ephemeral swamp during surveys for the Project and SRBP. Suitable habitat occurs throughout the Project area. Wildnet database records. Two ALA records within 10 km of the site located to the west and southwest.</td>
</tr>
<tr>
<td>Eastern Cattle Egret (<em>Bubulcus coromandus</em>)</td>
<td>M</td>
<td>Grasslands, wetlands, pasture and crops. Strongly associated with grazing animals (Pringle, 1985; and Marchant and Higgins, 1990).</td>
<td><strong>Known.</strong> Detected on a semi-ephemeral swamp during surveys for the Project and SRBP. Suitable habitat occurs throughout the Project area. No database records. Nearest ALA record located approximately 60 km of the site located to the southwest.</td>
</tr>
<tr>
<td>Eastern Osprey (<em>Pandion cristatus</em>)</td>
<td>M</td>
<td>Mainly coastal habitats but can occur on inland rivers and lakes (Debus, 2012).</td>
<td><strong>Known.</strong> Detected during surveys for the SRBP. Suitable habitat occurs throughout the Project area. Wildnet database records. Nearest ALA record located approximately 60 km of the site located to the southwest.</td>
</tr>
<tr>
<td>Lesser Frigatebird (<em>Fregata ariel</em>)</td>
<td>M</td>
<td>Typically marine, but frequents coastal areas.</td>
<td><strong>Potential.</strong> Although unlikely within the Project area, may occur in the region. Wildnet database record and one ALA record within 10 km of the site is located to the west.</td>
</tr>
<tr>
<td>Species Name</td>
<td>EPBC Act Status</td>
<td>Habitat Preference</td>
<td>Likelihood of Occurrence in the Project Area</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Whimbrel (Numenius phaeopus)</td>
<td>M</td>
<td>Found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats.</td>
<td><strong>Known.</strong> Detected on the Skardon River during surveys for the Project. Suitable mangrove habitat occurs along estuarine waterways throughout the Project area. Wildnet database records. One ALA record within 10 km of the site located to the west.</td>
</tr>
<tr>
<td>Bar-tailed Godwit (Limosa lapponica)</td>
<td>M</td>
<td>Found in coastal sandflats, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Rarely found on inland wetlands or in areas of short grass. The species prefers foraging on tidal estuaries and shallow water and roost on sandy beaches and sandbars.</td>
<td><strong>Unlikely.</strong> While within the overall distribution for the species, it is unlikely that the Project area hosts the bar-tailed godwit due to lack of suitable habitat. The species has not been recorded in the area and the closest suitable habitat is at the mouth of the Skardon River and coastal areas.</td>
</tr>
<tr>
<td>Common Sandpiper (Actitis hypoleucos)</td>
<td>M</td>
<td>Utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.</td>
<td><strong>Known.</strong> Detected during surveys for the Project. Suitable habitat occurs throughout the Project area. Wildnet database records. Nearest ALA record located approximately 40 km of the site located to the southwest.</td>
</tr>
<tr>
<td>Common Greenshank (Tringa nebularia)</td>
<td>M</td>
<td>Occurs in all types of wetlands and has a wide distribution. They are common throughout summer. The species is found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.</td>
<td><strong>Potential.</strong> Not detected during surveys for the Project; however, suitable habitat exists in the Project area in mangrove swamps associated with the Skardon River and other wetlands such as Big Footprint Swamp. Atlas of living Australia shows that the species has been observed at the mouth of the Skardon River.</td>
</tr>
<tr>
<td>Latham’s Snipe (Gallinago hardwickii)</td>
<td>M</td>
<td>Occurs on swamp and marsh margins and in wet pasture (Pringle, 1987).</td>
<td><strong>Potential.</strong> Suitable habitat may occur to the north and west of the Project area. EPBC Online search only. No database records or records from previous studies. EPBC Online search only. The nearest ALA record is approximately 80 km to the southeast of the site.</td>
</tr>
<tr>
<td>Gull-billed Tern (Gelochelidon nilotica)</td>
<td>M</td>
<td>Widespread species that may forage over fresh or saltwater environments and open grassy habitats. May occur a long way inland.</td>
<td><strong>Known.</strong> Recorded during surveys for SRBP. Location not stated, although most likely utilising Skardon River estuary.</td>
</tr>
<tr>
<td>Little Tern (Sternula albifrons)</td>
<td>M</td>
<td>Inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sandspits, and also on exposed ocean beaches.</td>
<td><strong>Known.</strong> Detected during surveys for the Project. Suitable habitat occurs throughout the Project area. Potential habitat is associated with estuaries of the Skardon River and wetlands. However, their preferred habitats are associated with coastal environments such as at the mouth of the Skardon River. Two ALA records within 10 km of the site located to the west.</td>
</tr>
<tr>
<td>Oriental Cuckoo (Cuculus optatus)</td>
<td>M</td>
<td>Widespread but sparsely occurring summer migrant to northern and eastern Australia. May occur in a variety of habitats including mangroves and rainforest.</td>
<td><strong>Potential.</strong> Species may occur on the fringes of the Project area where suitable habitat occurs. No wildlife online database records. One ALA record 60 km east and another 80 km south of the Project area.</td>
</tr>
</tbody>
</table>
### Migratory Species Known or Predicted as Likely to Occur

The following sections provide descriptions of the habitat preferences of the migratory species that were observed during field assessments or are considered likely to occur within the Project area. All were recorded in low numbers (see below) and, given the relatively small areas of preferred habitat present, it is considered unlikely the Project area supports significant populations of any of the species referred to below. It is unlikely that the Project area provides locally or regionally important habitat for these species.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>EPBC Act Status</th>
<th>Habitat Preference</th>
<th>Likelihood of Occurrence in the Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork-tailed Swift (<em>Apus pacificus</em>)</td>
<td>M</td>
<td>An aerial non-breeding summer visitor, may occur over any habitat type, including cleared land and infrastructure.</td>
<td>Potential. May be occasional aerial visitor to the Study area in the summer months. No database records. EPBC Online search only. The nearest ALA record is approximately 40 km to the east of the site.</td>
</tr>
<tr>
<td>Rainbow Bee-eater (<em>Merops ornatus</em>)</td>
<td>M</td>
<td>Open or lightly timbered areas, shrublands, farmland, cleared land, mangroves and rainforest edges. Also disturbed areas that have exposed bare soil in banks for breeding (Higgins, 1999).</td>
<td>Known. Wide spread and common species. Detected in Project area during site surveys. Wildnet database records. ALA shows numerous records within 10 km of the site located to the north, west and east.</td>
</tr>
<tr>
<td>Spectacled Monarch (<em>Symposiachrus trivirgatus</em>)</td>
<td>M</td>
<td>Both species generally occur mostly in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins <em>et al.</em>, 2006).</td>
<td>Unlikely. Lack of suitable habitat in the Project area. No database records or records from previous surveys. The nearest ALA record is approximately 50 km to the southeast of the site.</td>
</tr>
<tr>
<td>Satin Flycatcher (<em>Myiagra cyanoleuca</em>)</td>
<td>M</td>
<td>Satin Flycatchers are mostly found in eucalypt forest, favouring wet forests, moist gullies and watercourses (Higgins <em>et al.</em>, 2006).</td>
<td>Unlikely. There is a possibility that this species may occur on the fringes of the Project area and the SRBP area. However, it is unlikely that the species occurs across the majority of the Project area. During autumn/spring migrations but generally migrates along coastal areas.</td>
</tr>
<tr>
<td>Rufous Fantail (<em>Rhipidura rufifrons</em>)</td>
<td>M</td>
<td>Generally occur in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins <em>et al.</em>, 2006).</td>
<td>Known. This species was detected in the Big Footprint Swamp area during surveys for the SRBP. The Pisolite Hills IAS survey identified this species within mangrove habitat at the port development area. Wildnet database records. Atlas of living Australia shows two records within 10 km of the Project site located to the west.</td>
</tr>
<tr>
<td>Barn Swallow (<em>Hirundo rustica</em>)</td>
<td>M</td>
<td>Utilises open country with water or low moist green vegetation, such as pastures and farm crops, near margins of wetlands and human settlements. The species usually avoids densely populated areas.</td>
<td>Potential. Unlikely within the Project area, may occur in the wider region where suitable open habitat may occur. No database records or records from previous studies. The nearest ALA record is approximately 50 km to the southeast of the site.</td>
</tr>
<tr>
<td>Red-rumped Swallow (<em>Hirundo daurica</em>)</td>
<td>M</td>
<td>Found in grassland areas where they feed on insects. Vagrant to Australia and breeds in open hills within southern Europe and Asia.</td>
<td>Unlikely. No suitable habitat exists within the Project area. The tetrodonta woodlands are not likely to provide sufficient open habitats and grasslands for foraging. The closest record of the species is on Thursday Island – some 130 km north of the Project area.</td>
</tr>
</tbody>
</table>
The majority of these species are dispersive or seasonal migrants that move location as conditions for foraging and/or breeding become suitable. There are no distinct migratory routes for these species at or near the Project area. As such, no maps of migration routes are presented.

**Great Egret (Ardea alba) and Eastern Cattle Egret (Bubulcus coromandus)**

Eastern Cattle Egret and Great Egret were recorded within the Project boundary in low abundance on Big Footprint Swamp, in groups of six and two respectively. Both recorded in same area during surveys for SRBP (RPS, 2015a).

Great Egret is a common widespread species that may be found in most shallow, coastal and inland wetland habitats, both estuarine and freshwater and including man-made dams, ponds and moist grasslands (Marchant and Higgins, 1990; and Pizzey and Knight, 2007). This species hunts for fish, frogs and aquatic insects by wading slowly and waiting for prey (Marchant and Higgins, 1990). Breeding takes place mostly in summer, but also extends into autumn, with nests built in trees fringing or flooded by water, often in colonies (Marchant and Higgins, 1990; and Pizzey and Knight, 2007).

Eastern Cattle Egrets inhabit grasslands, wetlands and wooded lands, often foraging away from water in damp grassland, pasture and crops. The species is strongly associated with grazing animals in Australia, but also forages at garbage tips, follows machinery, and feeds independently. As with Great Egret the species breeds in summer, tending to nest in colonies and over water (Pizzey and Knight, 2007). Occurs in higher rainfall areas of pastoral Australia (McKilligan, 2005).

**Eastern Osprey (Pandion cristatus)**

Recorded during surveys in February 2015 for the SRBP (RPS, 2015).

The Eastern Osprey is found along the entire Australian coastline and may occur far inland on rivers and lakes, particularly in wet years (Debus, 2012). This species feeds on fish, foraging in rivers, lakes, estuaries and inshore coastal waters. Breeding pairs require nesting sites near suitable foraging areas, and nesting sites include tall trees and artificial structures such as power poles and towers (NPWS, 2002).

The Eastern Osprey population in Australia has decreased since European settlement but has been recovering in recent years (Olsen, 1998). They are threatened by loss of existing and suitable replacement breeding trees, disturbance at the nest site, reduction in quality and quantity of fish stocks, collision with or electrocution by power lines, and the use of pesticides (NPWS, 2002).

**Whimbrel (Numenius phaeopus) and Common Sandpiper (Actitis hypoleucos)**

Both species detected during surveys for the Project with Whimbrel observed on the Skardon River. Both species are summer migrants following breeding in the northern hemisphere. Whimbrel is largely a coastal species preferring estuarine areas and may occur around the entire Australian coastline. It is often found on the intertidal mudflats of sheltered coasts as well as harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It also used saltflats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and salt fields (Higgins and Davies, 1996). The Whimbrel is one of a small group of shorebird species that regularly roost in mangroves and other structures flooded at high tide. They often roost in the branches of mangroves around mudflats and in estuaries and occasionally in tall coastal trees. The greatest threat to the species is habitat loss (DotE, 2015).
Common Sandpiper utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al., 2007; Higgins and Davies, 1996). Both species are threatened by habitat loss such as coastal land and wetland reclamation (DotE, 2015).

**Little Tern (Sterna albifrons) and Gull-billed Tern (Geochelidon nilotica)**

Little Tern was detected during surveys for the Bauxite Hills Project. Gull-billed Tern was recorded during surveys in February 2015 for the SRBP (RPS, 2015a).

Within Australia, the Little Tern occurs along the coastal regions of eastern Australia, south to Tasmania, and across northern Australia, west to northern parts of Western Australia (Higgins and Davies, 1996). It is gregarious and usually occurs in small flocks, although it often roosts in large flocks. The species is found along a variety of coastal areas, including lagoons, estuaries, river mouths, lakes, bays, harbours and inlets, especially those with exposed sandbanks.

The species breeds along sandy beaches with nests located between the high tide mark and coastal vegetation (Holmes, 2012). Nests consist of a simple scrape in the beach substrate, sometimes lined with shell matter. In south-eastern and eastern Australia this species has suffered serious declines as a result of beachgoers, dogs and vehicles intruding on beach nest sites (Pizzey and Knight, 2003). Little Terns are also threatened by nest predation by rats, gulls, ravens, foxes and feral pigs, and by degradation of estuaries, pesticide residues in fish, and oil-fouling of both birds and beaches (Garnett et al., 2011).

Gull-billed Tern was added to the list of Migratory species under the EPBC Act in 2015. This is a relatively common and widespread species that is largely coastal in distribution but may also occur a well inland over larger freshwater bodies. It occurs on a variety of freshwater and saline wetlands including estuaries, mudflats and beaches. It is a colonial nesting species with nesting consisting of a lined scrape on offshore islands and sometimes elevated spits in lakes.

**Rainbow Bee-eater (Merops ornatus)**

Recorded near Big Footprint Swamp adjacent to the Project area boundary during surveys for the SRBP (RPS, 2015a).

The Rainbow Bee-eater is widely distributed throughout Australia and eastern Indonesia. The species occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (Higgins, 1999). It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water.

In Australia, the breeding season extends from August to January (Boland, 2004; and Higgins, 1999). The nest is located in an enlarged chamber at the end of a long burrow or tunnel that is excavated, by both sexes (DotE, 2015), in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (Higgins 1999). The species is distributed over much of mainland Australia and several near-shore islands.
Rufous Fantail (*Rhipidura rufifrons*)

Recorded near Big Footprint Swamp adjacent to the Project area boundary during surveys for the SRBP (RPS, 2015a).

Rufous Fantails occur in moist habitats, including closed forests, coastal scrubs, mangroves and along watercourses and gullies, and urban/rural areas during mid-year migration (Pizzey and Knight, 2007; Higgins *et al.*, 2006). They predominantly feed on small insects within the understorey (Higgins *et al.*, 2006). The species occurs across Northern Australia from the Kimberley to Cape York and down the entire eastern coast (Pizzey and Knight, 2007). The eastern races migrate to the north in early autumn and return in early spring to breed (Pizzey and Knight, 2007; Higgins *et al.*, 2006).

### 7.8.2 Marine Assessment Results

The EPBC Act Online Protected Matters search identified 14 marine fauna species listed as threatened (Critically Endangered, Endangered or Vulnerable) (see Table 7-17). A further 22 marine species listed as migratory under the EPBC Act and with potential to occur in the Project area and surrounds were identified.

#### Table 7-17 Predicted EPBC Act listed species – marine fauna

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>EPBC Status</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>WN</td>
</tr>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caretta caretta</td>
<td>Loggerhead Turtle</td>
<td>E,M</td>
<td>X</td>
</tr>
<tr>
<td>Chelonia mydas</td>
<td>Green Turtle</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Dermochelys coriacea</td>
<td>Leatherback Turtle</td>
<td>E,M</td>
<td>X</td>
</tr>
<tr>
<td>Eretmochelys imbricata</td>
<td>Hawksbill Turtle</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Lepidochelys olivacea</td>
<td>Olive Ridley Turtle</td>
<td>E,M</td>
<td>X</td>
</tr>
<tr>
<td>Natator depressus</td>
<td>Flatback Turtle</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balaenoptera musculus</td>
<td>Blue Whale</td>
<td>E,M</td>
<td>X</td>
</tr>
<tr>
<td>Megaptera novaeangliae</td>
<td>Humpback Whale</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td><strong>Sharks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carcharodon carcharias</td>
<td>Great White Shark</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Glyphis glyphis</td>
<td>Speartooth Shark</td>
<td>CE</td>
<td>X</td>
</tr>
<tr>
<td>Pristis clavata</td>
<td>Dwarf Sawfish</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Pristis pristis</td>
<td>Freshwater Sawfish</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Pristis zizron</td>
<td>Green Sawfish</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td>Rhincodon typus</td>
<td>Whale Shark</td>
<td>V,M</td>
<td>X</td>
</tr>
<tr>
<td><strong>Migratory Marine Fauna</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crocodylus porosus</td>
<td>Estuarine Crocodile</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Balaenoptera edeni</td>
<td>Bryde’s Whale</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Dugong dugon</td>
<td>Dugong</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Orcaella heinsohni</td>
<td>Australian Snubfin Dolphin</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Orcinus orca</td>
<td>Killer Whale</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Sousa sahuilensis</td>
<td>Indo-Pacific Humpback Dolphin</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Manta alfredi</td>
<td>Reef Manta Ray</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Manta birostris</td>
<td>Giant Manta Ray</td>
<td>M</td>
<td>X</td>
</tr>
<tr>
<td>Anoxypristis cuspidata</td>
<td>Narrow Sawfish</td>
<td>M</td>
<td>X</td>
</tr>
</tbody>
</table>

1: Status: Ex = Extinct; E = Endangered; CE = Critically Endangered; V = Vulnerable; M = Migratory; 2: Database source: WN = Wildlife online (accessed from EHP 2015); BA = Birdlife Australia; QM = Queensland Museum; PM = EPBC Protected Matters online search tool.
The EPBC Act Protected Matters search aims to include species which are likely to occur in a geographic region, based on known ranges and habitat preferences. Inclusion in the report does not necessarily mean that the animal or plant will occur at a specific location. Consideration of site specific information is important when assessing the results of the protected matters search and verifying that an animal or plant does occur at a specific locality, or has a high likelihood of occurring based on habitat attributes.

The threatened marine species and their potential to occur at or adjacent to the Project activities are listed below in Table 7-18.

### Table 7-18 Likelihood of occurrence of EPBC Act threatened marine species

<table>
<thead>
<tr>
<th>Species name</th>
<th>EPBC Act Status</th>
<th>Likelihood of occurrence in the Project area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loggerhead Turtle (Caretta caretta)</td>
<td>E,M</td>
<td><strong>Potential.</strong> The Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. The beaches adjacent to the proposed Project area are not important locations for Loggerhead Turtles (and this applies to the whole western Cape), although the waters are used for feeding.</td>
</tr>
<tr>
<td>Green Turtle (Chelonia mydas)</td>
<td>V,M</td>
<td><strong>Likely.</strong> There are seven widely separated breeding aggregations of Green Turtles that are considered separate stocks one of which is the Gulf of Carpentaria. The important nesting locations for the Gulf of Carpentaria Green Turtle stock are the Wellesley Islands, eastern Arnhem Land, Groote Eylandt and the Sir Edward Pellow Islands (Limpus, 2008a). Western Cape York is not an important nesting location. Forage potential in the Project area is low and unlikely to support Green Turtle for more than a short period.</td>
</tr>
<tr>
<td>Leatherback Turtle (Dermochelys coriacea)</td>
<td>E,M</td>
<td><strong>Unlikely.</strong> No major nesting has been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the Northern Territory. Some nesting has occurred in northern NSW near Ballina. However, no nesting has occurred in Queensland or NSW since 1996. The species is most commonly reported from coastal waters in central eastern Australia (from the Sunshine Coast in southern Queensland to central NSW); south-east Australia (from Tasmania, Victoria and eastern South Australia) and in south-western Western Australia. Based on this information Leatherback Turtles are highly unlikely to nest on western Cape York beaches or use the Gulf of Carpentaria as an important feeding area.</td>
</tr>
<tr>
<td>Hawksbill Turtle (Eretomochelys imbricata)</td>
<td>V,M</td>
<td><strong>Likely.</strong> Hawksbill Turtles are known to nest along western Cape York beaches, although the high density nesting locations are in Torres Strait (Long (Sassie), Hawkesbury and Dayman Islands) and islands in the northern Great Barrier Reef (e.g. Boydoning and Milman islands) (Limpus, 2009).</td>
</tr>
<tr>
<td>Olive Ridley Turtle (Lepidochelys olivacea)</td>
<td>E,M</td>
<td><strong>Likely.</strong> Low-density nesting occurs along the northwestern coast of Cape York Peninsula between Weipa and Bamaga (Limpus et al., 1983). Olive Ridley Turtle populations on western Cape York are at significant risk from the foraging activities of feral pigs.</td>
</tr>
<tr>
<td>Flatback Turtle (Natator depressus)</td>
<td>V,M</td>
<td><strong>Known.</strong> Flatback Turtles are the commonest nesting species in the proposed development area and the species nests only in Australia. There are several significant rookeries on islands in the Gulf Of Carpentaria. Available information demonstrates that nesting occurs on many beaches in the Gulf of Carpentaria. Along the part of western Cape York that has been surveyed, the beach between Port Musgrave and the Skardon River has the greatest prevalence of nesting.</td>
</tr>
<tr>
<td>Blue Whale (Balaenoptera musculus)</td>
<td>E,M</td>
<td><strong>Unlikely.</strong> The only known areas of significance to blue whales in Australian waters are feeding areas around the southern continental shelf, notably the Perth Canyon, in Western Australia, and the Bonney Upwelling and adjacent upwelling areas of South Australia and Victoria. Blue Whales are not known to regularly migrate through, aggregate, feed or breed in the Gulf of Carpentaria and as such the area is considered to be outside of their normal range.</td>
</tr>
<tr>
<td>Species name</td>
<td>EPBC Act Status</td>
<td>Likelihood of occurrence in the Project area</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Humpback Whale (<em>Megaptera novaeangliae</em>)</td>
<td>V,M</td>
<td>Unlikely. The feeding, migratory and calving areas for the eastern Australian and Western Australian populations of Humpback whales are known. The Great Barrier Reef complex and the Kimberley Region are important breeding and calving grounds for Humpback Whales. Hervey Bay and the Whitsundays appear to be important resting grounds for mothers and calves of the east coast population on their southward migration. Humpback whales are not known to regularly migrate through, aggregate, feed or breed in the Gulf of Carpentaria and as such the area is considered to be outside of their normal range.</td>
</tr>
<tr>
<td>Great White Shark (<em>Carcharodon carcharias</em>)</td>
<td>V,M</td>
<td>Unlikely. The northern-most Queensland record is Mackay. Areas where observations are more frequent include waters in and around some Fur Seal and Sea Lion colonies such as the Neptune Islands (South Australia); areas of the Great Australian Bight as well as the Recherche Archipelago and the islands off the lower west coast of Western Australia. Juveniles appear to aggregate seasonally in certain key areas including the 90 Mile Beach area of eastern Victoria and the coastal region between Newcastle and Forster in NSW. Therefore, white sharks are not known to regularly migrate through, aggregate, feed or breed in the Gulf of Carpentaria and as such the area is considered to be outside of their normal range.</td>
</tr>
<tr>
<td>Speartooth Shark (<em>Glyphis glyphis</em>)</td>
<td>CE</td>
<td>Likely. The Speartooth Shark have been recorded from the lower reaches (salinity between 0.8 and 28 ppt) of the Wenlock and Dacie Rivers and Port Musgrave as well as the Bizant River, and a number of river systems in the Northern Territory (Peverell et al., 2006). While it is possible that the species also occurs in other rivers of western Cape York, dedicated surveying and observer data from commercial fishing operations to date has not documented their occurrence elsewhere. Given the habitat preference of the species it possibly occurs in the Skardon River.</td>
</tr>
<tr>
<td>Dwarf Sawfish (<em>Pristis clavata</em>)</td>
<td>V,M</td>
<td>Likely. The Dwarf Sawfish occurs on sand and mudflats and upstream estuarine habitats, including in inundated mangrove habitats that the species access at high tides (Peverell, 2005; Stevens et al., 2008). Given the habitat preference of the species it is highly likely to occur in the Skardon River and may also occur at and adjacent to the proposed BLF.</td>
</tr>
<tr>
<td>Freshwater Sawfish (<em>Pristis pristis</em>)</td>
<td>V,M</td>
<td>Likely. The Freshwater Sawfish (previously identified as <em>Pristis microdon</em>) may potentially occur in all large rivers of northern Australia from the Fitzroy River in Western Australia to western Cape York and has a preference for river channel habitat. It is highly likely to occur in the Skardon River and may occur at and adjacent to the barge area.</td>
</tr>
<tr>
<td>Green Sawfish (<em>Pristis zijsron</em>)</td>
<td>V,M</td>
<td>Likely. The species is considered to be widely distributed throughout the Gulf of Carpentaria; however, it has a preference for sand and mud flats outside of river mouths (Peverell, 2005). It frequently utilises very shallow water (&lt; 1 m deep) and an individual animal commonly uses the same small patch of habitat repeatedly. Unlikely to be present at or adjacent to the barge landing. Individuals may occur at the river entrance shoals and at the transhipping location on the basis that adults are known to extend into deeper waters in the vicinity of river mouths.</td>
</tr>
<tr>
<td>Whale Shark (<em>Rhincodon typus</em>)</td>
<td>V,M</td>
<td>Unlikely. Ningaloo Reef, off the Western Australian coast, is the main known aggregation site of Whale Sharks in Australian waters. The species is generally found in areas of upwelling and at times when plankton abundance is very high (e.g. mass coral spawning event. Whale $S$ are known to regularly migrate through, aggregate, feed or breed in the Gulf of Carpentaria and as such the area is considered to be outside of their normal range.</td>
</tr>
</tbody>
</table>

Note: the likelihood of occurrence of “Likely” for Speartooth Shark and three Sawfish species is based on adopting a precautionary approach to the four species. There is no evidence suggesting the species do or do not occur in the Skardon River and as such, Metro Mining has assumed the four species do occur for the purpose of managing potential impacts.
An additional nine marine fauna species are listed as Migratory under the EPBC Act and are listed below in Table 7-19.

**Table 7-19 Likelihood of occurrence of EPBC Act migratory marine species**

<table>
<thead>
<tr>
<th>Species name</th>
<th>EPBC Act Status</th>
<th>Likelihood of occurrence in the Project area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryde’s Whale (Balaenoptera edeni)</td>
<td>M</td>
<td>Unlikely. There are two forms of Bryde’s #: the coastal form of Bryde’s Whale appears to be limited to the 200 m depth isobar, moving along the coast in response to availability of suitable prey. The offshore form is found in deeper water (500 m to 1000 m). No specific feeding or breeding grounds have been discovered off Australia. While Bryde’s whale may infrequently occur in the Gulf of Carpentaria, the region can be considered outside their normal distribution.</td>
</tr>
<tr>
<td>Killer Whale (Orcinus orca)</td>
<td>M</td>
<td>Potential. Killer Whales are more common in cold, deep waters, or inshore shelf waters near seal and sea lion colonies. As such the Gulf of Carpentaria can be considered to be outside its natural range. However, it has recently been reported that a single Killer Whale has been observed south of Weipa (August, 2014) (Cairns Post, Accessed March 29, 2015). Therefore there is some potential that Killer Whales may occasionally transit the western shores of Cape York Peninsula, and may pass through the waters offshore of the Skardon River.</td>
</tr>
<tr>
<td>Australian Snubfin Dolphin (Orcaella heinsohni)</td>
<td>M</td>
<td>Known. Also listed as Irrawaddy Dolphin (Orcaella brevirostris) which occurs in southeast Asian waters. The Australian Dolphin is now considered a separate species. The preferred habitat of Australian Snubfin Dolphins can vary regionally. There is no information to describe habitat preference of the species in the Gulf of Carpentaria. The species has been sighted in the recent past in the Skardon River estuary, south of the Project area in Port Musgrave (WorleyParsons, 2010) and in the Weipa area (RioTinto Alcan, 2012).</td>
</tr>
<tr>
<td>Indo-Pacific Humpback Dolphin (Sousa chinensis)</td>
<td>M</td>
<td>Known. Also listed as Sousa chinensis; however, the Genus has recently undergone revision and the dolphin that occurs in Australian waters has been assigned a new species name. The Indo-Pacific Humpback Dolphin has local populations along the Queensland coast that are small in number and discrete in geographic range (Hale et al., 1998). Population structure has not been determined within the Gulf of Carpentaria. The species has been sighted in the recent past south of the Project area in Port Musgrave (WorleyParsons, 2010) and in the Weipa area in 2012 (RioTinto Alcan, 2012).</td>
</tr>
<tr>
<td>Dugong (Dugong dugon)</td>
<td>M</td>
<td>Potential. Dugongs are known to occur in low densities in Port Musgrave (Saalfield and Marsh, 2004) and are closely associated with the areas of seagrass beds in the area. Seagrass surveys have been undertaken within the Skardon River since the late 1980s. Over this period a single sighting for Dugong has been recorded upstream within the Skardon River adjacent to the now decommissioned kaolin facility and barge ramp (Roelofs et al., 2003).</td>
</tr>
<tr>
<td>Estuarine Crocodile (Crocodylus porosus)</td>
<td>M</td>
<td>Known. The Estuarine Crocodile inhabits coastal and inland waterways from Gladstone to Cape York and through the Gulf of Carpentaria to the Queensland/Northern Territory border (Read et al., 2004) with the majority of the population occurring in tidally influenced areas (Fukuda et al., 2007). The habitat of the Estuarine Crocodile includes marine habitats such as mangroves, but they also commonly occur in freshwater habitats such as rivers, lakes and swamps. The species was recorded in Namaleta Creek during surveys for the SRBP (RPS, 2015a).</td>
</tr>
<tr>
<td>Giant Manta Ray (Manta birostris)</td>
<td>M</td>
<td>Unlikely. The Giant Manta Ray lives mostly in the open ocean, traveling with the currents and migrating to areas where upwellings of nutrient-rich water increase prey concentrations. As such the Gulf of Carpentaria can be considered to be outside its natural range.</td>
</tr>
<tr>
<td>Coastal Manta Ray (Manta alfredi)</td>
<td>M</td>
<td>Potential. The species is broadly distributed in tropical and subtropical waters. Aggregates at several sites of eastern Australia. Has been recorded from the Torres Strait.</td>
</tr>
<tr>
<td>Narrow Sawfish (Anoxypristis cuspidate)</td>
<td>M</td>
<td>Likely. Known to occur in the Gulf of Carpentaria and the most common sawfish species caught as bycatch from the local region (Peverell, 2005).</td>
</tr>
</tbody>
</table>

Note: the likelihood of occurrence of “Likely” for Narrow Sawfish is based on adopting a precautionary approach to the species. There is no evidence suggesting the species do or do not occur in the Skardon River and as such, Metro Mining has assumed the four species do occur for the purpose of managing potential impacts.
In addition to the species detailed above the EPBC Act Protected Matters search also listed several species listed as Marine under the EPBC act including:

- 34 species of seahorse/pipefish;
- 19 species of sea snake;
- Freshwater Crocodile (Crocodylus johnstoni);
- Common Dolphin (Delphinus delphis);
- Spotted Dolphin (Stenella attenuata); and
- Two species of Bottlenose Dolphin (Tursiops species).

Under the EPBC Act it is illegal to kill, injure, take trade keep or move species listed as Marine without a permit within a Commonwealth marine area. In addition all cetaceans (whales and dolphins) are protected in Australian waters and it is an offence to kill, injure or interfere with a cetacean in the Australian Whale Sanctuary (includes Commonwealth waters extending from the three nautical mile state waters to the boundary of the Exclusive Economic Zone).

The MNES guidelines do not assess the potential for significant impacts resulting from an action to species listed solely as marine under the EPBC act outside a Commonwealth marine area. As such, these species are not referred to in the following sections. For more information on these species and their potential to occur in the area refer to Chapter 6 – Marine Ecology and the Marine Ecology Technical Report (Appendix B3).

7.8.2.1 Threatened Marine Species Known or Predicted to Occur

The following section provides life cycle descriptions and habitat preferences of the threatened marine species considered likely or known to occur within the Project area. All species except Speartooth Shark are also listed as Migratory under the EPBC Act. The information provided is based largely on available desktop information. Further detail on each species is provided in the Marine Ecology Technical Report (Appendix B3).

**Flatback Turtle (Vulnerable)**

Flatback Turtles are the commonest nesting species in the proposed development area. The species nests only in Australia. They have a preference for shallow, soft-bottomed sea bed habitats away from reefs. The Flatback Turtle is carnivorous and mostly feeds on epibenthic invertebrates including sea cucumbers and soft corals. There are four genetic stocks of Flatback Turtles in Australia: Queensland east coast, Torres Strait/Gulf of Carpentaria, Northern Territory and Western Australia (Limpus, 2007). While nesting occurs at a large number of beach locations, some key rookeries have been identified. The most significant is Crab Island in the north-eastern Gulf of Carpentaria which is approximately 27 km southwest of Bamaga (Limpus et al., 1983). Other significant rookeries in the Gulf of Carpentaria include the Wellesley and Sir Edward Pellew Islands (Cogger and Lindner 1969; Limpus, 1995). In the north-western Torres Strait significant rookeries occur at Deliverance Island, Kerr Islet and Turu Cay (Limpus et al., 1989).

Available information demonstrates that nesting occurs on many beaches in the Gulf of Carpentaria. Flatback Turtles in the area of the proposed development nest all year round with a peak in May through to September. Along the part of western Cape York that has been surveyed, the beach between Port Musgrave and the Skardon River has the greatest prevalence of nesting (Table 7-20) (Bell, 2004). The most numerically important nesting location, Crab Island, produces mostly male
offspring while the scattered nesting in darker coloured beaches on western Cape York such as those in the area of the proposed development produce predominantly female offspring. Egg predation by feral pigs is identified as a significant impact on nesting success, and entanglement in marine debris (e.g. discarded fishing nets) has a significant impact on adults and hatchlings (Bell, 2004; Whytlaw et al., 2013).

Within the Marine Bioregional Plan for the Northern Marine Region these areas have been identified as ‘biologically important areas’ (BIAs). The Plan describes implementation of an 80 km buffer around these locations for management consideration (DotE, formally DSEWPaC, 2012). The nearest BIA for Flatback Turtles includes Crab Island located approximately 85 km to the north of the Project site.

Table 7-20 Number of turtle nesting tracks at four beach regions along western Cape York

<table>
<thead>
<tr>
<th>Location</th>
<th>Beach Distance (km)</th>
<th>Turtle Nesting Tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archer River to False Pera Head</td>
<td>35</td>
<td>Flatback Turtle - 35</td>
</tr>
<tr>
<td>False Pera Head to Boyds Bay</td>
<td>38</td>
<td>Flatback Turtle – 41; Olive Ridley/Hawksbill Turtle - 2</td>
</tr>
<tr>
<td>Pennymather River to Port Musgrave</td>
<td>39</td>
<td>Flatback Turtle – 60; Olive Ridley/Hawksbill Turtle - 1</td>
</tr>
<tr>
<td>Port Musgrave to Skardon River</td>
<td>35</td>
<td>Flatback Turtle - 95</td>
</tr>
</tbody>
</table>

**Loggerhead Turtle (Endangered)**

In Australia, the Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia (Limpus et al., 1992). While nesting is concentrated in southern Queensland and from Shark Bay to the North West Cape in Western Australia, foraging areas are more widely distributed. Loggerhead Turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas and individual animals show fidelity to both their foraging and breeding areas (Limpus, 2008b). The prey of Loggerhead Turtles is extremely diverse and principally of gastropod and bivalve molluscs, and portunid crabs and hermit crabs; but also consume other invertebrates less frequently including cnidarians (jellyfish and sea anemones), echinoderms (sea urchins and sea cucumbers) and fish (Limpus et al., 1994; 2001). The beaches adjacent to the proposed Project area are not important locations for Loggerhead Turtles (and this applies to the whole western Cape, although the waters are used for feeding.

**Green Turtle (Vulnerable)**

There are seven widely separated breeding aggregations of Green Turtles that are considered separate stocks: southern Great Barrier Reef (GBR), Coral Sea, northern GBR, Gulf of Carpentaria, Ashmore Reefs, Scott Reef and the Northwest Shelf (Bowen et al., 1992; Norman et al., 1994; Moritz et al., 2002). The important nesting locations for the Gulf of Carpentaria Green Turtle stock are the Wellesley Islands, eastern Arnhem Land, Groote Eylandt and the Sir Edward Pellew Islands (Limpus, 2008a). Western Cape York is not an important nesting location.

Adult Green Turtles eat mainly seagrass and algae, although they will occasionally eat other items such as jellyfish and sponges (Brand-Gardner et al., 1999; Read and Limpus, 2002; Arthur et al., 2007). No extensive beds of seagrass occur at and adjacent to the proposed barge locations, although *Halophila* species may be found as thin meadows of low density fringing the adjacent mangrove communities within the immediate subtidal zone. Algae and other macrophytes are also present. The biomass of seagrass and algae is unlikely to be suitable to support Green Turtles, even for a short period of time.
Hawksbill Turtle (Vulnerable)

Hawksbill Turtle in Australia is considered to comprise two distinct genetic stocks, one in the northeast of Australia and the other in Western Australia (Broderick et al., 1994; Limpus 2009). Hawksbill Turtles are generally associated with reef habitats. They feed principally on various species of sponge, but they may also feed on algae, soft corals and macro-zooplankton such as jellyfish and comb-jellies (e.g. Meylan, 1988; Berube, 2010). They are known to nest along western Cape York beaches, although the high density nesting locations are in Torres Strait (Long (Sassie), Hawkessbury and Dayman Islands) and islands in the northern Great Barrier Reef (Limpus, 2009). DSEWPac (2012) identifies a BIA surrounding the mainland coast of Western Cape York Peninsula north of the Cotterell River. The Cotterell River is located approximately 40 km north of the Skardon River.

Olive Ridley Turtle (Endangered)

The Olive Ridley Turtle has a worldwide circumtropical distribution, including northern Australia (Limpus, 2008c). It is highly likely that Australia has the largest remaining breeding population of Olive Ridley Turtles in the southeast Asia–western Pacific region (Limpus, 2008c). Low-density nesting occurs along the northwestern coast of Cape York Peninsula between Weipa and Bamaga (Limpus et al., 1983). Olive Ridley Turtle populations on western Cape York are at significant risk from the foraging activities of feral pigs (Whytlaw et al., 2013). Almost the entire Olive Ridley nesting population for Queensland occurs in the area of intense egg predation by feral pigs (Limpus, 2008c). Olive Ridley Turtles nest year round, although most nesting occurs during the dry season, from April to November. Immature and adult Olive Ridley Turtles are carnivorous, feeding principally on gastropod molluscs and small crabs, with foraging occurring from nearshore areas to the continental shelf (Limpus, 2009).

Dwarf Sawfish (Vulnerable)

The Dwarf Sawfish is distributed throughout northern Australian waters from the Gulf of Carpentaria and then across northern Australia and down into the Pilbara region of Western Australia. It is uncertain whether the species occurs along the coast of eastern Cape York. There are considered to be distinct populations on the west coast, the north coast and the Gulf of Carpentaria, with no migration between these locations (Phillips et al., 2011). The dwarf sawfish occurs on sand and mudflats and upstream estuarine habitats, including in inundated mangrove habitats that the species access at high tides (Peverell, 2005; Stevens et al., 2008). The species breeds in estuarine areas during the wet season with juveniles remaining in these areas up until about three years of age before migrating to other areas, with adults returning to the estuarine areas for pupping (Peverell, 2005; Thorburn et al., 2008). Given the habitat preference of the species it is highly likely to occur in the Skardon River and may also occur at and adjacent to the proposed barge landing area.

Largetooth Sawfish (Vulnerable)

The Largetooth Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River in Western Australia to western Cape York and has a preference for river channel habitat. It has a geographic range that also extends to the Queensland east coast to at least the Cairns region and down to approximately Perth in Western Australia (Stevens, 2005). It utilises both marine and freshwater habitats, but does not generally extend into coastal habitat such as the flats at the mouth of rivers, and appears to have a preference for waters of low salinity (Thorburn et al., 2004). Available information suggests that mature largetooth sawfish enter less saline waters during the wet season for pupping (Peverell, 2005). Freshwater areas (including isolated large
pools) are considered to be important nursery areas for the species (Peverell, 2005; Stevens et al., 2005). Unlike the dwarf sawfish, the Freshwater Sawfish does not associate with riparian vegetation such as mangroves (Wilson, 1999).

Given the habitat preference of the species it is highly likely to occur in the Skardon River and may occur at and adjacent to the barge area. However, given the salinity during the dry season is ambient seawater (35 ppt) and the species appears to have a preference for lower salinity water, the area around the barge landing area is unlikely to constitute critical habitat, at least during the dry season.

**Green Sawfish (Vulnerable)**

The Green Sawfish is distributed from about Cairns north to Shark Bay in Western Australia. It has been recorded in inshore coastal environments and offshore to 70 m of water, as well as estuaries and river mouths in slightly reduced salinities, but it does not enter freshwater habitats (Stevens et al., 2005). Its current distribution in Australia is considered to be substantially reduced as it was historically found the length of the Queensland east coast and into NSW. Smaller Green Sawfish (less than 2.5 m total length) are more common in inshore areas while larger animals (greater than 2.5 m total length) are found both inshore and offshore. The species is considered to be widely distributed throughout the Gulf of Carpentaria; however, it has a preference for sand and mud flats outside of river mouths (Peverell, 2005). It frequently utilises very shallow water (<1 metre deep) and an individual animal commonly uses the same small patch of habitat repeatedly (Peverell and Pillans, 2004; Stevens et al., 2008).

Given the current information on the habitat preference of the Green Sawfish, it is unlikely to be present at or adjacent to the barge landing. Individuals may occur at the river entrance shoals and at the transhipping location on the basis that adults are known to extend into deeper waters in the vicinity of river mouths.

### 7.8.2.2 Migratory Marine Species Known or Predicted to Occur

The following sections provide life cycle descriptions and habitat preferences of the marine species listed only as Migratory and considered likely or known to occur within the Project area. Further detail on each species is provided in the Marine Ecology Technical Report (Appendix B3).

**Estuarine Crocodile**

The Estuarine Crocodile inhabits coastal and inland waterways from Gladstone to Cape York and through the Gulf of Carpentaria to the Queensland/Northern Territory border (Read et al., 2004) with the majority of the population occurring in tidally influenced areas (Fukuda et al., 2007). The habitat of the Estuarine Crocodile includes marine habitats such as mangroves, but they also commonly occur in freshwater habitats such as rivers, lakes and swamps. The northwest Peninsula of Cape York is the most important region in Queensland for estuarine crocodile populations (Read et al., 2004). A high proportion (~85 %) of Estuarine Crocodile hatchlings on the northwest Peninsula of Cape York were recorded from the Wenlock River and its tributaries which highlights the importance of that area for Estuarine Crocodile populations. In northern Australia, Estuarine Crocodiles nest from November through until March (Webb et al., 1977).

The Port Musgrave area, and in particular, the Wenlock River, is recognised as containing significant habitat for the Estuarine Crocodiles with one of the largest breeding populations in Queensland (Abrahams et al., 1995; Read et al., 2004; DERM, 2007). The Cape York Peninsula Land Use Strategy (CYPLUS; Abrahams et al., 1995) has mapped the area as significant Estuarine Crocodile habitat, and the Draft Management Program for *Crocodylus porosus* in Queensland 2007-2017 (DERM, 2007) has highlighted Port Musgrave and North-Western Cape York Peninsula as two of five areas recognised
as a ‘principal geographic area’ where conservation efforts should be concentrated. The species was observed in Namaleta Creek during site surveys for the SRBP.

Crocodiles are a common resident of the Skardon River with bank slides and individuals being observed within the estuary system of the Skardon River on numerous occasions (Tom Koskela, pers. Comm.). The species was also observed during surveys for the SRBP (RPS, 2015a).

**Dugong**

Dugong (*Dugong dugon*) are long-lived (up to 70 years) marine mammals with low levels of reproductive output. After a gestation period of between 13 and 15 months, a female produces a single calf with calving intervals between three and seven years. Their slow breeding rate and long life span mean that Dugong are particularly susceptible to factors that threaten their survival and population recovery even when impacting processes are removed is slow. The Dugong, is the only herbivorous mammal that is strictly marine and a seagrass community specialist. Dugong prefer to select seagrass species that are high in nitrogen concentration relative to available seagrass resources and this is often the seagrass resources that are in the intertidal region (Sheppard *et al.*, 2010).

Dugong are abundant at many locations in the Gulf of Carpentaria and are usually associated closely with seagrass beds. A major proportion of dugongs in the Gulf of Carpentaria occur in the region of the Wellesley Islands, the Sir Edward Pellew Group, and Blue Mud Bay (Saalfield and Marsh, 2004). Of the estimated 27,602 (± 3,110) Dugong in the Gulf of Carpentaria, only 15 % occurred in the waters of the Queensland coast, reflecting the much greater area of seagrass along the Northern Territory coast (Saalfield and Marsh, 2004). Dugong are known to occur in low densities in Port Musgrave (Saalfield and Marsh, 2004) and are closely associated with the areas of seagrass beds in the area. Incidental observations while undertaking seagrass mapping identified the presence of Dugong feeding trails in the seagrass beds which is further evidence of Dugong foraging in Port Musgrave (WorleyParson, 2010). Seagrass surveys have been undertaken within the Skardon River since the late 1980s. Over this period a single sighting for dugong has been recorded upstream within the Skardon River adjacent to the now decommissioned kaolin facility and barge ramp (Roelofs *et al.* 2002).

Amyropogic impacts on dugong include: traditional hunting; incidental capture in large meshed commercial fishing nets; the shark control program; boat strike; and destruction of, and alienation from, seagrass habitat (Brodie and Waterhouse, 2012). Weather events such as cyclones that result in loss of seagrass habitat also contribute to the mortality of Dugong (e.g. Preen and Marsh 1995; Sobtzick *et al.*, 2012). While some seagrass of the genera (*Halophila* spp.) preferred by Dugong occur at and adjacent to the barge landing, and most probably elsewhere in the Skardon River (at least seasonally), it is unlikely to constitute a sufficient biomass to sustain a population of Dugong. Dugong consume between 21 and 36 kg of seagrass per day (Parks and Wildlife Service, 2003).

**Indo-Pacific Humpback Dolphin**

Indo-Pacific Humpback Dolphins occur in the coastal northern waters of Australia from approximately the Queensland – New South Wales border to Ningaloo Reef (Western Australia). The Indo-Pacific Humpback Dolphin has local populations along the Queensland coast that are small in number and discrete in geographic range (Hale *et al.*, 2004). However, population structure has not been determined within the Gulf of Carpentaria. Habitat preference of Indo-Pacific Humpback Dolphin is for shallow turbid estuarine and coastal waters (Parra 2006; Lin *et al.*, 2013) and in particular shallow channels (2 to 5 m) (Hale *et al.*, 1998), although they do range over a much larger depth range to approximately 20 m. Indo-Pacific Humpback Dolphins principally consume various species of coastal benthic and pelagic fish (Barros *et al.*, 2004; Parra and Jedensjö, 2013). Calves may
be born throughout the year, but spring and summer peaks are reported for many parts of their
range (Jefferson and Karczmarski, 2001), although whether this is the case in the Gulf of Carpentaria
is uncertain. The species has been recorded in recent years in the Port Musgrave area (Worley
Parsons, 2010) and further south near Weipa for the Amrun Project (RTA, 2013).

**Australian Snubfin Dolphin**

The preferred habitat of Australian Snubfin Dolphins can vary regionally. The largest recorded
population of Australian Snubfin Dolphin is in Blue Mud Bay (Northern Territory) which was
estimated at about 1,000 individuals with the dolphins preferring water depths between 2.5 and 18
m. Parra (2006) identified that in Cleveland Bay the preferred habitat was shallower water (1 to
5 m) in the vicinity of seagrass beds, whereas Cagnazzi et al. (2013) found that in Keppel Bay,
Australian Snubfin Dolphins used depths ranging from 2 to 15 m. There is no information to describe
habitat preference of the species in the Gulf of Carpentaria. Australian Snubfin Dolphins show a
larger dietary breadth than Humpback Dolphins, feeding on both fish and cephalopods (Parra
and Jedensjö, 2009). Like the Indo-Pacific Humpback Dolphins, coastal development is considered a
threat to the species, but it persists in areas with such developments – in this case Cleveland Bay
(Townsville) (Parra, 2006). This species exhibits site fidelity and long-term associations between
individuals. There is no reliable information on calving season.

Five dolphin sightings have been incidentally recorded, by PaCE, within the waters of the Skardon
River area between Mapoon (Cullen Point) and the lower estuary system of the Skardon River
(Table 7-21). Previous field investigations undertaken for the adjacent Port Musgrave area recorded
twenty four snubfin and two Humpback Dolphins sightings within the study area during 10 days of
field survey during 2009 (WorleyParsons, 2010).

<table>
<thead>
<tr>
<th>Date</th>
<th>Count</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2011</td>
<td>3</td>
<td>Within the lower Skardon River estuary.</td>
</tr>
<tr>
<td>January 2012</td>
<td>1</td>
<td>Within the lower Skardon River estuary.</td>
</tr>
<tr>
<td>November 2014</td>
<td>2</td>
<td>Transiting between Cullen Point and the Skardon River.</td>
</tr>
<tr>
<td>November 2014</td>
<td>1</td>
<td>The Skardon River mouth and inner estuary.</td>
</tr>
<tr>
<td>April 2015</td>
<td>10</td>
<td>The Skardon River mouth and at locations offshore from the river mouth feeding on schooling tuna.</td>
</tr>
</tbody>
</table>

**Narrow Sawfish**

The Australian distribution of Narrow Sawfish is unclear though it is most common in the Gulf of
Carpentaria (Last and Stevens, 2009). In a survey of the presence of the four sawfish species in
fisheries bycatch, Narrow Sawfish was the most abundant and was recorded in both the inshore and
offshore set net fisheries (Peverell, 2005). Though details of its ecology are not precisely known, it
probably spends most of its time on or near the bottom in shallow coastal waters and estuaries
(Compagno et al., 2006). The Narrow Sawfish inhabits estuarine, inshore and offshore waters to at
least 40 m depth (Last and Stevens, 2009). Inshore and estuarine waters are critical habitats for
juveniles and pupping females, whilst adults predominantly occur offshore (Peverell, 2005).
Northern Australia, particularly the Gulf of Carpentaria (Peverell, 2005), and parts of the
Queensland east coast (Harry et al., 2011), contain the most viable, ecologically functional
populations that remain worldwide.
Reef Manta Ray

The Reef Manta Ray is a large filter-feeding ray circum-globally distributed in tropical and subtropical waters (Couturier et al., 2012, cited in Marshall et al., 2011). While broadly distributed, populations appear highly fragmented, likely due to the specific resource and habitat needs of this species. It is commonly sighted inshore, around coral reefs and rocky reefs in coastal areas (Marshall et al., 2009; 2011) and within areas of upwelling which provide nutrient rich waters supporting high plankton abundance. The species predictably aggregates to particular locations such as Lady Elliot Island, North Stradbroke Island and Byron Bay in eastern Australia, for which they display a high degree of site fidelity (Couturier et al., 2011). Aggregation sites are strongly believed to represent critical habitats for this species. Reef Manta Ray has also been recorded from the Torres Strait (Couturier et al., 2011). While the presence of reef habitat and upwellings are limited in the gulf, the region comprises relatively high seasonal levels of productivity for phytoplankton and zooplankton. (Rothlisberg and Jackson, 1982).

7.9  MNES Impact Assessment – Terrestrial

7.9.1  Listed Threatened Species

7.9.1.1  Impact Assessment

Listed threatened species recorded or predicted as likely to occur within the Project area include Chocolate Tea Tree Orchid, Palm Cockatoo (Australian) and Black-footed Tree-rat (north Queensland). It is noted that Palm Cockatoo was listed as Vulnerable under the EPBC Act in October 2015. As the Project was listed as a Controlled Action in September 2015 the species is not required to be assessed. Nevertheless, the species is assessed under the EPBC Act Significant Impact Guidelines in the following sections.

The selection of impacts discussed and their evaluation is based on:

- The current understanding and layout of the Project (Section 7.4.4 and Chapter 2 – Description of Project);
- Currently known information about species affected (Section 7.8.1); and
- Information on potential impacts of Project construction and operation from the following sources:
  - Chapter 4 – Land
  - Chapter 5 – Terrestrial and Freshwater Ecology
  - Chapter 6 – Marine Ecology
  - Chapter 9 – Water Quality
  - Chapter 10 – Water Resources
  - Chapter 19 – Coastal Environment

Currently known information about the listed species is summarised in the community profiles shown in Table 7-22. Potential impacts and their mitigation measures are discussed under the individual headings below. Significance of the impacts is assessed subsequently using the significant impact criteria outlined in DotE (2013).
Table 7-22 Key data on threatened species

<table>
<thead>
<tr>
<th>Species</th>
<th>Baseline Data Results</th>
<th>EPBC Status</th>
<th>Key Threats</th>
<th>Recovery Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate Tea Tree Orchid (Dendrobium johannis)</td>
<td>Orchid specimens with some potential to be this species were recorded on the site. Suitable habitat occurs on the site and the species is considered likely to occur. Species occurs on trees growing in or close to swamps and in pockets of monsoon forest including Melaleuca species.</td>
<td>Vulnerable</td>
<td>Threats include habitat degradation and collection by orchid enthusiasts.</td>
<td>Cape York Peninsula Natural Resource Management Plan (Earth Tech, 2005)</td>
</tr>
<tr>
<td>Palm Cockatoo (Australian) (Probosciger aterrimus mcgillivrayi)</td>
<td>Eight WildNet records exist for Palm Cockatoo occurring within wider 25 km radius of study area. Recorded sporadically within Darwin Stringybark woodland during surveys for the Project. Also recorded in woodland fringingNamaleta Creek for SRBP. The species occur in eucalypt woodlands near closed forest or littoral forests. Pairs thought to occupy permanent breeding territories. The species can also occur in cleared areas. The species was recorded in RE 3.5.2 which dominates the mine pit areas mine area.</td>
<td>Vulnerable</td>
<td>Monitoring at Iron Range on the east coast the species has undergone gradual and continuing decline. Garnett et al., (2011) identified the following the following known threats to the Palm Cockatoo: Destruction of hollow-bearing trees during fires or cyclones; Destruction of habitat and decrease in hollow-bearing trees (mainly Weipa area); and Competition for hollows with increasing species such as Sulphur-crested Cockatoo.</td>
<td>The Action Plan for Australian Birds 2010 (Garnett et al., 2011)</td>
</tr>
<tr>
<td>Black-footed Tree-rat (Qld) (Mesembriomys gouldii rattoides)</td>
<td>No database records for the species occurring within wider 25 km radius of study area. Nearest ALA record approximately 60 km to the southeast. Individual recorded on remote camera during surveys for SRBP (refer Appendix B1). The species occurs in eucalypt woodlands often close to waterbodies and where hollows are plentiful. The habitat type in which the species was photographed was not recorded although most locations based in Darwin Stringybark woodland.</td>
<td>Vulnerable</td>
<td>Relatively poorly known but decline (approximately 30%) inferred from recent studies further south. Woinarski et al., (2014) identified destruction of habitat through clearing and fires as a threat.</td>
<td>Action plan for Australian mammals 2012 (Woinarski et al., 2014).</td>
</tr>
</tbody>
</table>

7.9.1.2 Potential Impacts and Mitigation Measures

Key potential impacts relating to threatened species likely to be found within and around the Project area include: habitat clearance and degradation, direct mortality and injury, noise and vibration, dust, and weeds and pests. These are described in further detail below.
Habitat Clearance and Degradation

The Project will require the clearing of remnant vegetation for construction of the MIA, open cut mine pits, road corridors and barge landing. Remnant vegetation may also provide habitat for fauna and flora listed as threatened under the EPBC Act. Vegetation clearing will take place in the dry season only. The layout of the proposed mine, associated infrastructure and the existing remnant vegetation on the site is depicted in Figure 7-15. Table 7-23 details the projected extent of vegetation clearing for each component and relevant REs within the Project including potential impacts to threatened fauna and flora species. Only those species considered ‘likely’ or ‘known’ to occur are considered. Table 7-23 also details the total projected clearing for each RE within the Project area and the remaining extent of each RE within a 20 km radius of the Project area and within the Cape York Bioregion. The extent of REs are based on ‘pure’ REs, or vegetation polygons in which only one mapped RE appears.

Table 7-23 Predicted impact on extant vegetation communities and MNES habitat

<table>
<thead>
<tr>
<th>RE</th>
<th>Brief Description</th>
<th>MNES Habitat</th>
<th>Extent of clearing impact (ha)</th>
<th>Within 20 km Radius of Project (ha)</th>
<th>Within Cape York Bioregion (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pit Areas (ha)</td>
<td>Infrastructure (ha)</td>
<td>Roads</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Rhizophora stylosa mangrove community</td>
<td>Not applicable</td>
<td>-</td>
<td>-</td>
<td>9.74</td>
</tr>
<tr>
<td>3.1.1a</td>
<td>Rhizophora stylosa/Ceriops tagal mangrove community</td>
<td>Not applicable</td>
<td>-</td>
<td>0.4</td>
<td>10.32</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Saltpan community fringing mangroves</td>
<td>Not applicable</td>
<td>-</td>
<td>-</td>
<td>0.25</td>
</tr>
<tr>
<td>3.1.6</td>
<td>Melaleuca quinquenervia open forest.</td>
<td>Chocolate Tea Tree Orchid</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
</tr>
<tr>
<td>3.3.12</td>
<td>Melaleuca spp. + Lophostemon suaveolens woodland on drainage swamps</td>
<td>Chocolate Tea Tree Orchid</td>
<td>7.9</td>
<td>-</td>
<td>0.62</td>
</tr>
<tr>
<td>3.3.22</td>
<td>Corymbia clarsoniana woodland on alluvial plains.</td>
<td>Not applicable</td>
<td>-</td>
<td>-</td>
<td>0.43</td>
</tr>
<tr>
<td>3.3.49b</td>
<td>Melaleuca viridiflora open woodland/ Lophostemon suaveolens open forest</td>
<td>Chocolate Tea Tree Orchid</td>
<td>-</td>
<td>-</td>
<td>7.22</td>
</tr>
<tr>
<td>3.3.9</td>
<td>Eucalyptus tetrodonta, Corymbia nesophila tall woodland</td>
<td>Palm Cockatoo Black-footed Tree-rat</td>
<td>1,343.3</td>
<td>17.53</td>
<td>68.59</td>
</tr>
<tr>
<td>Total remnant vegetation area</td>
<td></td>
<td></td>
<td>1,350.2</td>
<td>17.93</td>
<td>97.77</td>
</tr>
</tbody>
</table>
Potential Impacts

It is considered Chocolate Tea Tree Orchid, listed as Vulnerable under EPBC Act is likely to occur. The species is known from the broader region and the Project site contains suitable habitat for the species. Potential records of the Chocolate Tea Tree Orchid were encountered within wetland habitats proximate to the study area; however, individuals were not in flower and not able to be positively identified. All orchid species were detected in Melaleuca swamps outside of proposed mining operations and are unlikely to be impacted by the Project. A minimum buffer width of 365 m currently exists between proposed operations and the site of the records. Clearing for the Project will remove 16.34 ha of Melaleuca dominated habitat (RE 3.3.12, 3.3.14 and 3.3.49). These areas will be subject to an inspection by a qualified environmental specialist prior to clearing. Where individuals are identified they will be translocated to similar habitat elsewhere, where possible within the Project area boundary.

Palm Cockatoo has been observed on the site on several occasions during studies for the Bauxite Hills Project and SRBP. Habitat for the species includes Darwin Stringybark woodland (RE 3.5.2) and will be subject to the most clearing (1,429 ha over the life of the Project). The species nests in large tree hollows. Therefore it is anticipated that some impacts to this species may occur including a reduction in the quality and quantity of foraging and breeding habitat, although the species may be more likely to feed outside of this habitat.

Black-footed Tree-rat has been recorded on a remote camera trap during a SRBP survey in September 2014. Habitat for this species also includes Darwin Stringybark woodland although it may prefer eucalypt habitat closer to waterways. The species is also known to utilise tree hollows as daytime roost sites. Similar to the previous species, impacts to this species include a reduction in the quality and quantity of potential foraging and breeding habitat.

It is noted that Darwin Stringybark woodland is the dominant habitat in the region and bioregion. A further 44,280 ha of similar remnant habitat occurs within a 20 km radius of the Project. The Project will impact approximately 3.2% of this extent over the life of operations. A further 528,000 ha remains as remnant vegetation in the Cape York Bioregion.

Mitigation

Metro Mining will develop and prepare a site Rehabilitation Management Plan (RMP) which incorporates rehabilitation monitoring and trials and use of native species for rehabilitation. Rehabilitation will be carried out progressively across the site as the Project progresses. Flora species used for rehabilitation will be based on the results of Biocondition assessments already carried out during site surveys (refer Attachment 6, Appendix B1). The RMP Plan will incorporate the following:

- Monitoring of rehabilitation success to be conducted at locations representative of the range of conditions on the rehabilitating areas. Reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness;

- A seed bank will be maintained, sourced from adjacent undisturbed habitat and prior to clearing of Project impact areas;

- Use of fallen logs, rocks will be put into rehabilitation areas to retain fauna micro-habitats; and

- A small number of large, hollow-bearing trees will be selectively felled ahead of general clearing and will be relocated (e.g. cemented in place) within the rehabilitation areas to provide immediate breeding and nesting locations for some species, and act as ‘tall points’ for bird perching within the otherwise cleared areas, whilst rehabilitation is establishing.
General mitigation measures to be implemented to reduce the impacts of vegetation clearance and habitat loss include:

- Clear delineation of areas of native vegetation requiring removal to equipment operators and supervisors before any clearance to ensure disturbance is minimised;
- Use of some fallen logs, rocks will be put into adjacent habitats to retain fauna micro-habitats;
- Maintenance of retained areas of existing vegetation to assist in providing a source of seed for mine rehabilitation works; and
- Where practicable, minimise the total area of disturbance at any particular time and implement progressive rehabilitation.
Figure 7-15

Vegetation clearing for the Bauxite Hills Project

Legend
- Watercourse
- Area to be cleared
- Metro Mining Mine Lease Area

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
- QLD Government Open Source Data
- Australian Hydrological Geospatial Fabric (Geofabric) PRODUCT SUITE V2.1.1

CLIENT
Metro Mining Limited

DESIGNER
CDM Smith

DESIGNED
16/07/15

CHECKED
03/05/16

Scale @ A3 - 1:45,000
GCS GDA 1994 MGA Zone 54

For Information Purposes
Updated Pit Extents

F:\1_PROJECTS\BES150115_Bauxite_Hill\GIS\DATA\MXD\FINAL\ERA\TER_FW_EC\BES150115-009-R2_GROUND_REs_CL.mxd

SUMMARY

1. For information purposes
   16/07/15
   CDM Smith
   This drawing is confidential and shall only be used for the purpose of this project.

2. Updated Pit Extents
   03/05/16
   CDM Smith

DESIGNER
CDM Smith

CHECKED
03/05/16

CLIENT
Metro Mining Limited

Notes:

- Vegetation clearing for the Bauxite Hills Project
- Updated Pit Extents
Mortality and Injury

Potential Impacts

Direct mortality to MNES fauna may occur during tree clearing and during the construction phase of the Project and collision with increased vehicular activity during all Project phases. Mortality from tree clearing is only likely to impact Black-footed Tree-rat as it is anticipated that Palm Cockatoo individuals will disperse from the area prior to clearing should they occur in the local area. Increased traffic is only likely to impact Black-footed Tree-rat if it is encountered foraging on the ground at night. Increased traffic in the wider region is not expected as workers will be fly-in - fly out and stay on site.

No impacts are expected once the decommissioning phase has been completed and no further Project related traffic occurs within the Project area.

Mitigation

Workers at the site will be instructed to stop where feasible, when fauna are observed crossing roads and tracks. All clearing works will be supervised by a qualified fauna spotter in all remnant habitat. Speed limits will be in place on all roads throughout the Project area and set at levels which minimise the risk to fauna. Fauna exclusion fencing will be erected around construction and operational areas. The Project EMP will include other general measures to mitigate impacts to fauna such as:

- Vegetation clearing will be conducted in the early dry season (typically April to June) whilst the soil still retains some sufficient moisture to remove vegetation without leaving the root stock in-situ. This is outside the breeding season for a number of species. For example Palm Cockatoo is known to start nest preparation between August to November during the peak breeding period, although the species may breed all year round;

- A Significant Species Management Plan (SSMP) will be put in place prior to Project construction and clearing and include the presence of MNES species detailed in this Chapter. The Plan would outline measures such as translocation processes (during vegetation clearing) and maintain a register of MNES species records for the Project area and surrounds;

- Prior to vegetation clearing an ecological pre-clearance survey will be undertaken by an experienced environmental professional/fauna spotter. Results of the surveys will then inform additional measures that need to be taken either prior to, or during clearing. The surveys will include:
  - identify and mark any hollow bearing trees with a particular focus on potential breeding hollows used by threatened species (such as Palm Cockatoo), nests or other fauna breeding places
  - identify any available seed which can be collected where possible for future rehabilitation and
  - identify any listed flora or fauna species that may not have been recorded previously;

- During clearing fauna spotters will be present to identify any fauna or fauna breeding places, relocate fauna where possible, and ensure measures are taken to minimise impacts on fauna and their breeding places during clearing;

- The on-site Environmental Representative will be notified of any injured native fauna; and
Speed restriction will be imposed on the haul roads for safety reasons, which will also contribute to limiting fauna road mortality.

**Dust**

*Potential Impacts*

Increased dust resulting from excavations, topsoil stripping, vehicle movement, open cut mining activities and construction of infrastructure has the potential to impact flora and fauna within the Project area throughout construction and operation. Dust generation has the potential to smother plants, reducing photosynthesis and resulting in decreased vegetation condition or the death of vegetation. Increased dust can result in respiratory issues in fauna, adverse impacts on plant photosynthesis and productivity (Chaston and Doley, 2006), changes in soil properties ultimately impacting plant species assemblages’ (Farmer, 1993), and mortality and/or decrease in aquatic health on aquatic communities from the toxicity of poor water quality. In contrast, recent research on threatened flora in a semi-arid environment in Western Australia found no significant impact on plant health as a result of a range of dust accumulation loads (between 20 and 77 mg/m2) caused by vehicle movements (Matsuki *et al.*, 2016).

Project activities likely to generate dust include mining, waste rock stockpiling, vehicle movements, stockpiling (e.g. topsoil, spoil, product bauxite), and bauxite transport (e.g. haul trucks, etc.). A deposition rate of 500 mg/m2/day is considered sufficient to have a detrimental effect on plant health.

Air quality modelling for the Project (refer Chapter 12 – Air Quality) shows the highest daily dust deposition will occur at the mine village (located 300 m from operational areas on the Project site), with a total deposition of 58.7 mg/m2/day. This is approximately half of the recommended Air Quality Objectives set under State legislation and is not anticipated to significantly impact fauna and flora within the Study area.

**Mitigation**

Construction and operation activities will use appropriate dust suppression techniques, which will aid in limiting impacts of dust on vegetation and fauna including:

- Regular watering of active mining areas, stockpiles areas and haul roads that are subject to frequent vehicle movements;
- Where possible, erect physical barriers such as bunds and or wind breaks around stockpiles or areas where earth moving is required;
- Watering of overburden stockpiles if dust lift-off is visible;
- After initial extraction, all overburden material will be placed back within the mined area; and
- Overburden will be revegetated progressively.

Refer to Chapter 12 – Air Quality for more detailed management and mitigation measures related to air quality including dust suppression and avoidance measures.
Noise

Potential Impacts

Understanding of the impacts of noise on fauna is limited. There are no current government policies or guidelines that recommend thresholds or limits in relation to fauna. Noise may adversely affect wildlife by interfering with communication, masking the sound of predators and prey, causing stress or avoidance reactions, and in some cases may lead to changes in reproductive or nesting behaviour. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat.

Radle (2007) states the general consensus that terrestrial fauna will avoid any industrial plant or construction area where noise or vibration presents an annoyance to them. Additionally, many animals react to new noise initially as a potential threat, but quickly ‘learn’ that the noise is not associated with a threat (Radle, 2007). Increased noise from operation of machinery and vehicle traffic has the potential to disturb terrestrial fauna species and impact on feeding and breeding behaviour. In general, increased activity levels are likely to result in reduced fauna activity around work areas.

Noise will be generated by the Project through the use of machinery, plant, vehicles, and blasting. The generation of construction and operational noise will be in areas surrounded by intact woodland and wetlands. Fauna species that occur on the site are expected to leave the immediate area of noise impact. During operation the species may become habituated to adjacent habitat following completion of construction disturbance. Impacts to MNES threatened fauna from Project noise are expected to be minor at worst.

Mitigation

Construction and operation activities will use appropriate noise suppression methods, which will aid in limiting impacts of Project noise on surrounding fauna including:

- Training staff to operate the equipment in order to minimise unnecessary noise emissions;
- Keeping internal roads well maintained;
- As far as reasonably practicable, sources of significant noise will be enclosed;
- Acoustic covers to engines will be kept closed when the engines are in use and idling; and
- Plant machinery will be used in accordance with manufacturers’ instructions. Care will be taken to site equipment away from noise sensitive areas and where possible.

Refer to Chapter 13 – Noise and Vibration for more detailed management and mitigation measures related to air quality including dust suppression and avoidance measures.

Light

Potential Impacts

During the dry season it is proposed that mining operations will be continuous operating 24 hrs a day. Therefore lighting will be required at night associated with the mine areas, associated infrastructure such as MIA and accommodation camp, and haul roads. Headlights and flashing lights associated with vehicle movements will also contribute. Combined, these sources would also be expected to result in ‘sky glow’ or the general lightening of the night sky.
Light spill has the potential to impact on nocturnal terrestrial fauna species by disrupting feeding or breeding behaviour and reducing effective ranges. This is likely to be more pronounced in open woodland than light near mangroves as they are denser and light cannot penetrate. Though there are few studies on the impacts of artificial lighting on Australian fauna, research has shown behavioural changes in most faunal groups, for example sugar gliders, amphibians, sea turtles and birds (Ogden, 1996; Longcore and Rich, 2004).

Conversely, increased light will attract insects which may be beneficial for some species. Bats are solely nocturnal, highly mobile (i.e. more likely to come into contact with artificial lights) and forage at a height where light spill is most likely. As such, this group of mammals may be disproportionately affected by artificial lighting. Some species, which are not light adverse, would benefit from lighting due to an associated increase in insect abundance. Other species are light averse, and in some cases even small amounts of light may impinge on activity. Studies done in urban areas has shown that responses to artificial lighting by bats is species specific. Impacts to MNES threatened fauna from Project lighting are expected to be minor at worst.

**Mitigation**

Lighting will be required for the construction and operational activities associated with the Project. The current mine plan is based on a two 12-hour shifts for mining, therefore land-based lighting at night time will be required. The following lighting impact management measures will be employed for the Project:

- Direct lights away from adjacent bushland areas including installation of light shields and place lights back from retained bushland areas where possible;
- Lighting will be limited to only that which is essential during both construction and operational periods;
- Look at using lights that have a reduced light spill effect;
- Ground-level path lighting will be used, where practicable; and
- Intense lights, or cluster of light, will be avoided, where practicable.

**Increased Fire Risk**

**Potential Impacts**

The Project has the potential to increase fire risk associated with the operation of vehicles, and activities undertaken by site personnel (e.g. welding, cigarette butts). Uncontrolled fires have the potential to alter ecosystem characteristics and directly and indirectly impact on ecological values in the Project area. Vegetation communities such as *Melaleuca* wetlands which provide habitat for Chocolate Tea Tree Orchid are sensitive to fire and wildfires should be avoided. Uncontrolled fires may impact eucalypt woodland containing tree hollows that may provide resting and breeding habitat for MNES threatened fauna.

**Mitigation**

Appropriate management systems will be put in place to prevent accidental ignition of fires. Fire regimes and management measures will be documented in a site-specific Fire Management Plan (FMP) that will be developed in coordination with the Mapoon Land and Sea Rangers, and any neighbouring management plans. A fire break around the accommodation camp should be put in place and fuel loads managed within retained bushland around infrastructure and in wetland areas.
to minimise the risk of a hot bushfire occurring. Haul roads and access tracks can be used as fire breaks and to assist in managing fire.

Vegetation retained on site will be managed for fuel load and appropriate fire regimes will be put in place to maintain biodiversity values while minimising the risk of bushfire. Fire regimes and management measures will be documented in a site-specific FMP that takes into consideration safety needs but also the needs of each vegetation community and habitat attributes such as tree hollows. The FMP will be developed in coordination with the Mapoon Land and Sea Rangers, and any neighbouring management plans.

**Pest Fauna and Weeds**

*Potential Impacts*

Pest fauna are already present in the Project area and surrounds. Evidence of feral pig and cattle damage was observed at Big Footprint Swamp (refer Appendix B1). Feral predators such as cat and dingo have also been recorded during surveys of the area and have the potential to impact smaller fauna in general. Feral pigs may also spread weeds and creating erosional and water quality issues, particularly within habitats such as Big Footprint Swamp and mangrove habitats.

As plant and equipment is likely to be barged from Cairns, the introduction of tramp ants is a possible risk. Tramp ant species such as the Yellow Crazy Ant (*Anoplolepis gracilipes*) are those that are able to establish invasive colonies from a small founder population once introduced to an area. Yellow crazy ants, also known as crazy ants, are an introduced exotic species. They are widely regarded as environmental pests and are included as one of the world’s 100 worst invasive species. The pest ant has spread extensively since it was first discovered in Cairns in 2001 and despite Biosecurity Queensland’s ongoing treatment and surveillance activities, the known infested areas have increased since 2007. Several of the known infested areas were discovered in the past twelve months, significantly increasing the total area of infestation.

No highly invasive weed species currently occur within the Project area. Weeds known from the Weipa locality outside of the Project area with the ability to completely dominate and severely alter the ecosystems that they invade are:

- Sicklepod (*Senna obtusifolia*);
- Panicle Joint Vetch (*Aeschynomene paniculata*);
- Gamba Grass (*Andropogon gayanus*); and
- Prickly Croton (*Croton hirsutus*).

Potential impacts of invasive weed species include loss of habitat for native plants and animals and subsequent loss of biodiversity and safety hazards. The most significant potential impact of weed flora to terrestrial MNES is likely to be weed species that impact the wetlands in the area.

Movement of personnel, vehicles and equipment associated with construction and operational activities have the potential to facilitate the introduction and/or dispersal of weeds within the Project area and to the surrounding lands. However, the Project is not proposing to have any established road access into the site, therefore one of the major opportunities for the introduction and spread of weeds has been removed. While the risk of introducing weeds is minimised, importation of machinery and personnel into the area, particularly during the construction phase, still presents an opportunity for weed introduction.
The introduction and/or dispersal of weeds have the potential to:

- Increase competition for resources (e.g. space, light, nutrients) with native species;
- Reduce productivity of the land;
- Reduce natural biodiversity;
- Alter hydrological regimes, fire regimes and geomorphic processes;
- Injury or loss of native animals through injury or toxic death through consumption/contact; and
- Facilitate animal pest movement and disease spread.

**Mitigation**

A site-specific Pest and Weed Management Plan (PWMP) will be developed for the Project in coordination with the Mapoon Land and Sea Rangers, and in accordance with the Cook Shire Council Pest Management Plan 2012 – 2016. The pest fauna management aspect of the PWMP (appropriate to marine fauna) would be developed with the following measures:

- The program would focus on feral pigs, which are the main pest in the Project area; however, provision would be made for control of other fauna pests as required;
- The feral animal management program would be developed and implemented in the early stages of the Project;
- The program would focus on reducing pig numbers in sensitive environmental areas where pig populations are concentrated;
- Control measures would be compatible with accepted animal welfare outcomes; and
- The control program would include an appropriate monitoring plan for measuring program performance and guiding subsequent control effort.

Preventative methods are proposed to further reduce the risk of weeds being introduced into the area. These include:

- A thorough washdown procedure will be required for all plant and machinery prior to it being shipped to site;
- Clearing will be minimised to the area directly required for mining operations; and
- A washdown facility will be constructed on site for any vehicles that do enter/leave the mining lease areas, with a standard washdown procedure to be followed.

Any weeds that are identified within the Project will require appropriate treatment to reduce the potential for these species to spread to new areas. Should weed infestations occur, the treatment applications will be selected relevant to the species, the size and growth stage of each infestation and the timing of application.

Metro Mining will also develop and implement a Waste Management Plan to ensure that wastes are appropriately managed onsite, with a focus on reducing access to food wastes by pest fauna species (refer to Chapter 14 – Waste Management). Refer Chapter 8 – Biosecurity for more detail associated with mitigating the spread of pest fauna and weeds.
Impacts on Surface Water

Potential Impacts

Potential impacts to surface waters arising from the Project with the potential to impact aquatic values of the Project area include, water quality and alteration of surface water inflows to the swamps and wetland associated with the Skardon River. Surface flow modelling has been undertaken to determine surface water flows of the Project area. The modelling is detailed in the Surface Water Technical Report (see Appendix E2) including appropriate management and mitigation measures which are summarised in this section.

During mining, minor drainage channels supplying water to the Skardon River and associated swamps and wetlands will be disrupted, potentially altering flows to these watercourses. Surface water flows from areas associated with the Project may carry pollutants including, sediments, hydrocarbons and other chemicals. These will negatively impact water quality of aquatic environs, and lead to significant impacts of aquatic values. However, with appropriate mitigation measures applied no impacts to MNES threatened fauna are expected.

Mitigation

Management of potential impacts to water quality within aquatic environs will include:

- Implementing a site-specific Surface Water Management Plan;
- Implementation of the site ESCP which incorporates rehabilitation monitoring and trials;
- Sediment containing stormwater from mining operations will be directed to sediment ponds;
- Sediment removal devices will be incorporated in the watercourse crossing design, where appropriate, to reduce sediment loads entering the system; and
- Implementing suitable spill containment around hydrocarbon, chemicals and other harmful substance stores.

A Receiving Environment Monitoring Program (REMP) will be developed and periodically updated as required throughout the life of the Project. The REMP will be implemented through the EMP and will incorporate water quality monitoring to be undertaken up and down stream of the mine site, and in all Project affected waterbodies and watercourses on-site.

Refer to Chapter 9 – Water Quality for additional detail and management and mitigation measures associated with potential impacts to surface water.

Impacts to Groundwater

Potential Impacts

Groundwater resources are present within the Project area and have been assessed in Chapter 10 – Water Resources and Appendix E1. An assessment of the groundwater resources in the Project area has been completed and potential impacts to groundwater discussed. One potential area of impact is due to clearing of vegetation required and lowering of the ground surface during mining this has the potential to temporarily increase recharge rates.

Numerical groundwater modelling predicts that groundwater discharge rates to Big Footprint Swamp and Skardon River (including the tributaries and estuary) may increase during mining. The
quality of recharge water is expected to remain unaffected and relatively small additional volumes of groundwater discharged to the Skardon River are not expected to adversely affect aquatic or riparian ecosystem function.

Numerical groundwater modelling for the Project predicts that groundwater discharge rates to Big Footprint Swamp will have a minor net increase during and post mining activities. Using baseline information gathered for Big Footprint Swamp the groundwater modelling predicts that with, and without, the Bauxite Hills Mine, pool level fluctuations between wet and dry seasons would be very similar. With mining a maximum increase in pool level of 0.35 m above the pre-disturbance baseline may occur, although the maximum predicted increase in the peak pool level, at the height of the wet season, would be 0.15 m.

Currently Big Footprint Swamp has an area absent of any tree species directly surrounding the area of standing water during the dry season. If the size of standing water during the dry season significantly increases in area, and does not recede over several years, it is possible for *Melaleuca* trees to be impacted by anaerobic soil conditions. The modelling results indicate this to be highly unlikely due to the negligible effect on the extent of the inundation zone and connectivity of the swamp with groundwater. As recharge and groundwater discharge are expected to reduce following rehabilitation, any area of the swamp affected temporarily will likely be recolonised by *Melaleuca* trees post-mining. In the worst case scenario where the area of *Melaleuca* species declines this may have a temporary impact on habitat for the Chocolate Tea Tree Orchid (should it occur in the area of impact); however, as stated this is considered unlikely to occur.

**Mitigation**

A Ground Water management Plan (GWMP) will be established. Ongoing monitoring and analysis will refine the understanding of the hydrogeological regime of Big Footprint Swamp and the Skardon River and the sensitivity of the associated ecosystems to small variations in pool levels/groundwater discharge rates. If the outcome of further monitoring and investigation identifies unacceptable risks, direct intervention, such as redirection of excess water, may become necessary i.e. minimise the extent of the dry season inundation zone to facilitate aeration of the root zone and maintain the existing extent of *Melaleuca* trees. Further information is provided in detail in the Groundwater Technical Report (Appendix E1) regarding Big Footprint Swamp and potential impacts from hydrology changes.

Refer to Chapter 9 – Water Quality and Chapter 10 – Water Resources for management and mitigation measures associated with potential groundwater impacts.

### 7.9.1.4 Impact Significance

Assessment of impact significance has been completed as per DotE Significant Impact Guidelines (2013). These included criteria for species listed as Vulnerable at the time the Section 75 decision for this Project was made (September 2015), including Chocolate Tea Tree Orchid (Table 7-24) and Black-footed Tree-rat (Table 7-25). As stated previously Palm Cockatoo was listed as Vulnerable in October 2015 and as such is not required to be addressed for the Project. Nevertheless this species has been in Table 7-26.

The vulnerable species assessments commence with an evaluation of the likely importance of the population, as defined within the significant impact criteria for vulnerable species:

‘An important population is a population that is necessary for a species’ long-term survival and recovery.'
This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species’ range.

Given the specificity of the above definition and the scarcity of information and records available for most listed species and populations in the region (and Australia), it is difficult to determine: 1) attributes such as breeding and dispersal behaviour and whether the particular population is a ‘key source’ and 2) the genetic diversity of individuals inhabiting a population or sub-population. Given the paucity of information available, significance of impacts to threatened species has been based on experience of the assessment team and the latest available information.

**Chocolate Tea Tree Orchid**

The Chocolate Tea Tree Orchid is known to occur in Cape York and prefers open, humid habitats and is often found on trees growing in or close to swamps and in pockets of monsoon forest (Queensland Herbarium, 1997). Vegetation surveys have confirmed suitable habitat for the species does occur in the broader Project area, such as the lower melaleuca wetlands and fringing habitats. Given these suitable habitats occur within and proximate to the Project area and *Dendrobium* species were found within these habitats, it is likely this species could occur. The specimens were noted as likely to be The Three Lamellas Dendrobium based on their habit and form. As surveys were conducted at a time when the species is not flowering, it has been classified as "likely to occur".

No orchids have been identified in the proposed clearing footprint of the Project. Pre-clearance surveys will be undertaken by suitably qualified ecologists prior to clearing. Any orchids identified in proposed disturbance areas will be recorded and relocated to suitable habitat away from any potential disturbance. The species flowering period is March to July and if flowering individual orchids are found a sample will be taken for confirmation from the Queensland Herbarium. The area lies well within the known range of the species and an ‘important population’ is not considered likely to occur. Further discussion is included in Table 7-24.
Table 7-24 Assessment against significant impact criteria: Chocolate Tea Tree Orchid

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment Against Significance Criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>All orchids identified during surveys were not within the proposed disturbance areas for the Project. A number of orchid specimens were identified within fringing melaleuca and mangrove communities adjoining the proposed impact areas. The proposed action is not expected to result in a decrease to individual or orchid populations as no orchids were found within the proposed impact areas, and a minimum of 300 m buffer is proposed to these records. The proposed action will only result in minor impacts to habitat for these species such as wetlands including melaleuca and mangrove fringing communities. Approximately 37 ha of potential habitat is anticipated to be cleared to accommodate Project infrastructure. Should any threatened orchids be confirmed within the impact areas prior to clearing, they will be translocated where practicable into adjacent, suitable habitats that are outside of any potential impacts. Therefore no short term or long term decrease to the orchid populations are expected.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>The proposed action is not expected to result in a decrease to individual or orchid populations as no orchids were found within the proposed impact areas. The proposed action will only result in minor impacts to suitable habitat for these species such as wetlands including melaleuca and mangrove fringing communities. Approximately 37 ha of suitable habitat is anticipated to be cleared to accommodate Project infrastructure. Areas of melaleuca wetlands and mangroves are being retained on site and there are also large areas of suitable habitat for the orchid species in adjacent areas to the Project that will support populations. The Project is not expected to reduce the area of occupancy of important orchid populations.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project will not fragment existing orchid populations. Where orchids were found, and suitable habitat areas, all occur within the wetland areas of melaleuca and mangrove communities. These habitats are connected to the Skardon River and associated tributaries. Large areas of these habitats will be retained on site and are connected to adjacent habitats in the north, south and west of the Project.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>All orchids identified during surveys were not within the proposed disturbance areas for the Project. A number of orchid specimens were identified within fringing melaleuca and mangrove communities adjoining the proposed impact areas. The proposed action is not expected to result in a decrease to individual or orchid populations as no orchids were found within the proposed impact areas, and a minimum of 300 m buffer is proposed to these records. The Project will not adversely affect habitat critical to the survival of the species.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>It is considered the proposed action will not disrupt the breeding cycle of any existing important populations. The orchid species habitats are within wetland areas of melaleuca and mangrove communities. These are connected to the Skardon River and associated tributaries. Large areas of these habitats will be retained on site and adjacent areas therefore reproduction will not be impacted.</td>
</tr>
</tbody>
</table>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

All orchids were detected outside proposed Project impact areas within fringing melaleuca and mangrove communities. These specimens were noted as likely to be The Three Lamellas Dendrobium based on their habit and form; however, there is potential for some of these specimens to be Chocolate Tea Tree Orchid which is a very similar species (these species were recently known as the same species and referred to as Chocolate Tea Tree Orchid). No flowering material was present at the time of the survey. Therefore identification could not be confirmed.

The proposed action will only result in minor impacts to habitat for these species such as wetlands including melaleuca and mangrove fringing communities. Approximately 37 ha of suitable habitat is anticipated to be cleared to accommodate Project infrastructure. Should any threatened or least concern orchids be confirmed on site within proposed clearing areas they will be translocated to suitable adjacent habitats that are not subject to disturbance.

Although the action will result in the removal of up to 37 ha of potential habitat for the species, there are still large areas of suitable habitat being retained on site. Also large areas of suitable habitat exist in the broader region which support these orchid populations, therefore the species is unlikely to decline as a result of the Project.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat

Ecological surveys found minimal weed incursion within areas of remnant vegetation. Weeds observed were generally restricted to areas surrounding existing disturbances such as the existing camp facility at Skardon Mine.

The Project will implement a PWMP to control the introduction and spread of weed species across the Project area. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure. The Project is considered unlikely to result in invasive species becoming established in this species’ habitat.

Introduce disease that may cause the species to decline

The Project EMP will incorporate the management of invasive species which will assist in the prevention of pest plant introduction and associated diseases resulting from Project activities. Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The Project is considered unlikely to introduce disease that may cause the species to decline. Monitoring of any confirmed threatened orchids will also occur during operation of the Project to identify if any impacts are arising from disease.

Interfere substantially with the recovery of the species

All orchids were detected outside proposed Project impact areas within fringing melaleuca and mangrove communities. The proposed action will only result in minor impacts to habitat for these species such as wetlands including melaleuca and mangrove fringing communities. Approximately 37 ha of suitable habitat is anticipated to be cleared to accommodate Project infrastructure. Should any threatened or least concern individual orchids be confirmed on site within proposed clearing areas they will be translocated to suitable adjacent habitats that are not subject to disturbance.

The action is not likely to interfere with the recovery of this species. No areas identified as priority recovery areas or offsets for this species are known from the Project area or adjoining lands.

Black-footed Tree-rat

The subspecies of Black-footed Tree-rat found in north Queensland was listed as Vulnerable under the EPBC Act in June 2015. It was recorded on a camera trap in unspecified habitat (although likely to be Darwin Stringybark woodland) during intensive surveys for Northern Quoll in September/October 2014 for the SRBP (RPS, 2015a). It was not recorded on any other occasion despite extensive small mammal and remote camera trapping and spotlighting over several surveys.

The nearest record to the Project area appears to be a 2004 EHP record located approximately 30 km east of Weipa. Current records hold the species at various locations on Cape York Peninsula including Mareeba, Piccaninny Plains and Mungkan Kandju National Park (Greencap, 2015). The
species current potential distribution is the entire Cape York Peninsula where extensive tracts of undisturbed woodland remain and the species may well go undetected. The density of individuals in the area is uncertain; however, it is noted that the species was not detected during any other surveys for the Project or SRBP. It is considered unlikely an important population occurs in the area.

Preclearance surveys will require the presence of a fauna spotter to check tree hollows for resident fauna prior to clearing and be present when clearing takes place. Should any individuals be located during tree clearing they will be relocated to suitable adjacent habitats by a qualified environmental practitioner/fauna spotter. A SSMP would be put in place prior to Project construction and clearing and include the potential presence of this species. The Plan would outline measures such as translocation processes (during vegetation clearing) and maintain a register of individual records which will also add to the knowledge of the extent of the species occurrence in the area. Further discussion is included in Table 7-25.

**Table 7-25 Assessment against significant impact criteria: Black-footed Tree-rat**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>It is unlikely an important population exists in the area. The Project requires the clearing 1,429 ha of Darwin Stringybark woodland (RE 3.5.2). This habitat remains widespread in the surrounding region with a further 44,280 ha located within a 20 km radius of the Project area. The habitat the species is considered more likely to occur in (eucalypt woodlands close to watercourses/low-lying areas) will remain largely undisturbed by clearing and will remain connected to similar vegetation beyond the Project’s boundary. Tree clearing activities will require the presence of a fauna spotter to check tree hollows prior to clearing. Should any individuals be located during preclearance activities they will be relocated to suitable adjacent habitats by a qualified fauna spotter. The Project is unlikely to lead to a long-term decrease in the size of an important population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>It is unlikely an important population exists on the site. The Project requires the clearing 1,429 ha of Darwin Stringybark woodland. This habitat remains widespread in the surrounding region. There is 44,280 ha of the same habitat within a 20 km radius of the site and over 520,000 ha within the Cape York Bioregion. The habitat the species is considered more likely to occur in (eucalypt woodlands close to watercourses/low-lying areas) will remain largely undisturbed by clearing and will remain connected to similar vegetation beyond the Project’s boundary. The Project is not expected to reduce the area of occupancy of an important population (should such a population occur on the site) by more than a very minor extent.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project requires the clearing 1,429 ha of Darwin Stringybark woodland in three separate areas. This habitat remains widespread in the surrounding area (44,200 ha in a 20 km radius) and Cape York Bioregion. The habitat the species is considered more likely to occur in (eucalypt woodlands close to watercourses/low-lying areas) will remain largely undisturbed by clearing and will remain connected to similar vegetation beyond the Project’s boundary. The Project will not fragment an existing important population of this subspecies.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>The Project requires the clearing 1,429 ha of Darwin Stringybark woodland in three separate areas. This habitat remains widespread in the surrounding area (44,200 ha in a 20 km radius) and Cape York Bioregion. The habitat the species is considered more likely to occur in (eucalypt woodlands close to watercourses/low-lying areas) will remain largely undisturbed by clearing and will remain connected to similar vegetation beyond the Project’s boundary. The Project is unlikely to adversely affect habitat critical to the survival of the subspecies.</td>
</tr>
</tbody>
</table>
## Criterion

<table>
<thead>
<tr>
<th><strong>Criterion</strong></th>
<th><strong>Assessment against significance criteria (vulnerable)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>It is unlikely an important population occurs in the area or at what population density. It is unknown at what time of year the species may breed in the region. Clearing of vegetation will occur in the dry season and will largely avoid areas where the species is more likely to occur (eucalypt woodlands close to watercourses/low-lying areas). Tree clearing activities will require the presence of a fauna spotter to check tree hollows prior to clearing and present when clearing. The Project is unlikely to disrupt the breeding cycle of an important population.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project requires the clearing of 1,429 ha of Darwin Stringybark woodland. This habitat remains widespread in the surrounding region with a further 44,280 ha located within a 20 km radius of the Project area. The habitat the species is considered more likely to occur in (eucalypt woodlands close to watercourses/low-lying areas) will remain largely undisturbed by clearing and will remain connected to similar vegetation beyond the Project’s boundary. The Project will not decrease the availability or quality of habitat to the extent that the species is likely to decline.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Ecological surveys found minimal weed incursion within areas of remnant vegetation. Weeds observed were generally restricted to areas surrounding existing disturbances such as the existing camp facility at Skardon Mine. The area was already found to have populations of pest fauna including feral pigs and cattle. The Project will implement a PWMP to control the introduction and spread of weed species across the Project area. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure. The Project is considered unlikely to result in invasive species becoming established in this species’ habitat.</td>
</tr>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>The Project EMP will incorporate the management of invasive species which will assist in the prevention of pest plant introduction and associated diseases resulting from Project activities. Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The Project is considered unlikely to introduce disease that may cause the species to decline. Monitoring of any confirmed threatened orchids will also occur during operation of the Project to identify if any impacts are arising from disease</td>
</tr>
<tr>
<td>Interfere substantially with the recovery of the species</td>
<td>There is no State or Commonwealth recovery plan for this species. With appropriate mitigation measures applied, any potential impact on Black-footed Tree-rat will be minor and is considered unlikely to interfere with the recovery of the species.</td>
</tr>
</tbody>
</table>

### Palm Cockatoo

This subspecies is distributed across the north of Cape York Peninsula, Queensland, from north of Pompuraaw on the west coast to Saltwater Creek, Princess Charlotte Bay on the east coast. The species inhabits closed forest and riparian systems, and open woodlands adjacent to these habitats. They feed mostly on the hard seeds of fibrous and woody fruits of woodland, littoral and closed forest species, taken from the canopy and the ground. It was recorded infrequently during dry season fauna surveys (November, 2014) in groups of one to three individuals throughout the Project area and observed during SRBP surveys in fringing woodland immediately to the north of Namaleta Creek and in Darwin Stringybark woodland.

The Project will impact potential breeding habitat where large nest hollows may occur; however, this is unlikely to present primary foraging habitat which will remain largely undisturbed. Vegetation clearing for the Project will be conducted in the dry season (probably May to August). This is outside the breeding season for Palm Cockatoo which is known to start nest preparation between August and November during peak breeding period, although the species breeds all year round. The species is well within its known range and an important population is considered unlikely to occur.
Preclearance surveys will require the presence of a fauna spotter to check tree hollows for resident fauna prior to clearing and be present when clearing takes place. A SSMP would be put in place prior to Project construction and clearing and include the potential presence of this species. Further discussion is included in Table 7-26.

### Table 7-26 Assessment against significant impact criteria: Palm Cockatoo

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>It is unlikely an important population exists in the area. The Project requires the clearing 1,429 ha of Darwin Stringybark woodland (RE 3.5.2). This habitat remains widespread in the surrounding region with a further 44,280 ha located within a 20 km radius of the Project area. Vegetation clearing for the Project will be conducted in the dry season (probably May to August) outside of the known breeding season for Palm Cockatoo. Should any individuals be located during tree clearing they will be allowed to leave the area before any works commence. The Project is unlikely to lead to a long-term decrease in the size of an important population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>It is unlikely an important population exists on the site. The Project requires the clearing 1,429 ha of Darwin Stringybark woodland. This habitat remains widespread in the surrounding region and is unlikely to comprise primary foraging habitat for the species. There is 44,280 ha of the same habitat within a 20 km radius of the site and over 520,000 ha within the Cape York Bioregion. The Project is not expected to reduce the area of occupancy of an important population (should such a population occur on the site) by more than a very minor extent.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project requires the clearing 1,429 ha of Darwin Stringybark woodland in three separate areas. This habitat remains widespread in the surrounding area (44,200 ha in a 20 km radius) and Cape York Bioregion. The Project will not fragment an existing important population of this subspecies.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>The Project requires the clearing 1,429 ha of Darwin Stringybark woodland. This habitat is unlikely to comprise primary foraging habitat for the species and remains widespread in the surrounding region with a further 44,280 ha located within a 20 km radius of the Project area. The Project will not adversely affect habitat critical to the survival of the species.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>It is unlikely an important population occurs in the area. Vegetation clearing for the Project will be conducted in the dry season (probably May to August) outside of the known breeding season for Palm Cockatoo. Should any individuals be located during tree clearing they will be allowed to leave the area before any works commence. The Project is unlikely to disrupt the breeding cycle of an important population.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project requires the clearing 1,429 ha of Darwin Stringybark woodland. This habitat remains widespread in the surrounding region with a further 44,280 ha located within a 20 km radius of the Project area. The Project is unlikely to adversely affect habitat critical to the survival of the subspecies.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Ecological surveys found minimal weed incursion within areas of remnant vegetation. Weeds observed were generally restricted to areas surrounding existing disturbances such as the existing camp facility at Skardon Mine. The area was already found to have populations of pest fauna including feral pigs and cattle. The Project will implement a PWMP to control the introduction and spread of weed species across the Project area. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure. The Project is considered unlikely to result in invasive species becoming established in this species’ habitat.</td>
</tr>
</tbody>
</table>
### 7.9.1.5 Summary of MNES Baseline – Terrestrial Species

On the basis of a review of existing records, habitat preferences, and field survey of habitats, ecological communities, and species, the following terrestrial MNES are known, or are considered likely to occur within or near the Project area:

- **Threatened Species:**
  - Chocolate Tea Tree Orchid (Vulnerable) (likely)
  - Palm Cockatoo (Australian) (Vulnerable) (known)
  - Black-footed Tree-rat (north Queensland) (Vulnerable) (known)

- **Migratory Species:**
  - Great Egret (known)
  - Eastern Cattle Egret (known)
  - Eastern Osprey (known)
  - Whimbrel (known)
  - Common Sandpiper (known)
  - Gull-billed Tern (known)
  - Little Tern (known)
  - Rainbow Bee-eater (known)
  - Rufous Fantail (known).

An assessment of the potential impacts associated with the Project on these species is provided in the following sections:

- Section 7.9.1 Listed Threatened Species; and
- Section 7.9.2 Listed Migratory Species.
7.9.2 Listed Migratory Bird Species

7.9.2.1 Impact Assessment

A total of nine species listed as Migratory were recorded during the Project field surveys (Table 7-16). Bird species are listed as Migratory under international conventions relevant to Australia and the ecological values of the Project areas including:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA); and
- Ramsar Convention on Wetlands.

The three Migratory bird agreements list bird species that migrate between Australia and the other parties to the convention i.e. Japan, China and the Republic of Korea. These agreements impose obligations on signatories to regulate for the protection of the listed Migratory bird species. Under Australia’s commitment and in accordance with Section 20 and 20A of the EPBC Act, it is an offence to carry out an action that will, or is likely to have, a significant impact on a Migratory bird species without prior approval from the Commonwealth.

The selection of impacts discussed and their evaluation is based on that provided in the previous section for threatened MNES species. Impacts such as light impacts already discussed are not treated further as the impacts are considered to be similar and do not warrant further discussion.

Currently known information about the listed species is summarised in the community profiles shown in Table 7-27. Potential impacts and their mitigation measures are discussed under the individual headings below. Significance of the impacts is assessed subsequently using the significant impact criteria outlined in DotE (2013).

Table 7-27 Key data on listed migratory species

<table>
<thead>
<tr>
<th>Migratory species</th>
<th>Baseline Data Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Egret (Ardea alba)</td>
<td>Present in low numbers at Big Footprint Swamp adjacent to mine area.</td>
</tr>
<tr>
<td><strong>Key Threats</strong></td>
<td>Threats to this species as identified by DotE (2015) include: loss and/or degradation of foraging and especially breeding habitat through alteration of water flows, drainage and/or clearing of wetlands for development, frequent burning of wetland vegetation used as nest sites, salinisation and invasion by exotic plants or fishes.</td>
</tr>
<tr>
<td><strong>Recovery Plans</strong></td>
<td>Currently no recovery, conservation or threat abatement plans have been developed for the Great Egret in Australia.</td>
</tr>
<tr>
<td>Eastern Cattle Egret (Bubulcus ibis)</td>
<td>Present in low numbers at Big Footprint Swamp adjacent to mine area.</td>
</tr>
<tr>
<td><strong>Key Threats</strong></td>
<td>Threats to this species as identified by DotE (2015) include: loss and/or degradation of foraging and especially breeding habitat through alteration of water flows, drainage and/or clearing of wetlands for development, persecution of large colonies in urban areas, and potential cat predation.</td>
</tr>
<tr>
<td><strong>Recovery Plans</strong></td>
<td>Currently no recovery, conservation or threat abatement plans have been developed for the Eastern Cattle Egret in Australia.</td>
</tr>
<tr>
<td>Eastern Osprey (Pandion cristatus)</td>
<td>Recorded in surveys for SRBP (RPS, 2015a).</td>
</tr>
</tbody>
</table>
Migratory species

Key Threats
The main threat to this species is coastal development altering and degrading habitat. Other threats include pollutants such as pesticides impacting fish prey and water quality, competition with humans for prey, and persecution by humans (DotE, 2015).

Recovery Plans
Currently no recovery, conservation or threat abatement plans have been developed for the Eastern Osprey in Australia.

Whimbrel (*Numenius phaeopus*)

Baseline Data Results
Observed along Skardon River during Bauxite Hills surveys.

Key Threats
Key threats to this species include:
- Land clearing (particularly in Asian flyway locations), habitat fragmentation and/or habitat degradation due to agricultural activity, as well as other rural and urban developments;
- Climate change altering atmosphere/hydrosphere temperatures, rainfall patterns and/or frequency of severe weather events;
- Competition and/or habitat degradation by weeds;
- Increased predation from feral species;
- Declining water quality (salinity, nutrient and/or turbidity) and changes in wetland hydrology; and
- Pollution due to oil spills and other chemical pollutants (DotE, 2015).

Recovery Plans

Common Sandpiper (*Actitis hypoleucos*)

Baseline Data Results
Observed during Bauxite Hills surveys.

Key Threats
Key threats to this species include:
- Habitat loss and degradation, particularly in Asian flyway locations;
- Climate change altering sea levels and associated breeding/feeding grounds; and
- Impacts to freshwater flows (e.g. dams and weirs) and water quality (DotE, 2015).

Recovery Plans

Gull-billed Tern (*Gelochelidon nilotica*)

Baseline Data Results
Recorded in surveys for SRBP (RPS, 2015).

Key Threats
No threats noted for this species.

Recovery Plans
Species only recently listed as Migratory (June 2015) and no recovery or threat abatement plans have been developed for the Gull-billed Tern in Australia.

Little Tern (*Sterna albifrons*)

Baseline Data Results
Observed along Skardon River during Bauxite Hills surveys.

Key Threats
Naturally high nesting failure exacerbated by human-induced threats such as nest predation by introduced fauna, human recreational beach disturbance and coastal development impacting breeding habitat.

Recovery Plans
Little Tern Recovery Plan NSW (NSW NPWS, 2003).
Migratory species

Rainbow Bee-eater (*Merops ornatus*)

Baseline Data Results

Likely to occur within Project area but not recorded during the site surveys. This common widespread species is primarily an aerial species which although likely to present in the local area is unlikely to be reliant or dependent on the extant habitats. The species may use some of the study area for breeding and detailed surveys over seasons would be required to establish the actual level of presence and its habitat use.

Key Threats

- Hunting;
- Competition and/or predation from exotic species including the Cane Toad, Domestic Dog, Dingo and Fox);
- Vehicle related mortality from roads and railways; and
- Collision with shipping infrastructure (DotE, 2015).

Population size and population trends for this species have not been quantified, but the current population size is assumed to be reasonably large with little documented evidence of population declines. The Rainbow Bee-eater is currently considered to be a low priority for management (DotE, 2015).

Recovery Plans

No recovery plans currently exist for this species. Further research is required to determine the population size and population trends, determine threats and their actual or potential impacts, before any management programs can be implemented meaningfully.

Rufous Fantail (*Rhipidura rufifrons*)

Baseline Data Results

*Mine Area*

Recorded near Big Footprint Swamp adjacent to the Project boundary during surveys for the SRBP.

Key Threats

The main threat to this species is the continued clearing and fragmentation of suitable moist forest habitat (particularly along migration routes) by expanding urbanisation and other development.

Recovery Plans

No recovery plans currently exist for this species.

Migratory Bird Habitat

For waterbirds, the most important habitat area in proximity to the Project area is Big Footprint Swamp where Great Egret and Cattle Egret were recorded in low numbers. The swamp may also provide local breeding habitat for these species. Mangroves in the surrounding area may also provide roosting habitat for Migratory shorebird species such as Whimbrel as well as foraging habitat for Rufous Fantail.

As defined under the Significant Impact Guidelines 1.1 (DotE, 2013), an area may be classified as an ‘important habitat’ for a migratory species if the area contains:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- Habitat that is of critical importance to the species at particular life-cycle stages;
- Habitat utilised by a migratory species that is at the limit of the species range; and/or
- Habitat where the species is declining.

It is considered very unlikely the area can be considered as ‘important habitat’ because:

- The species were all observed in low numbers and there is no evidence suggesting the region supports an ecologically significant proportion of the populations of any of these species;
Given the widespread distribution of all of the species observed and the lack of observed breeding/nesting within the Project area, there is no evidence to suggest the habitat is of critical importance at particular life-stages for these species. The habitat that occurs across the Project site remains abundant across the region; and

The Project area is not at the limit of any of the species range or is it known to be habitat where any of the species is declining.

In addition, the Project area is unlikely to serve as a significant ‘staging’ site (resting place and feeding ground) for migratory shorebirds travelling via the East Asian Australasian Flyway.

7.9.2.2 Potential Impacts and Mitigation Measures

Taking into account key threats faced by the relevant migratory species and the location of potential habitat within the Project area in relation to Project activities, key potential impacts relating to the migratory species found or likely to be found within and around the Project area include habitat clearance and degradation, direct mortality and injury, and noise. These are described in further detail below.

Habitat Clearance

Potential Impacts

Key habitat for the migratory species encountered within the Project area consists of Big Footprint Swamp and mangrove habitat. Big Footprint Swamp will be protected by a Project-implemented minimum 100m buffer zone and no impacts from Project habitat clearing will occur.

A total of 20.5 ha of mangrove habitat (RE 3.1.1 and 3.1.3) will be cleared for the haul road, BLF and RoRo. There is abundant mangrove habitat in the surrounding area that will remain undisturbed. Melaleuca communities fringing drainage areas that may also provide potential habitat will be impacted by up to approximately 16 ha.

There is no evidence that habitat within the Project area should be considered as important habitat for a migratory species. The species were all observed as individuals or in low numbers and most were not observed within the Project area footprint. None of the species observed or likely to occur are known to be declining or at the limit of their range.

Mitigation

No additional measures are proposed to mitigate impacts from vegetation clearing to migratory species, as any impacts are likely to be minor (if they occur at all).

Noise

Potential Impacts

Noise has the potential to impact on fauna species. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat. Noise will be generated through the use of machinery, plant and vehicle movements.

Construction, and the generation of construction noise, will largely be away from migratory bird habitat. Noise levels will remain elevated after construction when mining commences, although these will be more constant and less intermittent. Big Footprint Swamp will be protected by a Project-implemented minimum 100 m buffer zone and no impacts from Project noise are expected.
Intermittent Project noise is expected to be generated in the area of the barge landing which may have an impact on wetland birds which may vacate these areas. However, substantial mangrove habitat will remain in the surrounding area.

While no government policies or published guidelines in respect to the acceptable noise levels for wildlife, particularly migratory birds, exist in Australia, it is unlikely that operational levels of noise would cause significant impact on migratory species on these habitats.

**Mitigation**

The lay-out of the Project infrastructure avoids migratory species habitat as much as possible. Accepted noise management practices will be implemented to minimise noise disturbance. No additional measures are proposed to mitigate potential noise impacts to migratory species, as any impacts are likely to be minor.

**Groundwater**

**Potential Impacts**

Big Footprint Swamp may experience some indirect impacts through changes to hydrology. In summary the groundwater modelling predicts that with, and without, the Bauxite Hills Mine pool level fluctuations between wet and dry seasons are very similar. With mining a maximum increase in pool level of 0.35 m above the pre-disturbance baseline may occur although the maximum predicted increase in the peak pool level, at the height of the wet season, is 0.15 m. This minor increase in the average peak depth has the potential to result in a small increase in the overall area inundated, particularly in the northern end of the swamp where the surrounding land is flatter. It is also possible for the average pool size that remains during the dry season may increase. Following the completion of mining activities, there is expected to be a permanent net increase in groundwater discharge to the swamp of approximately 1.5% from about 2035 onwards, resulting in <0.05 m increase in the peak pool level.

This is unlikely to have a significant impact on the ecological function of the wetland and usage by migratory wetland bird species. The changes have the potential to increase wetland bird foraging areas that may be available for a longer period into the dry season. No significant impacts are expected to migratory bird species from a rise in groundwater levels.

**Mitigation**

As described in Section 7.9.1.2 a REMP will be established including ongoing monitoring and analysis to refine the understanding of the hydrogeological regime of Big Footprint Swamp and the Skardon River and identify unacceptable risks and allow for direct interventions as the Project progresses. No additional measures are proposed to mitigate groundwater impacts to migratory species.

**Vessel Movements**

**Potential Impacts**

The proposed action will result in flat bottom barge vessels traversing the Skardon River at approximately 1.5 hour intervals. These vessels will transport the bauxite ore from the proposed port area to a larger shipping vessel moored in deeper waters off the coast. The movements will result in minor interactions with Migratory shorebird species’ foraging and roosting habitat including mangroves near the Skardon River port (mainly for Whimbrel), along the river reaches
and beach habitats near the river mouth (particularly Little Tern and Gull-billed Tern). The proposed levels of vessel movement associated with the Project are relatively low (two river vessel movements per 1.5 hours during operational periods) and are unlikely to have a significant impact on the these species. Specifically, there is a very low likelihood of any mortality or injury as a result of vessel movements given these species ‘flighty’ habits (i.e. individuals will disperse quickly from disturbance). Vessel movement impact will be very minor, isolated and short term in nature. There is likely to be an existing low level of recreational and commercial fishing vessel interactions in the broader estuarine and coastal habitats proximate to the area which the species are likely to have become habituated to when present. No dredging or alterations to hydrological processes within the Project area or Skardon River are proposed as a part of the action and thus there will be no impacts to these species habitats through altered hydrology.

**Mitigation**

No additional measures are proposed to mitigate vessel movement impacts to migratory species, as any impacts are likely to be minor and short-term.

### 7.9.2.3 Impact Significance

An assessment of the potential impacts on migratory species is provided in the following tables using the significant impact criteria from the MNES guidelines. As described in Section 7.9.2.1 no ‘important habitat’ as defined within the significant impact criteria for listed migratory species (DotE, 2013) occurs within or immediately surrounding the Project area.

**Little Tern and Gull-billed Tern**

The Little Tern tends to live and feed over shallower coastal waters – the estuaries, lagoons and channels around river and harbour entrances, and along shallows close inshore. The Little Tern roosts along the coast on sandy or rocky areas as well as in coastal lagoons. The species breeds along sandy beaches with beach scrape nests located between the high tide mark and coastal vegetation (Holmes, 2012). Gull-billed Tern is a widespread species that may occur along the coast and over freshwater bodies including inland lakes well away from the coast. Nesting consists of a lined scrape on offshore islands and sometimes elevated spits in lakes. Further discussion is included in Table 7-28.

**Table 7-28 Assessment against significant impact criteria: Little Tern and Gull-billed Tern**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Migratory Species</strong></td>
<td></td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>Migratory bird habitat within the Project area is unlikely to represent ‘important habitat’, as noted above. Both species were reported in low numbers. The Project will not result in the loss of any habitat for these species. The Project will not substantially modify or isolate an area of important habitat for either of these species.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>The Project will implement a PWMP to control the introduction and spread of weed species across the Project area. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion. The proposed action is unlikely to result in the introduction of invasive flora or fauna species which will have significant deleterious impacts to these species.</td>
</tr>
</tbody>
</table>
Whimbrel and Common Sandpiper

Both species are summer migrants following breeding in the northern hemisphere. Whimbrel is largely a coastal species preferring estuarine areas. It is often found foraging on intertidal mudflats and roosts in mangrove vegetation. Common Sandpiper utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. Both species detected during surveys for the Project with Whimbrel observed on the Skardon River. Further discussion is included in Table 7-29.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>Both species were observed in low numbers. The area is very unlikely to support an ecologically significant proportion of the population. There is no breeding habitat for Gull-billed Tern in the area. There is potential for Little Tern to nest where sandy beaches occur along the river or at the mouth of the Skardon River. Vessel movements along the Skardon River may cause transient disruption to feeding or resting activity but are not expected to disrupt nest sites. Coupled with the lack of ‘important habitat’ for migratory species occurring within the Project area, no significant impacts are expected.</td>
</tr>
</tbody>
</table>

Table 7-29 Assessment against significant impact criteria: Whimbrel and Common Sandpiper

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Species</td>
<td>Feral predators including cat and dingo are already resident in the area and were observed during site surveys. The Project will implement a PWMP to control the introduction and spread of weed species across the Project area including Big Footprint Swamp. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure.</td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>Migratory bird habitat within the Project area is unlikely to represent ‘important habitat’, as noted above. Both species were reported in low numbers. The Project will not result in the clearing of 20.5 ha of mangrove habitat. This will result in the loss of a minor area of roosting habitat for Whimbrel and some loss of adjacent mudflat foraging area. There is abundant similar habitat in the area surrounding the Project. The Project will not substantially modify or isolate an area of important habitat for either of these species.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>Both species breed in the northern hemisphere. Both species were observed in low numbers. The area is very unlikely to support an ecologically significant proportion of the population. Vessel movements along the Skardon River may cause transient disruption to feeding activity. Coupled with the lack of ‘important habitat’ for migratory species occurring within the Project area, no significant impacts are expected.</td>
</tr>
</tbody>
</table>

Eastern Osprey

The Eastern Osprey is found along the entire Australian coastline and may occur far inland on rivers and lakes, particularly in wet years (Debus, 2012). This species feeds on fish, foraging in rivers, lakes, estuaries and inshore coastal waters. Breeding pairs require nesting sites near suitable foraging areas, and nesting sites include tall trees and artificial structures such as power poles and towers (NPWS, 2002). Recorded during surveys in February 2015 for the SRBP. Further discussion is included in Table 7-30.
### Table 7-30 Assessment against significant impact criteria: Eastern Osprey

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Species</td>
<td>The proposed action will result in minor impacts to suitable foraging and breeding habitat for Eastern Osprey, mainly associated with the barge loading site and haul road components. These components intersect riparian and mangrove vegetation communities resulting in approx. 20.5 ha of direct clearing. Foraging resources (i.e. fish) are unlikely to be impacted to any more than a minor and localised degree. The proposed action is unlikely to substantially modify, destroy or isolate areas of important habitat for this species.</td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td></td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>Given the Eastern Ospreys ecology, breeding habits, size and foraging preferences it is unlikely the proposed action will result in the introduction or establishment of an exotic species which is harmful to them nor reduce the likelihood of these raptors establishing home ranges.</td>
</tr>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>The action will result in the direct loss of potential foraging and breeding habitat being up to approx. 20.5 ha. These habitats are extensive throughout the region and should established nesting sites fall within the proposed clearing areas it is unlikely the proposed action will impact the breeding cycle of these highly adaptable raptors.</td>
</tr>
</tbody>
</table>

### Eastern Cattle Egret and Great Egret

Both species are common and widespread species. Great Egret may be found in a variety of freshwater and estuarine wetland including artificial sources such as dams. Eastern Cattle Egrets inhabit grasslands, wetlands and wooded lands, often foraging away from water in damp grassland, pasture and crops. Both species breed in tall vegetation surrounding wetland areas and both species were observed on Big Footprint Swamp during Bauxite Hills Project and SRBP surveys. Further discussion is included in Table 7-31.

### Table 7-31 Assessment against significant impact criteria: Eastern Cattle Egret and Great Egret

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Species</td>
<td>The proposed action will result in minor impacts to suitable foraging habitat for these egret species, mainly associated with jetty and haul road components. Eastern Cattle Egret is less likely to use estuarine habitat. These components of the action intersect riparian mangrove vegetation communities resulting in impacts up to approx. 20.5 ha of direct clearing. Both species were observed on Big Footprint Swamp and the wetland may provide breeding habitat (although no evidence of breeding activity was observed). The proposed action will not directly impact this habitat and a minimum 100 m environmental buffer will be implemented on this site for the Project. It is unlikely the proposed actions impacts to mangrove and riparian vegetation will result in the reduction, significant fragmentation or isolation of any important habitat for these egret species.</td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td></td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>Feral predators including cat and dingo are already resident in the area and were observed during site surveys. The Project will implement a PWMP to control the introduction and spread of weed species across the Project area including Big Footprint Swamp. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure.</td>
</tr>
</tbody>
</table>
Criterion | Assessment
--- | ---
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species | These egret species were not observed in significant numbers and no evidence of breeding was observed. There is suitable breeding habitat on Big Footprint Swamp; however, this area will remain undisturbed. It is unlikely the proposed action will impact any significant populations of these species.

Rainbow Bee-eater

The Rainbow Bee-eater is a common and widespread species in Australia. It occurs in woodland, open forest, semi-arid scrub, and grassland and farmland where trees occur. The Rainbow Bee-eater requires habitat with loamy soil soft enough for nest tunnelling, yet firm enough to support the tunnel (Morcombe, 2010). They often nest in the banks river, creeks and road cuttings. This species is regularly noted in disturbed, agricultural and urban environments. Recorded near Big Footprint Swamp adjacent to the Bauxite Hills Project area boundary during surveys for the SRBP.

Much of the site provides suitable foraging habitat for the Rainbow Bee-eater. Breeding habitat is likely to be restricted to margins of woodland habitats where vegetation composition and soil types transition to those more favourable for tunnelling (e.g. loamy soils with open areas and high banks of upper ephemeral riparian areas). Further discussion is included in Table 7-32.

Table 7-32 Assessment against significant impact criteria: Rainbow Bee-eater

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Migratory Species</strong></td>
<td></td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>The proposed action will result in the clearing of suitable foraging including Darwin Stringybark woodland communities. Habitats which require clearing for mining operations are; however, the dominant vegetation type within the western areas of Cape York and northern areas of the Gulf Plains. Given this species migratory habits, robust nature (ability to forage and reside in cleared farming and urban environments) and the vast remnant areas of suitable habitat it is unlikely the proposed action will substantially modify, destroy or isolate important habitat for the species overall.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>It is unlikely, foraging and breeding habits it will be impacted by invasive species. This species readily inhabits environments where high densities of invasive species and ecology pressures are high such as agricultural and urban areas. The prevalence of cane toad may impact breeding individuals (predation of eggs/hatchlings); however, it is unlikely the proposed action will significantly increase the prevalence of this species causing a significant impact on breeding individuals within or adjacent to the Project area.</td>
</tr>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>The proposed action will result in the clearing of suitable foraging and potential breeding habitat (loamy, sandy soils in forest openings) throughout the entire area of the Project footprint. The greatest impact to habitat for this species occurs where proposed mining operations fall in the Darwin Stringybark woodlands. Habitats which require clearing for mining operations are; however, the dominant vegetation type within the western areas of Cape York and northern areas of the Gulf Plains. Given this species widespread distribution, robust nature (ability to forage and reside in cleared farming and urban environments) and the vast remnant areas of suitable habitat it is unlikely the proposed action will significantly disrupt the lifecycle of an ecological significant proportion of the species overall, particularly given how widespread and robust the species is.</td>
</tr>
</tbody>
</table>
Rufous Fantail

The rufous fantail inhabits rainforest, dense wet eucalypt and monsoon forest, paperbark and mangrove swamp, riverside vegetation; and open country while migrating (Morcombe, 2010). Breeding habitat occurs in in dense wet forests – rainforests, mangroves, the wet fern gullies in eucalypt forests and other dense vegetation (Morcombe, 2010). Recorded near Big Footprint Swamp adjacent to the Project area boundary during surveys for the SRBP (RPS, 2015a). Further discussion is included in Table 7-33.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>The proposed action will result in minor impacts to suitable foraging and breeding habitat for the Rufous Fantail including 20.5 ha of mangroves. This is mainly associated with the BLF and haul road components. There will be abundant similar habitat in the surrounding area. The Project will not substantially modify or isolate important habitat.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>This species breeding habitats are restricted for the most part to mangrove habitats (within the Project area). Invasive species which may occur as a result of the proposed action are unlikely to predate this species nor establish themselves in areas of suitable breeding habitat for the Rufous Fantail. The Project will implement a PWMP to control the introduction and spread of weed species across the Project area. The PWMP will be in place for the life of the Project, and will minimise the potential for weed invasion. The proposed action is unlikely to result in the introduction of invasive flora or fauna species which will have significant deleterious impacts to the Rufous Fantail.</td>
</tr>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>The proposed action will result in minor loss of suitable breeding habitat. However, this habitat is abundant and extensive within areas proximate to the Project area and the greater region. The proposed action is unlikely to disrupt the lifecycle of an ecologically significant proportion of the rufous fantail population. Larger areas of dry woodland habitat which the species may utilise for migration will be lost during the operation period of the proposed action. These areas; however, provide marginal movement habitats which are common and extensive throughout the Cape York Bioregion.</td>
</tr>
</tbody>
</table>

7.10 MNES Impact Assessment - Marine Species

The following section addresses the impacts to marine fauna listed under the EPBC Act as threatened and/or migratory species. The assessment is based on a thorough desktop review of available information from the site and limited field surveys (benthic habitats) carried out for the Bauxite Hills Project and SRBP. Further information is provided in the Marine Ecology Technical Report (Appendix B3) and Chapter 6 – Marine Ecology.

7.10.1 Commonwealth Marine Area

Commonwealth waters commence from the three nautical mile limit (Figure 7-17). They extend seaward to the 200 nautical mile limit (in the case of the Gulf of Carpentaria, the entire gulf waters are included). The areas identified for transhipping and movement of bulk carriers servicing the Project will be undertaken in Commonwealth marine waters. The location of the transhipment operations is dominated by open sandy substrates, with minor live benthic cover (1 – 3 %). Mining and port activities occur approximately 10 km east of the mouth of Skardon River and 18 km east of the Commonwealth Marine Area.
7.10.1.1 Commonwealth Marine Reserve

The West Cape York Commonwealth Marine Reserve is located to the northwest of Skardon River. The Reserve covers an area of 16,000 km² comprising national park, multiple use and special purpose zones. The reserve was declared in 2012. At the time of writing there is no change to users of the area until a management plan has been developed in accordance with the EPBC Act.

7.10.1.2 Marine Bioregional Plan for the North Marine Region

The study area also forms part of the area encompassing the Marine Bioregional Plan for the Northern Marine Region (Figure 7-16). This Plan covers the Commonwealth marine area extending from west Cape York Peninsula to the Northern Territory–Western Australia border. The Plan does not cover state or territory waters but, where relevant, does include information about inshore environments and the way they interact with species and habitats of the Commonwealth marine area.

The Commonwealth has prepared the Marine Bioregional Plan for the North Marine Region. The Plan area covers approximately 625,689 km² of tropical waters in the Gulf of Carpentaria and Arafura and Timor seas, and abuts the coastal waters of Queensland and the Northern Territory. The key ecological features of relevance to the Project are the Gulf of Carpentaria coastal zone and the Gulf of Carpentaria basin (for bulk carrier vessel ship movements only).

The Plan presents a summary of the analysis of pressures affecting conservation values in the region undertaken to inform the development of regional priorities. The Marine Bioregional Plan identified 12 regional priorities comprising six conservation values and six pressures. The six conservation values are:

- Listed marine turtles;
- Listed inshore dolphins;
- Listed sawfishes and river sharks;
- Dugong;
- Listed sea snakes; and
- The Gulf of Carpentaria coastal zone.

The conservation values are all relevant to the Project, and the listed marine species known or likely to occur in the Project area are described in Section 7.8.2. The six pressures that are regional priorities are less relevant to the Project, as the Project:

- Will not increase pressure associated with marine debris, bycatch, extraction of living resources (illegal, unreported and unregulated fishing) or climate change;
- Will involve physical habitat modification in the form of port infrastructure construction; however, this activity is minor, transient and not within Commonwealth marine waters, nor is it likely to result in impacts to Commonwealth marine waters; and
- May involve very minor modification of hydrological regimes from mining activities, although this is highly unlikely to impact Commonwealth marine waters.

The Marine Bioregional Plan identifies the six pressures of potential concern on ecosystem functioning and integrity on the Gulf of Carpentaria coastal zone are:
- Marine debris (e.g. derelict fishing nets, discarded plastic);
- Fishing bycatch;
- Extraction of living resources (illegal, unreported and unregulated fishing);
- Physical habitat modification;
- Climate change (sea level rise, ocean acidification, changed temperature); and
- Changes in hydrological regimes.

The Marine Bioregional Plan identifies that the pressures of potential concern on ecosystem functioning and integrity on the Gulf of Carpentaria basin are illegal, unreported and unregulated fishing, marine debris and climate change. Project shipping in the Gulf of Carpentaria basin will not contribute to these pressures.

In terms of the Marine Bioregional Plan strategies to address regional priorities, the Project contributes to Strategy D, through the EIS process, by increasing collaboration with relevant industries to improve understanding of the impacts of anthropogenic disturbance and address the cumulative effects on the region’s key ecological features and protected species.

Figure 7-16 North Marine Region area
7.10.2 Potential Impacts and Mitigation Measures

Taking into account key threats faced by the relevant marine species and the location of potential habitat within the Project area in relation to Project activities, key potential impacts relating to the migratory species found or likely to be found within and around the Project area include habitat clearance and degradation, direct mortality and injury, and noise. These are described in further detail below and in the Marine Ecology Technical Report (Appendix B3).

7.10.1.3 Coastal Processes

Potential Impacts

Hydrodynamics

The Project would provide a minor small scale impact on the system hydrodynamics at the proposed barge facilities. Minor changes in current flow from pile construction and barge moorings will result from a reduction in channel cross-sectional area, which in turn will result in localised increased tidal currents. The barges themselves may also induce altered current patterns and may lead to localised erosion of underlying soft sediments within the berth pocket, by way of increased current velocities during flood and ebb tidal flows and during manoeuvre of the barges and tugs via propwash.

Similar minor changes in current velocities may also be expected surrounding the mooring blocks for cyclone moorings. Localised mobilisation of soft sediments may be expected within the immediate vicinity of these features.

The land elevation where the proposed upstream facilities options are located are sufficiently high that sea level rise or storm tide inundation over the 12 year Project life are not considered to be an issue of concern. The absence of the need for deepening or widening the berth pocket, or access route for the barge operation means overall hydrodynamic function will remain as per the existing predevelopment case. The proposed development is not expected to have any impacts on the river flushing as there is no change to the tidal prism of the Skardon River.

Sediment Transport

No developments are proposed that would alter sediment transport processes within the Skardon River such that broad scale impacts would occur. The scale of changes via the development of the barge facility and operational processes of the bauxite barges are thought to remain within the natural scale of variability demonstrated within the Skardon River system. The greatest impact on sediment transport would originate from propwash by tugs and other service vessels. The use of pile construction is best suited to minimise impacts upon sediment transport.

Shoreline and Bank Evolution

The barging of the bauxite from Skardon Port to the offshore transhipment location will result in the generation of vessel wake waves within the Skardon River. As mangroves are present along the majority of the banks of the Skardon River any vessel wake waves are expected to be attenuated by the established mangrove vegetation and will therefore not result in significant erosion of the river bank. However, it is also noted that ongoing port operations have the capacity to alter bank stability and erosion factors (bank erosion within the Urquhart Point area of Weipa Harbour). Given the potential for cumulative impact from other proposed operations, and the proposed operational life of 12 years, further investigation into vessel wake and wave erosion potential is highly recommended.
Details of the barging of bauxite from Skardon Port to the offshore transhipment location are as follows:

- Bauxite will be placed in storage and preloaded onto barges to affect a loading of a Panamax vessel in approximately 4 to 6 days. Each Panamax vessel will require approximately 15 - 20 loaded barges to complete its cargo. Each barge will typically have a capacity of 3,000 t and be towed by a tug of 2,000 horsepower (HP);

- At the target bauxite production rate of 5 Mtpa, this will result in approximately 2 bulk carrier shipping movements per week, or 40 bulk vessel movements per annum. Given say 20 barge loads per week to make 1 bulk carrier movement per week an estimated 80 barge movements would be experienced through the Skardon River (in and out). This would result in approximately 1,666 barge movements per year (over an approximately 40 week operation) during full production; and

- This presents a significant increase in vessel traffic for the river (presently minimal use by larger commercial vessels).

**Mitigation**

Based on the potential impacts on coastal processes resulting from the proposed development as detailed above, the following mitigation measures are recommended:

- To minimise any impact in terms of bank stability, water quality and habitat loss at the port location existing native riparian vegetation around the port will be maintained. This is especially important for mangrove vegetation as it will help to prevent bank erosion due to locally generated wind waves and vessel wake waves from the barges;

- Establish a vessel traffic plan for construction and operational activities. The plan will identify restricted access areas and minimise the interaction between vessel operations and potential seagrass and other benthic habitat communities;

- Impose suitable vessel speed limits (4 – 6 knots) and operational area restrictions to minimise any potential increased bank erosion due to the barging activity. This will be defined based on the barge vessel size and capacity as well as the transport frequency;

- Freshwater inflows, particularly within the upper estuary may influence operational draft for some vessels. This would be factored into operational management processes as required;

- The channel offshore of the mouth of the Skardon River will be hydrographically surveyed every year (at the end of the wet season). The results from the survey would be used to further understand the morphological evolution of the entrance and ensure ongoing safe barge navigation for the subsequent dry season;

- Given the duration of the proposed operations (12 years), and the potential cumulative influence of other proposed operations within the river, the examination of bank erosion potential and vessel wake impact is recommended for further investigation. This study would also refine the most appropriate vessel speed scenarios with regards to minimizing wave propagation and maximizing transit speed through the Skardon River;

- Implement a seagrass monitoring program for the Skardon River that will survey seagrass abundance, distribution and species composition biannually for the duration of the Project; and
Shoreline monitoring stations would be developed to define baseline conditions and progress through construction and operations to provide early warning of shifts in bank stability, vegetation stability and erosion.

7.10.1.4 Water Quality

Potential Impacts

Although sediments sampled vary, the sand and gravel fraction appears to dominate the channel areas throughout the Skardon River. Mangrove and bank environments may possess greater silt and clay fractions as materials deposit along these shorelines. However, these environments will not be open to significant perturbations beyond the initial construction period. Currents within the river channel are relatively high as can be witnessed by the sand wave shoals present throughout the river system.

Operation of barges and supply vessel (greater than 1600 movements per year) may be expected to generate propwash as sediments are mobilized from the bottom in shallower waters. The prevalence of sands within the sediment matrix suggests that impacts would be short lived with the bulk of mobilized materials resettling to the channel areas. Continual scour is likely to reduce the effect of propwash over time.

The sediments of the Skardon River represent ambient conditions and display little in the way of evidence from historical contamination and contaminant effects as a result of sediment mobilisation during construction and operation are not anticipated.

Sampling for ASS indicates some potential of ASS and PASS generation from sediments if disturbed and exposed to oxidation. The river-based sampling confirms an absence of ASS, though these sediments presented elevated PASS concentration within the upper estuary and adjacent to the existing barge and proposed facilities. Sediments within the proposed conveyor alignments and barge loading areas have the potential to create acid drainage problems should these be exposed to oxygenated conditions or oxygenating processes. However, given the proposed piling construction methods the risk is considered low.

Minor spillages of potential contaminants may be anticipated during construction and operations. The management of these would be addressed by standard operating practices and application of spill repose procedures by the selected contractors. This risk of sediment contamination during construction is low.

Bauxite spillage into the Skardon River estuarine environment has potential to occur during barge loading and transhipment. The material is chemically inert and would present physical changes to the local sediment only.

Mitigation

A long-term program of ambient water quality monitoring is recommended to be established prior to the commencement of construction and facility operation. This program would require preconstruction site data to generate finalised site specific criteria for comparative assessment during operational conditions. Those areas surveyed would feature a combination of sites, and sufficient predevelopment surveys to allow consideration of the Before, After, Control and Impact (BACI) approach to monitoring and change definition.

Key aspects for monitoring will include the identification of any chronic or acute changes to water quality as a result of the proposed Project. Acute affects will be most likely related to initial
construction processes. Chronic affects may consider the response of wharf, barge and vessel operation upon water quality within the immediate operational area. Mitigation measures for maintaining estuarine water quality include the following:

- Regular monitoring of sediments within the proposed BLF and RoRo footprints, barge route and bulk carrier loading facility would be undertaken as part of operational management processes. This screening process will be undertaken as a baseline (pre-construction) and repeated annually to confirm operational processes are not leading to impacts of the surrounding sediments;

- Physical sampling or monitoring using video or still imagery may be applied to define the occurrence of operational spillages of bauxite during loading and unloading. While not a contamination process, spillages to the environment would be minimised, and amendments to loading equipment or processes made if such events are occurring on a repetitive basis;

- Where possible barge and tug movements will be targeted to the upper tidal range to reduce the impact of propeller wash on sediments;

- Minimise vessel speed limits to reduce the impact of propeller wash;

- Ensure spill management procedures are in place and bulk fuel handling standards of operations are set according to the Australian Maritime Safety Authority (AMSA) and Port Authority requirements;

- Dust management will occur at the BLF; and

- A Project Stormwater Management Plan will be implemented including measures to restrict the impact of wet season overtopping of the sediment dam and impacts at the stockpile facility.

Once final construction designs are approved, and final footprints for infrastructure such as the BLF and RoRo are determined, an additional detailed ASS Assessment will be undertaken prior to construction to delineate ASS in accordance with the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland (QASSIT, 1998). The results of the detailed ASS Assessment shall support the preparation of an ASS Management Plan with consideration of specific construction programs and methodologies associated with the Metro Mining infrastructure in accordance with the Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines v4.0 (2014).

### 7.10.1.5 Vessel Strike

#### Potential Impacts

Shipping and vessels pose a potential risk to marine megafauna through collisions including MNES species such as marine turtles and cetacean species. The proposed Project will increase the number of vessels active in the Skardon River area during construction and increase the number of vessels during the operational phase. The proposed Project will use existing transit routes within the region and hence will not change the spatial scale of potential overlap between shipping and marine megafauna.

Turtles may encounter vessels within the proposed channel alignments and during offshore operations. Displacement of turtles due to the passage of a vessel is anticipated to be relatively short lived, with individuals diving to avoid vessels in the immediate vicinity.
The size, displacement and lack of mobility of operational vessels associated with the Project will necessitate a slow speed when operating. Barges and supply vessel operations do not present a substantial risk of vessel strike with turtles. Vessels at risk of collision with marine fauna (small survey or service vessel) will be used on the Project infrequently. With operational access and speed limit zones in place, a low impact upon marine turtles is anticipated.

A key determinant in the potential for collisions between vessels and cetaceans is the speed of the vessel (Vanderlaan and Taggart, 2007; Wiley et al., 2011). Given the slow speed of vessel (barge) movements within the operational port limits, vessel strike on cetaceans is not considered a risk requiring specific mitigation.

Dugong mortality by boat strike from fast moving vessels planning in shallow water is well documented (Groom et al., 2005). Speed limits for fast moving vessels in designated transit areas can effectively mitigate potential impacts. Slow moving displacement vessels such as barges and tugs as proposed within this Project do not pose a substantial risk. With speed limits in place for particular types of vessel, and the operation of all marine craft to agreed vessel access channels, a low impact upon Dugong is anticipated.

**Mitigation**

Marine operations will be conducted in compliance with the vessel access and speed limit plan (ranging from 4 to 6 knots) provided within the Project EMP. Research has identified that visual cues rather than noise induces avoidance behaviour in turtles, making reduced speeds the most appropriate tool for prevention of boat strike incidents. This will minimise general interactions with marine species and adjacent habitats. Observations of marine fauna will be recorded (including species and location) and incidences of direct interaction such as vessel strike, or near vessel strike reported to the site environmental officer.

**7.10.1.6 Light Spill**

**Potential Impacts**

Artificial light in general has been identified as a global environmental challenge that significantly threatens components of biodiversity (Hölker et al., 2010; Lyytimä, 2013). The life cycle of marine turtles is particularly susceptible to light pollution when it occurs at or adjacent to nesting areas (Witherington, 1992; Kamrowski et al., 2012, 2014a and b). A direct line of sight from the light source to the nesting beach is not necessary to illicit a response from hatchling as they respond to light glow (Kamrowski et al., 2014a). Lights at or adjacent to a nesting beach can result in turtle hatchlings heading inland rather than into the ocean with subsequent mortality. Lights adjacent to nesting beaches can also result in hatchlings entering the ocean safely, only to re-emerge closer to the light source. The impacts of artificial lighting are reduced during the full moon period, but enhanced due to cloud cover (Kamrowski et al., 2014a).

Three sources of artificial light from the proposed Project were considered in this assessment:

- Light from the mine;
- BLF and camp; and
- Lighting from the transhipment site (including during transhipment operations).

Navigation lights from moving vessels or navigation buoys were not considered to be a plausible impact.
The mine site, BLF, RoRo and mining camp are not adjacent to beaches used by nesting turtles. As such, this proposed Project differs substantially from the Amrun (formerly South of Embley) project (Rio Tinto Alcan) where large port facilities are directly at and adjacent to areas used by nesting Flatback and Olive Ridley Turtles. The proposed SRBP is also of a substantially smaller scale than that approved by the South of the Embley project. The distance from the mine and port locations to area suitable for Flatback Turtle nesting is approximately 10 km, and native vegetation separates the location of the infrastructure from the nesting beaches.

The transhipment process will occur offshore at designated transhipment anchorages. Additional lighting on the barge, and potentially the bulk carrier may be required. These activities will occur approximately 10 to 12 km offshore. Attention to vessel lighting will minimise light spill potential. No mitigation measures are considered necessary.

**Mitigation**

Methods to reduce the potential impacts of lighting need to remain considerate of occupational safety and navigation requirements thus the following measures will be taken:

- Only essential lighting will be included in development;
- Turtle friendly lighting will be used where necessary and possible with an initial preference for long wavelength lights (560-700 nm) to be used wherever possible, where this is not possible, low pressure sodium (LPS) lights or LEDs will be considered. If LPS are used, then amber light filters will be installed;
- Lighting design will consider techniques that limit turtle impacts and include light shrouding where necessary (i.e. be well shielded, full cut-off and downward directed type fixtures);
- Luminaries will be mounted low in the vertical plane and use the lowest intensity for the task;
- Intense lights or clusters of lights will be avoided wherever possible;
- An automated control system will be implemented to reduce or switch off unnecessary lighting;
- White lights that emit ultraviolet light will be avoided, strong blue or green spectral elements will also be limited;
- An illumination plan will be developed describing each light source in terms of its purpose, location, footprint, intensity and spectral composition and document steps to avoid, mitigate and manage the impacts of each source;
- Install timers and motion detectors wherever possible;
- Periodic inspections, audits and corrective management of light sources will be undertaken; and
- Inductions for staff and contractors will include relevant information on marine turtles.

**7.10.1.7 Underwater Noise**

**Potential Impacts**

When aquatic animals are subject to introduced noise sources their behavioural patterns may change. This is called a behavioural response and may include, among many possible responses, avoidance of the area, change in vocalisations, and parent/offspring distance modification. At increased levels underwater noise may also cause temporary hearing impacts, permanent hearing
impacts or other tissue trauma, including death. Activities associated with construction in the marine environment and operations, have the potential to displace local marine fauna in general, including marine turtles, cetaceans and sawfish from habitat and interrupt behaviours through the creation of underwater noise. Although in reality little is known about the potential impacts on marine turtles or sawfish from increased noise exposure.

Activities associated with construction in the marine environment and operations, have the potential to displace cetaceans from critical habitat and interrupt critical behaviours through the creation of underwater noise. Cetaceans have been found to avoid some human sound sources for ranges of several kilometres, abandoning valuable habitat in the process (Tyack 2008). For mobile marine animals, avoidance behaviour is the common response to underwater noise when that noise reaches a certain threshold, and this is well established in the peer reviewed literature (e.g. Nowacek et al., 2001; Ng and Leung, 2003; Hodgson and Marsh, 2007; DeRuiter and Doukara, 2012). Jefferson et al., (2009) identified that Indo-Pacific Humpback Dolphins avoid areas during pile driving but return once construction ceases. The area where piling is proposed for the Project is limited to the barge landing area within the Skardon River.

Matrix Acoustics has calculated underwater noise levels from the different port construction and operational activities (refer Table 4-13 and Table 4-14, Appendix B3). Following the approaches to underwater impact assessment published by Southall et al., (2007) a screening for underwater noise impact has been undertaken based on the calculated noise levels.

Given the calculated noise profiles and conservative application of the adopted screening criteria, permanent hearing loss to cetaceans may be expected over a distance of 100 - 200 m from the pile driving activity depending upon the pile type. While temporary impacts and behavioural disturbances may extend to between 1,000 m and 2,000 m. Potential low level behavioural responses may extend for many kilometres due to pile driving, and over a very limited extent from vessel activity and during operations. These finding generally corresponds to the findings of David (2006) and Bailey et al., (2010), which outline that injury to a dolphin from pile driving activities is limited to an area of approximately 100 m from the source, although behavioural responses may occur over an area of many kilometres (David, 2006; Bailey et al., 2010).

Doug Cato and John Lewis (pers comm, 2015) suggests that the acoustic propagation environment in the Skardon River at the proposed development site would be exceptionally poor, due to factors such as shallow water, muddy bottom, high turbidity, lack of any substantial direct transmission pathways. John Lewis (pers. comm, 2015) does not expect “any tangible effects beyond a few hundred metres at best, for any pile driving within the river itself”. This comment agrees with the predictions presented above and observations made by David (2006) and Bailey et al., (2010).

Underwater noise may also be generated by vessel movements. Surface shipping is considered to represent the most widespread source of low frequency (< 1,000 Hz) anthropogenic noise in the marine environment. Concern emanates around the possibility that such noise may mask echolocation vocalisations or communications; acoustically mask prey; lead to separation of calves from mothers; or if intense and localised, alienate animals from preferred aggregation sites or migratory pathways. That said the existence of a disturbance, in this case noise does not necessarily mean that a negative impact occurs. The co-existence of dolphins at a large number of locations on the Queensland east coast at or directly adjacent to port facilities where vessel movements are substantially greater than proposed in the SRBP provides an indication that animals can adapt to this disturbance and maintain viable populations.

Dugong are also potentially sensitive to underwater noise, and construction activities such as pile driving. Pile driving and vessel activities within the vicinity of seagrass meadows has the potential to temporarily drive dugong from the area. However, John Lewis (pers. comm, June 2015) indicates
that “most of the noise energy from pile driving (approximately 200 Hz) is at frequencies below the threshold of hearing for dugongs,” and as such impacts may be more related to physical disturbance than noise profiles.

**Mitigation**

Underwater noise generated by construction of the barge landing will be temporary. The following mitigation measures will be applied during the pile-driving program to reduce the potential impacts on MNES marine fauna:

- Piling will be carried out during the day only and noise will be attenuated by appropriate engineering measures where practicable;
- Correct specifications of piles and the pile driver for the proposed constructions works will be used to avoid excessive energy requirements to achieve pile penetration;
- A 1,000 m safety exclusion zone will be established around piling works. This zone will be confirmed by measuring noise from initial marine piling operations and redefining safety exclusion zone if required;
- As part of the SSMP all staff will be educated on the potential presence of marine megafauna and reporting of observations to the Environmental Officer;
- Trained marine megafauna observers will be on-board the pile driver to identify any cetaceans (or other megafauna) present in the area of construction, and pile driving activities will not start if an animal is identified within 100 m of the pile driver when operating. Construction will not recommence until the fauna move out of the exclusion zone. Observations of marine fauna will be recorded;
- All impact and vibratory piling works will adopt a soft start approach. In the first instance, this could incorporate piling commencing at low energy levels and then building up progressively to full impact force. If this is not possible, then a single pile impact could be conducted followed by another single pile impact after about five minutes. Then normal piling can then begin after another 10 minutes, so as to allow any marine mammals who may be approaching to leave the area. If either of the soft start approaches described is not practically feasible for operational reasons, then an acoustic deterrence device may be used to allow marine fauna to leave the area prior to commencement of full piling; and
- Marine-based pile driving activities will take place during daylight hours.

Operations and the resulting increased underwater noise from barge and tug movements are proposed for approximately 32 weeks of the year, being closed during the wet season. The vessel management plan will avoid shallower waters, restrict vessel movements and speeds.

**7.10.1.8 Pest Fauna and Weeds**

**Potential Impacts**

**Pest Fauna**

Pest fauna are already present in the Project area and surrounds and evidence of feral pig and cattle damage was observed at Big Footprint Swamp (refer Appendix B2). Feral predators such as cat and dingo have also been recorded during surveys of the area. The most significant current impact to marine fauna resulting from feral species is nest-predation of marine turtle species by feral pigs. It
has been estimated that 90% of Flatback Turtle and Olive Ridley Turtle nests are subject to predation in western Cape York (Environment Australia, 2003). Feral pigs may also spread weeds and creating erosional and water quality issues, particularly within habitats such as Big Footprint Swamp and mangrove habitats.

*Pest Flora*

There are no significant weed species expected to impact MNES marine fauna.

*Marine Pests*

Marine pests have the greatest potential to be introduced during construction activities, with a lower risk continuing during operations. Marine pests can enter the environment through ballast waters and biofouling of marine vessels and as such effective biosecurity measures are needed to maintain the pest free status of the area. Marine pests are species with invasive traits that can cause significant adverse impacts to marine industries, the environment, human health and or amenity if introduced, established or translocated within Australia, as well as generating substantial costs for eradication attempts or ongoing management.

A feature of OGV operations is the use of significant quantities of ballast water, primarily as a cargo substitute for those ships arriving (empty) to take on cargo at a terminal. Under the Australian ballast water management regulations, all ballast water arriving in Australia from overseas is considered ‘high risk’ and so banned from discharge in Australian waters. In general terms, ships are required to undertake ballast water exchange at sea, such that water taken up from shallow, coastal or littoral waters overseas is replaced with water sourced from the open ocean, considered less likely to harbour marine species of potential quarantine concern.

Biofouling is a quarantine concern because of the risk that a vessel or other object is carrying fouling and may act as the means of transport for a potential marine pest species into Australian waters, or between different regions within Australia. Not all fouling species represent a biosecurity threat, and given the millions of movements of vessels over many hundreds of years, many fouling species have already established broad geographic distributions (i.e. the ‘cosmopolitan’ and ‘cryptogenic’ species). Some fouling species; however, do pose significant quarantine risks to Australia and potentially to Skardon River.

All vessels have some degree of biofouling, even those which may have been recently cleaned or had a new anti-fouling coating applied. In general terms, the longer a vessel has been in water, the greater the size and complexity of its biofouling community.

For Skardon River, ship-sourced terrestrial quarantine risks are considered to be somewhat limited compared to most ports by virtue of the distance from shore that the ships will anchor (approximately 12 km from the mouth of the Skardon River). Noting this, it may be assumed that ships arriving at Skardon River from overseas are unlikely to pose an unacceptable level of terrestrial quarantine risks, with these risks appropriately managed by standard DAWR protocols.

Vessels arriving at Skardon River from other Australian ports are unlikely to represent any specific quarantine hazard, assuming that they had already been accorded ‘coastal status’ by Australian quarantine authorities. This will include the domestic movements of barges carrying materials from Cairns and Weipa.
Mitigation

A site-specific PWMP will be developed for the Project in coordination with the Mapoon Land and Sea Rangers, and in accordance with the Cook Shire Council Pest Management Plan 2012 – 2016. Measures associated with the PWMP have been outlined previously in Section 7.9.1.2.

Marine Pests

The DAF released guidance into the design, operation and reporting of marine pest monitoring within Australia via the Australian marine pest monitoring guidelines and Australian pest monitoring manual. These documents will be used to establish a practical monitoring, management and reporting program for introduced marine pests as required in the draft EMP. The objectives of the Marine Pest Monitoring Program will be:

- Early detection of introduced marine pests into the Skardon River; and
- To allow implementation of an introduced marine pest emergency response where an introduced marine pest is detected.

The draft EMP provides an overview of the monitoring program and the timing of the monitoring program components.

The National Biofouling Management Guidelines for Commercial Vessels provide commercial vessel operators with tools to minimise the amount of biofouling accumulating on their vessels and thereby minimise the risk of spreading marine pests around the Australian coastline. This would include the regular barges proposed to deliver goods and remove wastes from the Project, generally operating between Cairns and/or Weipa, and the site. The Guidelines will be appended to the Project EMP.

All non-trading vessels such as barges, heavy lift vessels and tugs to be used on the Project shall observe the National Biofouling Management Guidelines for Non-Trading Vessels. These vessels will be operating almost exclusively within the Project area, and will have limited opportunity to collect and/or spread any marine pests. The Guidelines will be appended to the Project EMP.

The preferred supplier of marine support services will be required to demonstrate compliance with the relevant requirements of both guidelines.

The OGVs used to export the bauxite are currently not required to implement the guidelines due to the short timeframes in Australian waters they are considered a low risk. Where a specific biological risk is identified with OGVs they can be placed in quarantine until the risk is managed in accordance with current best practice.

In accordance with the Quarantine Act 1908, OGV proposing to discharge high risk ballast water will be required to complete their ballast water exchange in mid-ocean outside of Australia’s territorial sea (the area within 12 nm of the Australian coastal baseline).

Routine Monitoring

Routine marine pest monitoring in the Skardon River will provide early detection of new pest translocations and inform emergency response. It is anticipated that a Marine Pest Monitoring Program will be developed and led by Ports North with collaboration from Metro Mining and Gulf Alumina. It is anticipated that the marine pest monitoring programme that will be based on the National System processes, standards and rationale, as described in the Australian Marine Pest Monitoring Manual and Guidelines.
Further detail is provided in Chapter 8 - Biosecurity.

### 7.10.2 Impact Assessment

Listed threatened marine species recorded or predicted as known, likely or potential to occur within the Project area are assessed for significant residual impacts as described under the Significant Impact Guidelines 1.1 (DotE, 2013) in the following sections.

The selection of impacts discussed and their evaluation is based on:

- The current understanding and layout of the Project (Section 7.4.4 and Chapter 2 – Description of Project);
- Currently known information about species affected (Section 7.8.2); and

Currently known information about the listed species is summarised in the community profiles shown in Table 7-34. Potential impacts and their mitigation measures are discussed under the individual headings below. Significance of the impacts is assessed subsequently using the significant impact criteria outlined in DotE (2013).

**Table 7-34 Key data on threatened species or species groups**

<table>
<thead>
<tr>
<th>Marine Turtles</th>
<th>Five species have potential to occur in the area. Flatback Turtle known to nest on local beaches. Olive Ridley Turtle is also known to nest in low densities on western Cape York Peninsula.</th>
</tr>
</thead>
</table>
| **EPBC Status** | Flatback Turtle – Vulnerable  
Green Turtle – Vulnerable  
Hawksbill Turtle - Vulnerable  
Olive Ridley Turtle – Endangered  
Loggerhead Turtle - Endangered |
| **Key Threats** | The main threats in Australia include:  
 Artificial lighting disturbing the emergence of hatchlings;  
 Coastal development;  
 Fishing practises including boat strike, bycatch and fishing debris (e.g. discarded nets);  
 Marine pollution; and  
 Nest predation by dogs and feral pigs in particular (DotE, 2015). |

**Sawfish species and Speartooth Shark**

<table>
<thead>
<tr>
<th>Baseline Data Results</th>
<th>None of the species have been recorded in the Skardon River previously. Based on habitat preference and distribution Dwarf and Freshwater Sawfish are considered likely to occur. Green Sawfish may potentially occur in the lower estuary. Speartooth Shark is known from the Port Musgrave area to the south and has potential to occur in the Skardon River.</th>
</tr>
</thead>
</table>
| **EPBC Status** | Green Sawfish – Vulnerable  
Freshwater Sawfish – Vulnerable  
Dwarf Sawfish – Vulnerable  
Speartooth Shark – Critically Endangered |
| **Key Threats** | The main threats to these species include:  
 Fishing pressure as bycatch;  
 Indigenous hunting; and  
 Habitat disturbance and degradation. |
Recovery Plans
Sawfish and river sharks multispecies recovery plan (DotE, 2015b)

**Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin**

Baseline Data Results
Australian Snubfin Dolphin has been recorded in the Skardon River estuary and nearby previously. Also known from Port Musgrave and Weipa area. Indo-Pacific Humpback Dolphin is also known to occur in Port Musgrave and the Weipa area.

**EPBC Status**
Migratory

**Key Threats**
The main threats to these species include:
- Competition with fisheries for prey and as fisheries bycatch;
- Vessel strike; and
- Habitat disturbance and degradation (Woinarski et al., 2014).

**Recovery Plans**
Action plan for Australian mammals 2012 (Woinarski et al., 2014).

**Dugong**

Baseline Data Results
A single observed record of this species in 2003 in the Skardon River. Species known to occur in Port Musgrave to the south.

**EPBC Status**
Migratory

**Key Threats**
The main threats to these species include:
- Entanglement in fishing and shark netting, and as bycatch;
- Indigenous hunting;
- Vessel strike; and
- Coastal development, habitat disturbance and degradation (DotE, 2015).

**Recovery Plans**
Action plan for Australian mammals 2012 (Woinarski et al., 2014).

**Estuarine Crocodile**

Baseline Data Results
Known to occur in the Skardon River. The Port Musgrave area is known as an important nesting site for the species in the region.

**EPBC Status**
Migratory

**Key Threats**
The main threats in Australia to this species are minor but includes:
- Entanglement in fishing netting; and
- Habitat destruction and degradation including by Water Buffalo in Northern Territory.

**Recovery Plans**
No current recovery plan for this species.

### 7.10.2.1 Impact Significance – Threatened Marine Species

Assessment of impact significance has been completed as per the Significant Impact Guidelines (DotE, 2013). All species with some potential to occur have been considered as no specific on-site surveys of marine species have been carried out. These included criteria for species listed as Critically Endangered, Endangered and Vulnerable at the time the Section 75 decision for this Project was made (September 2015). The Critically Endangered and Endangered species assessments commence with an evaluation of a defined ‘population of the species’, as defined within the significant impact criteria for these species:

*A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, or endangered threatened species, occurrences include but are not limited to:*

---

**METRO MINING LIMITED**

7-134
Matters of National Environmental Significance

- A geographically distinct regional population, or collection of local populations; or
- A population, or collection of local populations, that occurs within a particular bioregion (DotE, 2013).

Three species are listed as Critically Endangered (Speartooth Shark) or Endangered (Loggerhead and Olive Ridley Turtle). The two marine turtle species are wide ranging species whose occurrence in the area cannot be described as ‘geographically distinct’ or as occurring in a particular bioregion. Loggerhead Turtles in the area are likely to have migrated from eastern Queensland rookeries. The entire population of Olive Ridley Turtles nesting in Australia are considered a genetically distinct subpopulation of the global distribution (Limpus, 2008). It is unknown if Speartooth Shark occurs in the Skardon River although it is known to occur in the Port Musgrave region.

The vulnerable species assessments use the definition of an ‘important population’ as described previously in Section 7.10.2.1. None of the species listed as Vulnerable in the following sections are at the limit of the species distributional range.

Given the specificity of the above definition and the scarcity of information and records available for most listed species and populations in the region (and Australia), it is difficult to determine: 1) attributes such as breeding and dispersal behaviour and whether the particular population is a ‘key source’ and 2) the genetic diversity of individuals inhabiting a population or sub-population. Given the paucity of information available, significance of impacts to threatened species has been based on experience of the assessment team and the latest available information.

7.10.2.2 Marine Turtles

Existing Threats

Outside the Project development processes there are two major anthropogenic threats to marine turtles along the beaches of western Cape York – predation by feral pigs and entanglement in discarded high seas fishing net (ghost nets). The former is considered the most significant. Feral pigs are a well acknowledged environmental problem in Australia and they are identified as key threatening process under the EPBC Act and a Threat Abatement Plan (TAP) is currently in place. Impacts on Flatback and Hawksbill Turtle nesting is identified specifically as a significant reason for listing feral pigs as a key threatening process. Feral pigs and cattle have been identified within the coastal zone adjacent to the Skardon River entrance and along the river system within and adjacent to the bauxite plateau (Tom Koskela, Pers. Comm). Evidence of pig damage to turtle nests (tracks and fresh rooting marks) have been observed by PaCE along the northern and southern shores along the entrance to the Skardon River.

Ghost nets are discarded or lost nets that continue to float around the ocean until eventually they wash up on beaches. These nests can entangle and kill marine turtles in the open ocean and/or in inshore areas. According to the Carpentaria Ghost Nets Program which is an Indigenous community and Commonwealth government partnership in northern Australia, most ghost nets in the Gulf of Carpentaria originate from southeast Asian countries in particular Taiwan, Indonesia and Korea.

Significant Impact Assessment

Flatback Turtle is by far the species known to nest on the mainland local to the Project area, of the marine turtles occurring in the region (Table 7-20). Olive Ridley Turtle is also known to nest in low densities on western Cape York Peninsula (Limpus, 2008) south to Weipa (Limpus, 2008). All marine turtle species (except Leatherback Turtle) are considered to have some potential to occur in the wider area.
The proposed construction and operations of the Project present a limited impact to marine turtles. Disturbance to preferred foraging and nesting habitat is negligible given the absence of dredging or excavation, and the potential impacts attributable to lighting are not considered a significant issue given the distance between the nesting beaches and proposed BLF within the upper reaches of the Skardon River. Increased vessel movements within the Skardon River and adjacent coastal regions present the greatest potential for interaction, though the risks are considered minor. Marine turtles are considered separately in each of the following tables. Further discussion is included in Table 7-35 to Table 7-39.

**Table 7-35 Assessment against significant impact criteria: Flatback Turtle**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>The Project is not of a nature or scale that could plausibly lead to a long term decrease in the size of the Flatback Turtle population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>The Flatback Turtle has an extremely large area of occupancy and the Project will not plausibly reduce this area of occupancy in any meaningful or measurable way.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project contains no components that could plausibly fragment the existing populations of Flatback Turtles.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>The Project will not remove that is potentially used as foraging habitat by Flatback Turtles. The nearest recognised important breeding habitat or BIA is situated at Crab Island some 85 km to the north. However, Flatback Turtles are known to nest along the Skardon River beaches. The key threat to nesting habitat is the presence of feral pigs. Activities to mitigate the effects of feral pigs in the wider area by Metro Mining, or others, would provide significant respite in nesting conditions and recruitment success.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>Lighting has the potential to disrupt the nesting activities of marine turtles. The majority of mining operations are sufficiently inland (approx. 10 km) away from beach nesting areas and buffered by extensive native vegetation to the extent that light spill from mining operations is highly unlikely to be an impacting process. The nesting beaches themselves will not be traversed during construction or operation of the mine. Staff or contractors will not be permitted to camp on beaches. The light from the proposed Project will interact with other light sources from the adjacent SRBP; however, given the distance of the Projects from potential nesting areas (&gt; 6 km at their nearest at the river mouth) cumulative impacts are not expected. A contingency plan to reduce light spill will be included as part of the Project’s EMP should it be deemed necessary.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project will not modify, destroy, isolate or decrease the quality of the habitat to the extent that any decline in the species will occur. Predicted benthic impacts to seagrass and biota within the channel alignment would be locally insignificant.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas (e.g. central Queensland), have not been implicated in the introduction of invasive species that are harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required locally sourced water will be used thus eliminating the risk of introduction or translocation of invasive species.</td>
</tr>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas where the abundance of Flatback Turtles is relatively high (e.g. central Queensland), have not been implicated in the introduction of disease. The Project will not plausibly introduce disease that may cause the population of Flatback Turtles to decline.</td>
</tr>
</tbody>
</table>
The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan. The proposed implementation of feral animal control and marine debris clean-up program will assist recovery potential for the region.

Table 7-36 Assessment against significant impact criteria: Green Turtle

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment Against Significance Criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfere substantially with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan. The proposed implementation of feral animal control and marine debris clean-up program will assist recovery potential for the region.</td>
</tr>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>The Project is not of a nature or scale that could plausibly lead to a long term decrease in the size of the Green Turtle population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>The Green Turtle has an extremely large (circumglobal) area of occupancy and the Project will not plausibly reduce this area of occupancy in any meaningful or measurable way.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project contains no components that could plausibly fragment the existing populations of Green Turtles.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>Based on the current state of knowledge, no BIA have been identified for the Green Turtle at or adjacent to the proposed Project location.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>There is no nesting of Green Turtles in the region.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>High quality habitat (seagrass) for Green Turtles is absent at and adjacent to the proposed Project location. The area is to be modified (but not removed) by the construction of the BLF. The available seagrasses do not constitute important foraging habitat for Green Turtles.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas (e.g. central Queensland), have not been implicated in the introduction of invasive species that are harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required locally sourced water will be used thus eliminating the risk of introduction or translocation of invasive species.</td>
</tr>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas (e.g. central Queensland), have not been implicated in the introduction of disease harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species (including disease).</td>
</tr>
<tr>
<td>Interfere substantially with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan.</td>
</tr>
</tbody>
</table>

Table 7-37 Assessment against significant impact criteria: Hawksbill Turtle

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfere substantially with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan.</td>
</tr>
<tr>
<td>Lead to a long-term decrease in the size of an important population of the species</td>
<td>The Project is not of a nature or scale that could plausibly lead to a long term decrease in the size of the Hawksbill Turtle population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population</td>
<td>The Hawksbill Turtle has an extremely large area of occupancy and the Project will not plausibly reduce this area of occupancy in any meaningful or measurable way.</td>
</tr>
<tr>
<td>Fragment an existing important population into two or more populations</td>
<td>The Project contains no components that could plausibly fragment the existing populations of Hawksbill Turtles.</td>
</tr>
</tbody>
</table>
Bauxite Hills Project ▪ Matters of National Environmental Significance

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>Based on the current state of knowledge, the nearest BIA has been identified north of the Cotterell River, approximately 40 km to the north of the Skardon River. They are omnivorous and are believed to feed predominantly on algae, sponges and seagrass over coral reef areas. The nearest coral reef structure to the Project is located 6-7 km south of the Skardon River. Additional reef habitat is located at Kerr Reef, 15 km to the south west.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>Lighting has the potential to disrupt the nesting activities of marine turtles. The majority of mining operations are sufficiently inland (approx. 10 km) away from beach nesting areas and buffered by extensive native vegetation to the extent that light spill from mining operations is highly unlikely to be an impacting process. The nesting beaches themselves will not be traversed during construction or operation of the mine. Staff or contractors will not be permitted to camp on beaches. The light from the proposed Project will interact with other light sources from the adjacent SRBP; however, given the distance of the Projects from potential nesting areas cumulative impacts are not expected. A contingency plan to reduce light spill will be included as part of the Project’s EMP should it be deemed necessary.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project will not modify, destroy or decrease habitat through that is potentially used as foraging by Hawksbill Turtles. Given the available foraging area for the species in the Gulf of Carpentaria, the nature and scale of the disturbance will not isolate or decrease the quality of the habitat to the extent that any decline in the species will occur.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Port projects including those of a larger scale, have not been implicated in the introduction of invasive species that are harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required locally sourced water will be used thus eliminating the risk of introduction or translocation of invasive species.</td>
</tr>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas have not been implicated in the introduction of disease harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species (including disease).</td>
</tr>
<tr>
<td>Interfere substantially with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan. The proposed implementation of feral animal control and marine debris clean-up program will assist recovery potential for the region.</td>
</tr>
</tbody>
</table>

Table 7-38 Assessment against significant impact criteria: Loggerhead Turtle

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Endangered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of a population of the species</td>
<td>The Project is not of a nature or scale that could plausibly lead to a long term decrease in the size of a population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of the species</td>
<td>The Loggerhead Turtle has a global distribution throughout tropical, sub-tropical and temperate waters. The spatial scale of the Project is insignificant with respect to the area of occupancy of the species.</td>
</tr>
<tr>
<td>Fragment an existing population into two or more populations</td>
<td>The proposed activity does not feasibly create a barrier to movement either directly or indirectly.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>Based on the current state of knowledge, no BIA has been identified for the Loggerhead Turtle at or adjacent to the proposed Project location.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of a population</td>
<td>There is no nesting of Loggerhead Turtles in the region.</td>
</tr>
</tbody>
</table>
The Project will not modify, destroy, isolate or decrease the quality of the habitat to the extent that any decline in the species will occur.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Endangered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project will not modify, destroy, isolate or decrease the quality of the habitat to the extent that any decline in the species will occur.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the endangered species habitat</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas where the abundance of Loggerhead Turtles is relatively high (e.g. central Queensland), have not been implicated in the introduction of invasive species that are harmful to the species. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required locally sourced water will be used thus eliminating the risk of introduction or translocation of invasive species.</td>
</tr>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>Port projects including those of a larger scale, and in areas adjacent to nesting areas where the abundance of Loggerhead Turtles is relatively high (e.g. central Queensland), have not been implicated in the introduction of disease. The Project will not plausibly introduce disease that may cause the population of Loggerhead Turtles to decline.</td>
</tr>
<tr>
<td>Interfere with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan.</td>
</tr>
</tbody>
</table>

Table 7-39 Assessment against significant impact criteria: Olive Ridley Turtle

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (Endangered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of a population of the species</td>
<td>The Project is not of a nature or scale that could plausibly lead to a long term decrease in the size of a population.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of the species</td>
<td>The Olive Ridley Turtles has a circumtropical distribution throughout tropical, subtropical and temperate waters. The spatial scale of the Project is insignificant with respect to the area of occupancy of the species.</td>
</tr>
<tr>
<td>Fragment an existing population into two or more populations</td>
<td>The proposed activity does not feasibly create a barrier to movement either directly or indirectly.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>Based on the current state of knowledge, no BIA has been identified for the Olive Ridley Turtle at or adjacent to the proposed Project location.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of a population</td>
<td>Lighting has the potential to disrupt the nesting activities of marine turtles. The majority of mining operations are sufficiently inland (approx. 10 km) away from beach nesting areas and buffered by extensive native vegetation to the extent that light spill from mining operations is highly unlikely to be an impacting process. The nesting beaches themselves will not be traversed during construction or operation of the mine. Staff or contractors will not be permitted to camp on beaches (check that this is the case). The light from the proposed Project will not be interacting with any other light sources in the region to create a cumulative impact. A contingency plan to reduce light spill will be included as part of the Project’s EMP should it be deemed necessary.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project will not modify, remove or destroy habitat that is potentially used as foraging by Olive Ridley Turtles.</td>
</tr>
</tbody>
</table>
Bauxite Hills Project • Matters of National Environmental Significance

<table>
<thead>
<tr>
<th>Result in invasive species that are harmful to a vulnerable species becoming established in the endangered species habitat</th>
<th>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the SRBP. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required locally sourced water will be used thus eliminating the risk of introduction or translocation of invasive species.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce disease that may cause the species to decline</td>
<td>Port developments at Weipa have not been implicated in the introduction of disease, and these developments are at a larger scale than that proposed for the SRBP. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species (and diseases). The Project will not plausibly introduce disease that may cause the population of olive Ridley turtles to decline.</td>
</tr>
<tr>
<td>Interfere with the recovery of the species</td>
<td>The nature and scale of the Project will not plausibly interfere with the recovery of the species as outlined in the national Marine Turtle Recovery Plan. The proposed implementation of feral animal control and marine debris clean-up program will assist recovery potential for the region.</td>
</tr>
</tbody>
</table>

7.10.2.3 Sawfish Species and Speartooth Shark

It is considered likely that two species of sawfish – the Largetooth Sawfish and the Dwarf Sawfish may occur within the Skardon River. A further species, the Green Sawfish may occur at the proposed transhipping location. While not confirmed as occurring in the Skardon River, it is plausible that the Speartooth Shark also occurs there. Based on existing survey evidence a key location for the Speartooth Shark and several of the sawfish is the nearby Port Musgrave/Ducie River/Wenlock River area, directly to the south of the Skardon River.

The significant overall threat to sawfishes and the Speartooth Shark is very clearly associated with incidental capture by commercial fishing operations. A lesser impact is from recreational fishing activities. The impacting processes from the proposed Project are highly unlikely to result in impacts to sawfishes or the Speartooth Shark. The species will not plausibly be negatively impacted by artificial lighting, underwater noise or shipping movements. Proposed construction and operational activities are outside the wet season which is identified as the key pupping period for sawfishes. Proposed construction and operational activities also largely occur outside of what is believed to be the pupping period for the Speartooth Shark.

The barge transit routes or the transhipping operations will not alter key habitat. The Project will not directly or indirectly alter the hydrology of the Skardon River and as such will not affect the extent or condition of freshwater and brackish water habitats that are considered to be important for the life history of Largetooth Sawfish and the Speartooth Shark. The placement of the piling at the proposed barge landing location, may create a local habitat that is not utilised by Largetooth Sawfish, but this habitat modification does not provide a barrier to movement of animals up and down the river as they do not extend across the whole river. The area to be disturbed is not consequential given the area of the Skardon River and highly unlikely to have any impact on Largetooth Sawfish at the population level. The assessment in Table 7-40 demonstrates the Project will not comprise impacts to the extent that recovery of sawfishes and river sharks will be negatively affected should they occur in the Skardon River.
Table 7-40 Assessment against significant impact criteria: sawfish species and Speartooth Shark

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment Against Significance Criteria (Vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of a population</td>
<td>The Project is highly unlikely to lead to a long term decrease in the size of any populations of sawfish or Speartooth Shark. The Project will not plausibly result in the death of any individual animals, and the impacting processes are not of a type or scale where a long-term decrease in the size of the population is plausible. Fisheries impact are widely considered the key impacting factors influencing populations.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of the species</td>
<td>The Skardon River is not currently included as part of the published estimate of the area of occupancy of the Speartooth Shark (Stevens et al., 2005). If the species does occur there, the estimated area of occupancy for the species will increase. The impacting processes that will occur as a result of the Project will not feasibly reduce the area of occupancy. The area of occupancy for the Largetooth and Green Sawfishes is northern Australian waters (north of 20°S). The Dwarf Sawfish has an area of occupancy from the Gulf of Carpentaria and then across northern Australia and down into the Pilbara region of Western Australia. The Project will not feasibly reduce the area of occupancy of sawfishes.</td>
</tr>
<tr>
<td>Fragment an existing population into two or more populations</td>
<td>The proposed activity does not feasibly create a barrier to the movement or migration of sawfish or the Speartooth Shark - either directly or indirectly.</td>
</tr>
<tr>
<td>Adversely affect habitat critical to the survival of the species</td>
<td>The critical habitat for the survival of the Speartooth Shark on western Cape York is the Port Musgrave/Ducie River/Wenlock system which is remote from the Project and not impacted by it. Critical habitat for the Largetooth Sawfish are the freshwater areas (including isolated pools) which the species likely uses as a nursery area. Freshwater habitat is also considered important nursery habitat for Speartooth Sharks. This critical habitat will not be impacted directly or indirectly by the Project. Available information suggests Dwarf Sawfish use mangrove habitat and shallow waters adjacent to mangroves and such habitat will not be altered to any significant extent by the Project with approximately 20.5 ha of mangroves expected to be cleared. Available information suggests that the Green Sawfish prefers the sand and mud flats outside of river mouths, although it does extend into deeper coastal waters. The transhipping operations will not alter habitat such as the shallow sand and mud banks that the Green Sawfish prefers.</td>
</tr>
<tr>
<td>Disrupt the breeding cycle of an important population</td>
<td>The Project is highly unlikely to disrupt the breeding cycle for sawfish or the Speartooth Shark. For sawfish, pupping occurs during the wet season when construction and operational activities will not occur. To the best available knowledge pupping for the Speartooth Shark occurs October-December. Construction is not proposed during this period. Operations will not plausibly interfere with the passage of Speartooth Shark for pupping in the lower estuary, or the migration of recruits to the upper estuarine/lower freshwater reaches if they do occur.</td>
</tr>
<tr>
<td>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</td>
<td>The Project will modify (but not remove) habitat through the placement of pilings at the BLF. The nature, scale and location of these habitat modifications will not plausibly result in the decline of sawfishes or the Speartooth Shark. The installation of culverts between the freshwater and estuarine reaches will improve hydrological flows of the area. Connectivity between the freshwater and marine system will remain.</td>
</tr>
<tr>
<td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the SRBP. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained onboard for the minimum time to ensure risk was negated.</td>
</tr>
</tbody>
</table>
7.10.2.4 Impact Significance – Migratory Marine Species

An assessment of the potential impacts on migratory marine species is provided in the following tables. Important habitat for marine is the same as defined for migratory bird species under the significant impact criteria from the MNES guidelines. No ‘important habitat’ as defined within the significant impact criteria for listed migratory species (DotE, 2013) is considered to occur within or immediately surrounding the Project area.

**Dugong**

The species has been recorded in Skardon River only once previously during seagrass surveys (Roelofs, 2003). The proposed BLF have recorded seagrass within its immediate vicinity as well as other scattered areas in the Skardon River. It is unlikely the extent of seagrass in the river constitutes a sufficient biomass to sustain a population of dugong. Given the occurrence of Dugong within heavy industry Ports such as Gladstone Harbour, and busy coastal waterways of Moreton Bay and Cleveland Bay, the severity of any Project affects are likely to be low. Further discussion is included in Table 7-41.

**Table 7-41 Assessment against significant impact criteria: Dugong**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>The extent of seagrass habitat in the Skardon River is unlikely to be sufficient to support Dugong populations. The habitat impacts that will result from the Project will not destroy or isolate an area of important dugong habitat.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the SRBP. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained onboard for the minimum time to ensure risk was negated.</td>
</tr>
</tbody>
</table>
Bauxite Hills Project • Matters of National Environmental Significance

Criterion | Assessment
---|---
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species | The Project is not in a location that contains habitat suitable to support an ecologically significant dugong population. As such, there is little or no scope for the Project to seriously disrupt the species lifecycle.

**Estuarine Crocodile**

Estuarine Crocodiles are a common resident of the Skardon River with bank slides and individuals being observed within the estuary system of the Skardon River on numerous occasions (Tom Koskela, pers. comm.) including during surveys for the SRBP (RPS, 2015a). Overall, the Project will not significantly impact the Estuarine Crocodile (Table 7-42). Estuarine Crocodile exist in close proximity to human habitation and port operations throughout Queensland. The Skardon River has not been identified as a key area for nesting. The Port Musgrave area, and in particular, the Wenlock River, is recognised as containing significant habitat for the Estuarine Crocodile with one of the largest breeding populations in Queensland.

**Table 7-42 Assessment against significant impact criteria: Estuarine Crocodile**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for a migratory species</td>
<td>While Estuarine Crocodiles utilise the Skardon River, the Project, the barge landing location cannot be considered important habitat. The scale of habitat modification at the barge landing location (clearing of 20.5 ha of mangroves) is not sufficient to alter the carrying capacity of the habitat to the extent that river wide populations of the Estuarine Crocodile will be impacted. The critical habitat for the Estuarine Crocodile is the Wenlock River which is not impacted by the Project.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the Bauxite Hills Project. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained on-board for the minimum time to ensure risk was negated.</td>
</tr>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>The construction and operation of the Project is largely outside of the breeding season for the estuarine crocodile. The Project contains no aspects that will create a barrier to the movement of the Estuarine Crocodile or alter the foraging of a key population. The port construction and operations are in the marine environment.</td>
</tr>
</tbody>
</table>

**Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin**

Australian Snubfin Dolphin has been recorded in the Skardon River estuary and adjacent open water habitat in recent years (Table 7-21). Indo-Pacific Humpback Dolphin has been observed in the Port Musgrave region and is considered likely to occur. Dolphin species may be impacted by increased underwater noise and vessel movements as a result of the Project activities. However, dolphins co-exist at a large number of locations on the Queensland east coast at, or directly adjacent to port facilities where vessel movements are substantially greater than proposed for the Project. This provides an indication that animals can adapt to this disturbance and maintain viable populations.
Overall with respect to cetaceans, it is concluded that the Project is unlikely to have a significant impact (Table 7-43).

**Table 7-43 Assessment against significant impact criteria: Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Species</td>
<td>There are uncertainties regarding the area of occupancy in the Gulf of Carpentaria of the dolphin species. However, there is no available information which identifies that the Project location is an important area for dolphins. The scale of the Project is small relative to available habitat that may be occupied by the species. The proposed activity does not feasibly create a barrier to movement either directly or indirectly. The available information from areas including Cleveland Bay and Moreton Bay where port developments are extensive and vessel movements are substantial, demonstrate that populations do not fragment in response to this type of disturbance, even when it is of a scale and intensity much greater than proposed in this Project.</td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the SRBP. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained onboard for the minimum time to ensure risk was negated.</td>
</tr>
<tr>
<td>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</td>
<td>It is highly unlikely an ecologically significant population of either species occurs in the Skardon River. Vessel movements in the estuary may cause transient disruption to feeding; however, this is only considered likely to cause a minor impact and the Project is highly unlikely to disrupt the breeding cycle for the dolphin species considered.</td>
</tr>
</tbody>
</table>

**Narrow Sawfish**

The most common sawfish likely to found in the region. As with the threatened sawfish species discussed in the previous section the major threat to this species is from fisheries bycatch. Impacts to this species as a result of the Project are expected to be minor, if at all. Further discussion is included in Table 7-44.

**Table 7-44 Assessment against significant impact criteria: Narrow Sawfish**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (migratory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Species</td>
<td>The Narrow Sawfish is broadly distributed throughout the Gulf of Carpentaria and uses the full range of coastal habitat, from estuary to nearshore offshore waters to a depth of 40m. The Project operations would not substantially modify or impact upon important habitat. Given known distributions of the Narrow Sawfish within the Queensland Gulf waters (approx. 90,000 km²), the proposed works would, at an absolute maximum, (1,000 km²) represent low intensity utilisation of less than 0.01% of the habitat area.</td>
</tr>
</tbody>
</table>
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the Project. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained on-board for the minimum time to ensure risk was negated.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

Given the identified distribution of the species within the Gulf it is highly unlikely that the localised passage of barges within the Skardon River and adjacent waters would seriously impact upon breeding, feeding or resting behaviour of a significant portion of the population. The fecundity of the Narrow Sawfish makes it considerably less sensitive to pressures potentially experienced by other sawfish and migratory species.

**Reef Manta Ray**

As the Australian populations are currently unaffected by significant pressures of fishing take or on habitat, the listing within the EPBC Act under migratory species seeks to provide legislative protection to contribute to mitigating threats in other parts of the world. Experts consulted as part of the application for listing in Australia agree that the Australian population, based on current evidence, is currently one of the world’s healthiest (Department of Environment, 2012). While the concept of preserving a species globally by listing it locally provides some formal system of protection, the proposed operations by Metro Mining do not represent significant threats to its sustainability locally, nationally or internationally. Further discussion is included in Table 7-45.

**Table 7-45 Assessment against significant impact criteria: Coastal Manta Ray**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Migratory Species</strong></td>
<td></td>
</tr>
<tr>
<td>Result in an invasive species that is harmful to the migratory species</td>
<td>Port developments at Weipa have not been implicated in the introduction of</td>
</tr>
<tr>
<td>being established in an area of important habitat for the migratory</td>
<td>invasive species, and these developments are at a larger scale than that</td>
</tr>
<tr>
<td>species</td>
<td>proposed for the Project. Ballast water of vessels in bulk carriers will</td>
</tr>
<tr>
<td></td>
<td>adhere to relevant national and international standards aimed at preventing</td>
</tr>
<tr>
<td></td>
<td>the spread of invasive species. Barges proposed for use are designed to</td>
</tr>
<tr>
<td></td>
<td>operate with minimum ballast and where ballast is required fresh water</td>
</tr>
<tr>
<td></td>
<td>will be used thus eliminating the risk of introduction or translocation</td>
</tr>
<tr>
<td></td>
<td>of invasive species. In an exceptional circumstance where marine water</td>
</tr>
<tr>
<td></td>
<td>was required for barge ballast, it would be retained on-board for the</td>
</tr>
<tr>
<td></td>
<td>minimum time to ensure risk was negated.</td>
</tr>
<tr>
<td>Substantially modify, destroy or isolate an area of important habitat for</td>
<td>Key aggregation sites for Reef Manta Ray are located along the eastern</td>
</tr>
<tr>
<td>a migratory species</td>
<td>coast and north west coast of Australia. These sites represent important</td>
</tr>
<tr>
<td></td>
<td>sites for breeding, feeding and cleaning. The Project will not have an</td>
</tr>
<tr>
<td></td>
<td>impact upon reef habitat or alter hydrological connectivity. The Project</td>
</tr>
<tr>
<td></td>
<td>would not conceivably alter nutrient regimes in the Gulf of Carpentaria or</td>
</tr>
<tr>
<td></td>
<td>alter food sources via changing plankton abundance or distribution.</td>
</tr>
</tbody>
</table>

| Seriously disrupt the lifecycle (breeding, feeding, migration or         | The study area is outside the identified areas for aggregation in Australia. |
| resting behaviour) of an ecologically significant proportion of the     | Given the published significance of these aggregation areas to the species, |
| population of a migratory species                                       | serious disruption upon breeding, feeding or resting are not plausible. The |
|                                                                          | Project would not establish barriers to migration. Some interaction with   |
|                                                                          | vessel movements during Project operations may be plausible, though given  |
|                                                                          | the nature of this species, such interactions would not appear detrimental |
|                                                                          | to populations (the eastern coast and west coast populations support      |
|                                                                          | tourism ventures where recreational divers swim with aggregating Manta     |
|                                                                          | Rays).                                                                     |
7.10.3 Impact Assessment – Commonwealth Marine Area

Commonwealth waters commence from the 3 nautical mile (nm) limit. They extend seaward to the 200 nm limit (in the case of the Gulf of Carpentaria, the entire gulf waters are included). The areas identified for transhipping and movement of bulk carriers servicing the Project will be undertaken in Commonwealth marine waters.

7.10.3.1 Transhipment Operations

The location of the transhipment operations is dominated by open sandy substrates, with minor live benthic cover (1 to 3%). Bulk carriers will anchor within the identified area and load bauxite via deck based cranes. The potential impact of the Project on the Commonwealth marine area has been reviewed (Table 7-47) and found not to be significant.

7.10.3.2 Bulk Carrier Movements

In moving approximately 5 Mtpa of bauxite per year, approximately 40 Panamax vessels with a capacity of 60,000-75,000 dwt will be required. This equates to approximately 1 bulk vessel per week. Given the throughput of bauxite export vessels from the nearby Port of Weipa (estimated at 450 vessel per year or 7-9 vessel per week) the proposed movements will present a small fraction of the existing export vessel traffic within the region.

Outside the existing requirements in place for international trading vessel ballast water management, vessel strike may be considered the next greatest potential impact for bulk shipping operations within Commonwealth waters. The Australian Government is working on improving the management of ship strikes in its waters with reference to actions identified in the United States’ guidance document for minimising the risk of ship strikes, endorsed by the Marine Environment Protection Committee (MEPC) of the International Maritime Organisation (IMO), at its meeting in July 2009. As a first step, the Australian Government is gathering information to assess the risks and impacts of ship strikes on cetaceans in Australian waters to help to inform a National Ship Strike Reduction Strategy.

7.10.3.3 Marine Bioregional Plan

This assessment has considered the outcomes of lengthy assessments made with regards to the Marine Bioregional Plan for the North Marine Region. Resources within the plan have been reviewed including:

- Schedule 1 - Pressure analysis, which defines pressures of concern within the region; and
- Schedule 2 - Regional advice on matters of national environmental significance, which defines matters of significance and provides resources as to their occurrence.
Table 7-46 Assessment against significant impact criteria for Commonwealth Marine Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Assessment against significance criteria (vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result in a known or potential pest species becoming established in the Commonwealth marine area</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the Project. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained onboard for the minimum time to ensure risk was negated. Introduced pest monitoring has been conducted from the Skardon River since 2008 (again in 2011). No evidence of marine pest introduction has been recorded. Monitoring is proposed to continue as part of operational requirements for this Project.</td>
</tr>
<tr>
<td>Modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results</td>
<td>Port developments at Weipa have not been implicated in the introduction of invasive species, and these developments are at a larger scale than that proposed for the Project. Ballast water of vessels in bulk carriers will adhere to relevant national and international standards aimed at preventing the spread of invasive species. Barges proposed for use are designed to operate with minimum ballast and where ballast is required fresh water will be used thus eliminating the risk of introduction or translocation of invasive species. In an exceptional circumstance where marine water was required for barge ballast, it would be retained onboard for the minimum time to ensure risk was negated. Introduced pest monitoring has been conducted from the Skardon River since 2008 (again in 2011). No evidence of marine pest introduction has been recorded. Monitoring is proposed to continue as part of operational requirements for this Project.</td>
</tr>
<tr>
<td>Modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results</td>
<td>The transhipping and bulk vessel components of the Project will not result in habitat impacts that will adversely impact the functioning or integrity of the Commonwealth marine area. The benthic habitats have been inspected, and determined to be dominated by sandy substrate with a low live cover. Scattered benthic biota has been recorded, but is well represented in adjacent areas.</td>
</tr>
<tr>
<td>Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution</td>
<td>The potential impacts on marine species of conservation significance (including cetaceans) have been assessed elsewhere in this report. No substantial adverse impacts are likely to occur.</td>
</tr>
<tr>
<td>Result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health</td>
<td>The Project will not result in substantial changes to air or water quality. Runoff from disturbed areas will be managed to minimise sediment release to the marine environment. The barge designs proposed for use mitigate against oil spills in the unlikely event of a collision.</td>
</tr>
</tbody>
</table>
### Criterion

<table>
<thead>
<tr>
<th>Assessment against significance criteria (vulnerable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected</td>
</tr>
<tr>
<td>The Project will not result in the introduction of persistent organic chemicals, heavy metals or other potentially harmful chemicals in the marine environment. Management measures such as bunding of hydrocarbon storage areas, and design measures and operational procedures for fuel transfer are proposed to minimise risk of release of contaminants.</td>
</tr>
<tr>
<td>Have a substantial adverse impact on heritage values of the Commonwealth marine area, including damage or destruction of an historic shipwreck</td>
</tr>
<tr>
<td>There are no examples of heritage values (including shipwrecks) in the Commonwealth marine area at or adjacent to the Project activities.</td>
</tr>
<tr>
<td>Interfere substantially with the recovery of the species</td>
</tr>
<tr>
<td>All orchids were detected outside Project impact areas within fringing melaleuca and mangrove communities. The proposed action will only result in minor impacts to habitat for these species such as wetlands including melaleuca and mangrove fringing communities. Approximately 37 ha of suitable habitat is anticipated to be cleared to accommodate Project infrastructure. Should any threatened or least concern individual orchids be confirmed on site within proposed clearing areas they will be translocated to suitable adjacent habitats that are not subject to disturbance. The action is not likely to interfere with the recovery of this species. No areas identified as priority recovery areas or offsets for this species are known from the Project area or adjoining lands.</td>
</tr>
</tbody>
</table>

### 7.11 Cumulative Impacts

#### 7.11.1 Cumulative Impacts – Terrestrial Species

Cumulative impacts on terrestrial ecological values were assessed by considering impacts on vegetation communities and MNES species from past, current and (reasonably foreseeable) proposed developments within the broader bioregion. The scope of the cumulative impact assessment included:

- Projects within 150 km of the proposed development;
- Projects in the broader bioregion; and
- Known major infrastructure projects (e.g., power stations or water infrastructure) that are seeking approval or have obtained development approval other than through an EIS.

Two operational and several proposed mine developments were identified in the broader bioregion (Figure 7-17), and include:

- Skardon River Bauxite Project - Gulf Alumina Limited are progressing approvals for the Project, approximately 100 km north of Weipa. The Project includes three MLAs - MLA 40082, 40069 and 6025 covering a total area of 3,925 ha. These MLAs surround and dissect those of the Bauxite Hills Project (refer inset Figure 7-17). The Project involves the construction and operation of an open cut bauxite mine with an expected life of ten years. The Project’s Environmental Impact Statement was publically released from 2 November 2015 to 11 December 2015, information from which has already informed sections of this Chapter;
- Weipa and Amrun (formerly South of the Embley) developments - Rio Tinto Aluminium Limited have mined and shipped bauxite from the Weipa mine (north of the Embley River) since 1963. This development has long been the only operating bauxite mine in Queensland, and one of the world's largest. The bauxite reserves at the Weipa mine are gradually depleting; however, Rio Tinto Aluminium Limited recently secured approval (subject to conditions) to expand the development to include MLAs south of the Embley River (the Amrun Project);

- Hey Point Project - Green Coast Resources Pty. Limited proposes to develop a bauxite mine approximately 10 km south of Weipa. A site-specific application for an EA was lodged with EHP in July 2013. Due to the relatively minor scale of the proposed development the EHP deemed that an EIS was not required; however, further information was requested pertaining to land values (rehabilitation), surface and groundwater, and biodiversity impacts. The requested supporting information was submitted to the EHP in November 2014; and

- Aurukun development - On August 19 2014, Glencore was selected by the Queensland government as the preferred developer of the Arukun Bauxite Resource, and the Development Agreement was finalised in December 2014. Glencore are currently progressing a feasibility study for the development. The proposed development is approximately 100 km south east of Weipa on Archer Bay, between the Ward and Watson Rivers.

Other significant developments in the area include the Urquhart Point Minerals Sands Project, Archer River Quarry, the existing Port of Weipa, and a proposed port development on the Embley River.
Legend
- Town
- Port Musgrave
- Road
- Watercourse

Surrounding Projects
- Metro Mining Bauxite Hills Project
- Gulf Alumina Skardon River Bauxite Project
- Rio Tinto Alcan Weipa Bauxite Project
- Rio Tinto Alcan Amrun Bauxite Project
- Glencore Aurukun Bauxite Project

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
QLD Government Open Data Source;
Australian Government Bureau of Meteorology.

Figure 7-17
Significant development projects surrounding the Project area

F:\1_PROJECTS\BES150115_Bauxite_Hill\GIS\DATA\MXD\FINAL\ERA\SOCIAL\003-R1_SURROUND_PROJ.mxd
7.11.1.1 Cumulative Impact Assessment

Of the developments currently operating or proposed for the area, the Gulf Alumina SRBP is expected to have the greatest cumulative impact on terrestrial ecological values when considered in conjunction with the Project. The SRBP is directly adjacent to the Project, is due to commence construction at a similar time and operations will also occur during the dry season. The SRBP is also the most likely to proceed as environmental studies have been completed, the EIS has been released, and public consultation completed. The most relevant impacts to be considered for terrestrial flora species relate to the area of remnant vegetation and REs to be impacted, associated loss of fauna habitats and corresponding impacts relating to habitat fragmentation and threatening processes.

Cumulative Impacts to Vegetation Communities and Threatened Flora Species

The loss of remnant vegetation cover will occur as a result of construction and operation of the Bauxite Hills Project and SRBP. Direct impacts on vegetation will occur as a result of staged vegetation clearing for the pit mine areas, and to accommodate the Project infrastructure. For the Bauxite Hills Project a total of 1,467 ha of remnant vegetation is required to be cleared and the SRBP will result in a total of approximately 1,374 ha. The total combined area of clearing is 2,841 ha. Over 95% of the total clearing will impact Darwin Stringybark woodlands (RE 3.5.2). This is the most widespread vegetation community in Cape York (refer Table 7-23) and supports a range of flora and fauna species. There are no impacts to any TECs as a result of the two bauxite mine Projects.

Flora ecology surveys for both Projects have not confirmed the presence of any threatened flora species under the EPBC Act. Surveys for Project potentially recorded Chocolate Tea Tree Orchid encountered within wetland habitats proximate to proposed mining areas. The vast majority of known and potential habitat for threatened flora species identified as likely to occur in the broader Project area do not fall within the areas proposed for mining. These habitats are generally associated with buffers protecting riparian or wetland areas and the impact of the Project on these species was not considered significant under the EPBC Act Significant Impact Guidelines 1.1 (DotE, 2013) (refer Table 7-24). All orchid species were detected in Melaleuca swamps adjacent to proposed mining operations and are unlikely to be impacted by the proposed mining operations. A minimum buffer width of 360 m currently exists between proposed operations and these records. If these orchids are recorded at a later date in the SRBP area they are also likely to be located in vegetation communities outside of proposed disturbance areas. A SSMP will be developed for the Project and will include this species. Should an orchid species be recorded within an area required for clearing the species also will be translocated to suitable adjacent habitats.

Cumulative Impacts to Wetlands

Both the Bauxite Hills Project and SRBP do not expect direct impacts on the two palustrine wetlands: Big Footprint Swamp and Lunette Swamp. The two wetlands are outside of proposed mining and infrastructure areas; however, it is noted that the Projects will be undertaking some clearing and mining in close proximity to these wetland areas. Therefore there is potential for indirect impacts to wetlands through changes to hydrology, potential for increased pest animals and plants and altered fire regimes. Both Projects have stated there is likely to be potential for changes to surface water runoff and groundwater levels in these wetland systems. It is expected there will be a small increase in the peak water table in parts of the area due to enhanced recharge, and other parts of the area a decrease in the peak water table due to discharge in the mine pits.

In the vicinity of Big Footprint Swamp, Ewan Wilson Consulting (2015) identifies two time periods when changes to the water table are most extreme:
• Year 2022 when the peak water table to the north of Big Footprint Swamp is predicted to decrease by 0.1 m and the peak water table to the south is predicted to increase by 0.1 m; and

• Year 2026 when the peak water table in the south of Big Footprint Swamp is predicted to increase by 0.1 m.

At these times the Project groundwater modelling is showing small to negligible increases in peak pool level. In year 2026 the peak pool level is predicted to increase by less than 0.1 m. Therefore, a combined peak pool level is no more than 0.2 m. It could be viewed that the predicted drawdown by Skardon River in year 2022 will be offset by the predicted increase in pool level by the Project. Further information in relation to the groundwater modelling is provided in the SRBP EIS Chapter 13 and Appendix E1 – Groundwater Technical Report.

It is not expected the minor changes to pool level and subsequent potential increase in the inundation zone for a period of the year, will have a significant impact on the wetlands ecological function and biodiversity. The wetlands are resilient to changes in water level and duration of inundation due to natural conditions being quite dynamic between wet and dry seasons and also monsoons. The wetlands will still provide habitat for aquatic and terrestrial flora and fauna.

**Cumulative Impacts to Threatened Fauna Species**

Direct impacts to threatened MNES fauna known or potentially occurring in the area would result from vegetation clearing required to accommodate the mine and infrastructure footprints for the Bauxite Hills Project and SRBP. This will in turn result in a loss of foraging and breeding habitats for some species. The largest impact will be to the Darwin Stringybark woodlands and those species that utilise these habitats for foraging, nesting and breeding. This may include the Palm Cockatoo and Black-footed Tree-rat. Both Projects will result in a large loss of Darwin Stringybark woodland in the order of 2,841 ha, that will be cleared in stages over approximately 10 years. The clearing represents approximately 6.4% of the extent of this RE within a 20 km radius of the Project and 0.005% of the total extent of this RE in the bioregion. There will be large areas of Darwin Stringybark woodland that will be retained adjacent to those areas cleared within the MLAs, and in the local region and bioregion. Therefore the loss of foraging habitat is not likely to be significant, also including consideration that species such as Palm Cockatoo are highly mobile and will forage over large areas. Therefore the most significant cumulative impact is likely to be the loss of breeding places such as hollow-bearing trees.

A SSMP and a Vegetation Clearing Plan will be prepared prior to disturbance. These plans will identify specific mitigation measures that will be in put in place to reduce impacts to fauna species and associated habitats and breeding places. Specific mitigation measures will be put in place to minimise the loss of hollow-bearing trees through:

• Retention in-situ where possible;

• A small number of large, hollow-bearing trees will be selectively felled ahead of general clearing and relocated (e.g. cemented in place) within the rehabilitation areas to provide immediate breeding and nesting locations for some species, and act as ‘tall points’ for bird perching within the otherwise cleared areas, whilst rehabilitation is establishing;

• Use of fauna spotters during clearing to ensure hollow bearing trees are identified and measures taken to encourage fauna to exit the hollow, or the spotter will check for fauna once the tree is down and relocate the species to suitable habitats away from clearing; and

• Installation of appropriate nest boxes in adjacent intact habitat that are designed for particular species requirements.
Migratory birds recorded or likely to occur in the Project areas predominantly utilise estuarine habitats such as mangroves, tidal flats and bays associated with the Skardon River and mouth of the Skardon River. Migratory species such as Great Egret and Eastern Cattle Egret have been recorded in close proximity to Big Footprint Swamp and may use this as a foraging area in the wet season. The SRBP will not require clearing in any wetland REs and the Bauxite Hills Project estimates wetland impacts up to 20.5 ha of mangrove habitat. While there are some predicted changes to hydrology of the Big Footprint Swamp and Lunette Swamp in proximity to the two mines, these changes are not expected to have a negative impact on the ecological function or biodiversity values of these swamps. Groundwater modelling is predicting a small increase in pool level and area of inundation which may benefit Migratory bird species by providing a larger foraging area for potentially a longer duration. Therefore it is not expected the Projects will have a cumulative impact on Migratory birds or their habitats.

7.11.2 Cumulative Impacts – Marine

In terms of the marine environment, the only project considered to have a cumulative impact is the Gulf Alumina - SRBP. The potential cumulative impacts have been defined based upon operational areas for the project, namely Skardon River, transhipment area and bulk carrier movements.

7.11.2.1 Skardon River

The Skardon River is presently undeveloped, with previous commercial operations having been discontinued several years ago upon the cessation of kaolin mining. Low scale commercial and recreational fisheries occur within the river. Camping occurs on the shore during the dry season. Pressures upon habitat and marine species is of limited impact, being managed by existing regulatory processes (e.g. catch numbers and size limits). The Mapoon Council manages access to the area by campers.

Gulf Alumina is proposing to establish a very similar operation to the Project on the Skardon River and represents a similar investment in infrastructure and target tonnages. Gulf Alumina are proposing a purpose-built barge operating from the existing jetty infrastructure areas, rather than barges and tugs at a new development location as proposed by Metro Mining. Gulf Alumina are proposing bed-leveling to improve barge access over the ebb tide bar while Metro Mining is not. The construction process for both projects is very similar with regards to barge infrastructure. A short construction period during the dry season would be targeted by both operations. The Gulf Alumina project presents reduced clearing on mangrove habitat by way of construction of the BLF access corridor and associated RoRo facility for the supply of equipment and materials. The Gulf Alumina facility is situated at the start of seagrass habitat distribution, and as such less seagrass will be passed by barges and vessel traffic.

The operational scenario would present a substantial increase in vessel traffic should both projects overlap. To meet the basic annual tonnages and weekly bulk carrier loading targets described by the proponents, up to 100 barge movements would be required within the Skardon River each week (~3600 movements annually). In comparison, the Port of Weipa experiences approximately 1000 movements along the channel (in and out) annually, though with much larger vessels than proposed by either Gulf Alumina or Metro Mining. These movements would be accompanied by additional movements associated with fuel and materials supply.
7.11.2.2 Predicted Cumulative Impacts

Mangroves and Seagrass

The Project will require the clearing of 20.46 ha of mangrove habitat for the BLF, RoRo and haul roads. The addition of the Gulf Alumina project would present a minor increase in mangrove disturbance (approximately 0.2 ha) due to clearing and construction of marine facilities. These impacts are localised in extent and represent a relatively small proportion of the available mangrove habitat in the wider area. On a local reach scale, impacts may be considered cumulative (i.e. reducing refuge or feeding habitat). However, on an estuary wide scale, the impacts may not appear to interact.

The Gulf Alumina project does not interact with seagrass in as close proximity as the Metro Mining Project. However, both projects have the potential to induce deposition and minor erosion over adjacent seagrass beds due to propeller wash when manoeuvring. Due to the increased passage of vessels within the upper estuary and the necessary crossover of utilisation of the same navigation route, cumulative increases in seagrass impact may be expected.

Water Quality and Sediment

Given their relatively close proximity, and the ebb and flood of the river (i.e. tides will move any impacts up or down stream past the other operation), cumulative impacts upon water quality due to fuel spillages or chemical releases (construction and operational) may be anticipated. Generally the likelihood of such events are small, and by following standard mitigation practices and operational standards any increase would be of a minor concern. The increased risks of hydrocarbon spillages may be considered of higher importance given the doubling of infrastructure and hydrocarbon movements through the river. However, having two operations capable to respond to a larger spill event may provide a reduction to the overall risks associated with a spill (i.e. it is highly unlikely that two projects would need to react to a spill at the same time). Despite this scenario, the proximity of the two operations is likely to dictate that the impacts to water quality are cumulative.

Propeller Wash

It is assumed that the combined programs would double the incidence of propeller wash within the navigation channel as the channel alignment is being shared. The proposed tug and barge operation is expected to present a smaller footprint for propeller wash, though its perceived capability to operate on a wider tidal range may make up for the initial reduced impacts. Propeller wash has been modelled and described as a low impact process resulting in low level increases in suspended sediments which occur infrequently, and over a short duration.

Given the dominance of sands and gravel fractions, the more frequent passage of vessels over the navigation alignments may enhance the process of bed armouring. Finer sediment fractions would be winnowed quicker leaving heavier sediments which are less prone to mobilisation. Given the limited water quality impacts predicted by modelling, assessing the fate of suspended sediments may assist in defining the extent of potential cumulative impacts (i.e. assessing depositional areas and considering potential sensitive habitat distributions).

Vessel Movements

Should both projects occur over the same period, or overlap to some extent, the Skardon River would be exposed to increased vessel traffic (approximately doubled). The key impacts associated with such traffic volumes include potential bow wave and wake impacts, propeller wash, physical
disturbance of marine fauna and potential for vessel strike. While the footprint of impact due to increased vessel movements would remain the same (i.e. both utilising a single navigation corridor through the Skardon River), the frequency of passages would increase. Interaction with significant species and the risk of vessel strike may potentially double.

**Safety**

Vessel navigation and safety will be managed under the existing protocols. The proposed number of vessel movements would represent a substantial increase and consideration of processes with MSQ Cairns Harbour Master would need to be undertaken.

**Noise**

Cumulative impacts associated with construction may be of greatest concern should piling operations be undertaken together. Additional assessment of noise profiles would be required, and a potential extension of exclusion zones to protect marine fauna.

Operational noise has been assessed as a relatively local impact. However, the repeated use of barges along the channel with increased frequency is likely to result in a cumulative impact on the noise environment. Fauna would be exposed to a doubling of noise impacts and as such, it is considered a cumulative impact.

**Lighting**

Lighting from the two projects will result in a cumulative increase in lighting footprints depending upon their stages of development. However, given extensive buffers between nesting beaches from vegetation and topography, the resulting light impacts from proposed mining, barge facility and camp areas will not result in a cumulative increase in lighting impact along turtle nesting beaches. Offshore lighting during transhipment may provide a cumulative effect, although over distances of between 5 and 15 km, the resulting light impacts are considered minor. Techniques for light spill mitigation have been provided for consideration as an impact mitigation measure where appropriate. Mitigation of the potential impacts to nesting turtles via the selection of appropriate lighting for facilities and barges is proposed by both proponents.

**Feral Animal Control**

The incidence of predation of eggs and hatchlings by feral animals is considered a significant threat to marine turtle recovery. The implementation of two active mining operations, increased disturbance to pigs and other pest animals, and a doubling of feral animal control investment in the local region may reduce the risks of predation on turtle nests along the nesting beaches to the west of the projects resulting in a cumulative positive impact to nesting turtles in the area.

### 7.11.2.3 Transhipment Area and Bulk Carrier Movements

Bulk carriers and coastal freighters service the existing trade requirements within the Gulf of Carpentaria for bauxite export, fuel, cattle and general supplies. These vessels operate within designated shipment routes several km to the west of the proposed transhipment locations. The transhipment areas are both undeveloped locations largely undisturbed by anthropogenic processes.

Approximately 140 bulk carriers would be required to service both projects each year (70 each for Gulf Alumina and Metro Mining). The nearby port of Weipa processes approximately 500 bulk carriers annually, exporting some 30 million tons of bauxite. The additional carriers required for
the Gulf Alumina project would represent an approximate 14% increase in bulk carrier movements for the region. A further 14% would be attributable to the proposed Metro Mining Project, increasing bulk carrier movements within the wider region by nearly 30% (both projects combined).

7.11.2.4 Predicted Cumulative Impacts

Marine Pests

Existing requirements are in place for ballast water management on international trading vessels. However, unlike physical impacts such as water quality or sediment impact, the incursion of a marine species which is self-perpetuating cannot be effectively described as a localised impact. Given the doubling in bulk vessel passages the risk of marine pest incursion would potentially double. The risk of introduction of marine pests is considered cumulative.

Vessel Strike

Vessel strike may be considered the greatest potential impact for bulk carrier operations within Commonwealth waters. The Australian Government is working on improving the management of ship strikes in its waters with reference to actions identified in the United States’ guidance document for minimising the risk of ship strikes, endorsed by the MEPC of the IMO, at its meeting in July 2009. As a first step, the Australian Government is gathering information to assess the risks and impacts of ship strikes on cetaceans in Australian waters to help to inform a National Ship Strike Reduction Strategy.

The increase in vessel movements through adjacent navigation routes will increase the potential risk of vessel strike with significant marine fauna. Vessel strike risks are considered cumulative.

Propeller Wash

The operation of transhipment zones will be duplicated, as will the potential for propeller wash during departure of the bulk carriers. However, given an absence in significant benthic habitat, the localised impact of propeller wash, the broad expanse of immediate alternative habitat and the distances between the two operations, the impacts attributable to propeller wash within the transhipment areas may be considered separate processes and an effective increase in marine pressures would not occur. The distances between the two locations would facilitate mitigation of impacts. Propeller wash impacts from the transhipment process are not considered cumulative.

Water Quality and Sediment

As for propeller wash the two proposed transhipment locations would generally experience only localised impacts to water and sediment quality. The sites are separated over several kilometres and the risks of potential pollutant releases are perceivably very small. Water and sediment impacts from the transhipment process are not considered cumulative.

The threats from a larger more significant hydrocarbon spill due to two operators is not anticipated given the rarity of such events. However, having access to dual resources for spill response may limit operational impacts of a spill overall.
7.12 Summary of Impacts to MNES

The potential unmitigated impacts to MNES as a result of the Project include:

- The clearing of remnant vegetation including 1,429 ha of Darwin Stringybark (RE 3.5.2) woodland providing potential habitat for Palm Cockatoo and Black-footed Tree-rat;
- The clearing of remnant vegetation including 17 ha of potential habitat for Chocolate Tea Tree Orchid (*Melaleuca* woodlands);
- The clearing of 20.5 ha of mangrove and 0.25 ha of salt pan vegetation providing potential habitat for Estuarine Crocodile and Migratory bird species;
- Construction of the BLF may cause disturbance of ASS and have localised noise impacts on marine fauna;
- Groundwater hydrology impacts have been modelled suggesting a potential raising of seasonal water levels in adjacent wetland areas such as Big Footprint Swamp by an average of 0.15 m which provides habitat for migratory wetland bird species;
- Vessel movements in the Skardon River and to the offshore transhipment area may provide noise impacts and potential for vessel strike of Dugong, marine turtles, Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin;
- Erosion resulting in sediment runoff into adjacent wetlands and creeks and a reduction in water quality for estuarine fauna;
- Surface water and groundwater flows from areas associated with the Project may carry contaminants including, sediments, hydrocarbons and other chemicals in the estuarine environment resulting in a reduction in water quality for estuarine fauna;
- Dust accumulation from traffic movements, construction and operation activity may have deleterious impacts on vegetation health and estuarine water quality resulting in a reduction in habitat value for terrestrial fauna and estuarine fauna respectively;
- Increased fire risk which may result in changes to vegetation structure and species richness which may reduce habitat for listed terrestrial fauna; and
- Increases in the occurrence of terrestrial and marine weed and pest species reducing habitat values and increasing competition with listed fauna.

These impacts will be mitigated under measures incorporated and monitored within the Project EMP and are considered to be minor in extent. Assessment under the EPBC Act Significant Impact Guidelines 1.1 (DotE, 2013) indicate there will be no significant residual impacts as a result of the Project’s activities.

The greatest cumulative impact to terrestrial values is associated with the joint development of the Project and Gulf Alumina’s SRBP arises from the clearing of Darwin Stringybark woodland and the associated value to native fauna and connectivity. The cumulative impact of this clearing is fully incorporated in the assessment shown in Section 7.11.1.

The greatest cumulative impact to the marine environment associated with the joint development of the Project and Gulf Alumina’s SRBP may arise from the increased boat traffic in the Skardon River estuary and potential impacts to increased turbidity, erosion of benthic communities and banks, and
collision and noise impacts on marine fauna. The cumulative impact of these activities is fully incorporated in the assessment shown in Section 7.11.2.

7.13 Environmental Offsets Strategy

Based on the preceding significant impact assessments of MNES species (both terrestrial and marine) no significant residual impacts to MNES fauna or flora are predicted to occur as a result of the Project’s activities. Therefore, no environmental offsets are required under the EPBC Act Offsets Policy. Nevertheless biodiversity offsets will be required for the Project to compensate for any significant, residual biodiversity values listed as MSES which includes limited habitat for MNES (e.g. mangrove habitat). For the sake of completeness Metro Mining has included the following Project Environmental Offsets Strategy.

To fully address the Projects offset requirements a Biodiversity Offsets Strategy Report has been prepared by Amec Foster Wheeler (Appendix C). This report evaluates both MNES and MSES offset requirements, including a Significant Impact Assessment for MSES using the Queensland Environmental Offsets Policy: Significant Residual Impact Guideline (SoQ, 2014) to determine the extent of offsets required. Offset delivery options are then considered (e.g. direct offsets, financial contributions, in-direct offsets) as applicable under relevant policies and timing of offset delivery.

This section identifies the MNES and MSES offset requirements and extent of the impacts to be offset and evaluates suitable offset delivery options based on the findings of the following technical reports:

- Terrestrial Ecology Assessment Report (Amec Foster Wheeler, 2016a) (Appendix B1);
- Aquatic Ecology Assessment Report (Amec Foster Wheeler, 2016b) (Appendix B2);
- Skardon River Bauxite Project Terrestrial Ecology Report (RPS, 2015); and

Objectives

As evident in the aforementioned sections Metro Mining is seeking to avoid, minimise and mitigate environmental impacts to the greatest extent possible when planning for, and operating the Project. Where possible, infrastructure will be located away from significant biodiversity areas, clearing of native vegetation will be minimised where possible and mitigation measures such as those in Section 7.9.1.2, 7.9.2.2 and 7.10.2 will be implemented. Where a significant residual impact (after management and mitigation measure has been implemented) to MNES or MSES has been determined, these are proposed to be offset. An overall objective is to integrate Commonwealth and State offset requirements to avoid duplication. This is also an intended purpose of the Environmental Offsets Act 2014.

It is recognised the Project’s bioregion and landscapes are unique, and present some challenges to the typical approach of offset delivery. A more flexible approach is needed. The Cape York Peninsula Bioregion is highly vegetated and remote. Threats from vegetation clearing and fragmentation in the bioregion are low. Threats to biodiversity are recognised from altered fire regimes, pest animals and plants, and grazing. Challenges to offsetting are evaluated in this report including land tenure, and recommendations to deliver offsets in a way that will provide the greatest conservation gains and involvement of local traditional owners to provide social benefits are recommended. Offset delivery options tailored to this Project are discussed further in Table 7-48.
Post approvals Metro Mining will undertake further analysis and consultation to finalise the offset delivery options which will be detailed in an Offset Delivery Plan. The Offset Delivery Plan will be submitted to the relevant assessment agencies for approval prior to Project commencement, including any vegetation clearing on site.

**EPBC Act Environmental Offsets Policy**

The EPBC Act Environmental Offsets Policy outlines the Commonwealth Government’s approach to the use of environmental offsets. Offsets are viewed as the third strategy to reduce potential impacts to MNES after avoidance and mitigation, which are generally referred to as on-site measures. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. This policy provides flexibility in delivering ‘good environmental outcomes’. For example, the enduring protection and management of a threatened species’ habitat can be achieved through a variety of methods, including through conservation land management by rural landholders, or in partnerships with Indigenous communities.

The Offsets Assessment Guide accompanies this policy, to give effect to the requirements of this policy, utilising a balance sheet approach to measure impacts and offsets. It applies where the impacted protected matter is a threatened species or ecological community. An offset can comprise a combination of direct offsets and other compensatory measures and should align with conservation priorities for the impacted protected matter. Offsets that deliver social, economic and/or environmental co-benefits are encouraged.

**Environmental Offsets Act 2014**

A new offset framework was introduced in Queensland in July 2014. This includes:

- *Environmental Offsets Act 2014*;
- *Environmental Offsets Regulation 2014*; and

The above framework replaces all previous State offset policies. The Queensland Offset Framework establishes an ‘avoid, mitigate, offset’ hierarchy for development. Where it is demonstrated that impacts cannot be avoided or mitigated, and there is a ‘significant’ residual impact to a prescribed environmental matter, then an offset is required.

Under the Queensland Environmental Offsets Policy (QEOP) to avoid duplication between jurisdictions, State governments can only impose an offset condition on a prescribed activity, if the same, or substantially the same impact and the same, or substantially the same matter, has not been subject to assessment under the EPBC Act for an activity declared as a controlled action. Therefore it is proposed where a MSES is also listed as MNES and impacts have been assessed, that outcome will also apply to the MSES value.

A proposed offset delivery package needs to be approved by EHP for MSES and MNES. A draft Offset Delivery Plan is required to be submitted and approved prior to disturbance. Three primary options (or a combination of options) are provided for offset delivery. These are detailed below.

**Financial Settlement Offsets**

A financial settlement payment can be used to meet an offset requirement for MSES impacted by a development. It must be calculated using the Financial Settlement Offset Calculation Methodology set out in the QEOP. A financial settlement must be paid to the offset account administered by EHP.
prior to Project commencement. Financial payments are made up of costs associated with on-ground land management, administration and landholder incentive payment.

**Land-based Offsets**

This is referred to as a type of proponent-driven offset. The offset is to achieve an equivalent environmental outcome. It must be of a size and scale proportionate to the significant residual impact on MSES. Land-based offsets are to provide environmental values as similar as possible to those being lost and may consist of remnant or non-remnant vegetation. The size of a land-based offset can be determined through use of the Land-based Offsets Multiplier Calculator or using a rapid assessment which caps the offset at a ratio of 1:4.

The offset must be legally secured for at least the duration of the impact. The policy provides a number of options for legal security, specifically:

- Voluntary declaration under the VM Act;
- Nature refuge or other form of protected area under the *Nature Conservation Act 1992* (NC Act); or
- Statutory covenant for environmental purposes under the *Land Act 1994* or *Land Title Act 1994*.

**Direct Benefit Management Plans**

Proponent-driven offsets can also be delivered through priority actions identified in a direct-benefit management plan (DBMP). DBMPs are pre-approved packaged investments that outline priority actions to address threats to, and provide substantial benefits for MSES. Substantial benefits are achieved by providing landscape scale benefits for those matters, or if the matter is localised, improved outcomes compared to a traditional land-based offset. Research and education can be included but form no greater than 10% of the package, unless otherwise agreed. Examples of DBMP actions are:

- Enhancing, restoring and establishing key habitat across multiple tenures or properties;
- Protecting and restoring significant freshwater, marine or estuarine ecosystems;
- Threat mitigation activities such as weed or feral animal control on a landscape or multiple property scale;
- Research programs that are consistent with published recovery plans, conservation advice statements or government/community established programs; and
- Landscape scale fire management activities.

In electing to provide an offset (or part of) through a DBMP, the proponent will need to include the approved DBMP that relates to the MSES, in an offset delivery plan outlining how the actions will be implemented and demonstration of how proposed actions are additional to existing activities, are cost effective, and will provide a conservation outcome.

**Significant Impact Assessments**

This section summarises the analysis that has been completed to determine the MSES that are known and likely to occur in the Project site, and whether the Project will have a ‘significant, residual impact’ to MSES. MSES are prescribed environmental matters defined in Schedule 2 of the *Environmental Offsets Regulation 2014*. This section summarises the significant impact assessments.
that have been completed to identify whether the Project will have a significant, residual impact to MNES or MSES, which are then required to be offset.

### 7.13.1 MNES Confirmed within the Project Area

An assessment of the impacts to MNES has been carried out using the Significant Impact Guidelines 1.1 (DotE, 2013). The results of the assessment are located in Chapter 7 – MNES and summarised in Appendix C. The assessment of impacts to MNES is as follows:

- No TECs listed under the EPBC Act have been identified within or adjacent to the Project site;
- No listed flora species were confirmed; however, one orchid species, Chocolate Tea Tree Orchid listed as Vulnerable under the EPBC Act is identified as likely to occur within the Project site;
- Two terrestrial threatened fauna species listed as Vulnerable under the EPBC Act have been recorded during surveys or are likely to occur within the Project site – Palm Cockatoo and Black-footed Tree-rat. Palm Cockatoo was listed under the EPBC Act in October 2015. The Project was listed as a ‘controlled action’ by DotE in September 2015 prior to the listing of Palm Cockatoo and as such, the species is not required to be considered further;
- Nine marine threatened fauna species listed as Critically Endangered, Endangered or Vulnerable under the NC Act and/or EPBC Act have been recorded during previous surveys or are considered likely to occur within the Project site:
  - Five threatened marine turtle species
  - Australian Snubfin Dolphin and Australian Humpbacked Dolphin
  - Three sawfish species and Speartooth Shark
  - Dugong
- Nine avian species listed as Migratory under the EPBC Act have been recorded, or are likely to occur, in the Project area (refer to Table 7-16); and
- Two marine fauna species listed as Migratory under the EPBC Act have been recorded, or are likely to occur, in the Project area.

Under the assessment for potential significant impacts to MNES no significant residual impacts have been predicted on matters of MNES and therefore no offsets are proposed under the EPBC Act.

### 7.13.2 MSES Confirmed within the Project Area

This section summarises the analysis that has been completed to determine the MSES that are known or likely to occur in the Project area, and whether the Project will have a ‘significant, residual impact’ to MSES. MSES are prescribed environmental matters defined in Schedule 2 of the Environmental Offsets Regulation 2014. Table 7-47 provides an assessment of the impacts to MSES fauna known or likely to occur on the site under the Significant Residual Impact Guideline (SoQ, 2014).

The remaining MSES impacts have then been assessed for significance in detail in the Biodiversity Offsets Strategy (refer Table 4-3, Appendix C) guided by the Significant Residual Impact Guideline, 2014. Table 7-47 summarises the predicted impacts to MSES of the Project.
### Table 7-47 Impacts to MSES through clearing for the Project

<table>
<thead>
<tr>
<th>MSES Trigger</th>
<th>VM Act or NC Act Status</th>
<th>Direct Impact Area of Estimated Disturbance (ha; max)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endangered and OC REs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC RE 3.3.12</td>
<td>OC</td>
<td>0.6 ha (Southern Haul Road)</td>
</tr>
<tr>
<td><strong>Watercourse REs (within a defined distance from a Strahler stream order)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stream Order 2 (25m Buffer) RE 3.1.1</td>
<td>-</td>
<td>0.06 ha (Southern Haul Road)</td>
</tr>
<tr>
<td>Stream Order 2 (25m Buffer) RE 3.1.1a/3.1.3</td>
<td>-</td>
<td>0.39 ha (Southern Haul Road)</td>
</tr>
<tr>
<td>Stream Order 2 (25m Buffer) RE 3.3.22</td>
<td>-</td>
<td>0.28 ha (Southern Haul Road)</td>
</tr>
<tr>
<td>Stream Order 3 (50m Buffer) RE 3.1.1a/3.1.3</td>
<td>-</td>
<td>0.05 ha (BLF)</td>
</tr>
<tr>
<td>Stream Order 3 (50m Buffer) RE 3.1.1a/3.1.3</td>
<td>-</td>
<td>0.03 ha (RoRo Facility)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>0.81 ha</td>
</tr>
<tr>
<td><strong>Connectivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The connectivity tool was run and the result stated there is no significant impact to connectivity.</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>Waterways barrier works – estuary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major category - 5</td>
<td>-</td>
<td>9.23 ha (Northern Haul Road)</td>
</tr>
<tr>
<td>Major category - 5</td>
<td>-</td>
<td>9.64 ha (Southern Haul Road)</td>
</tr>
<tr>
<td>Major category - 5</td>
<td>-</td>
<td>1.00 ha (BLF)</td>
</tr>
<tr>
<td>Major category - 5</td>
<td>-</td>
<td>0.15 ha (RoRo Facility)</td>
</tr>
<tr>
<td>Major category - 5</td>
<td>-</td>
<td>4.25 ha (Mooring Area)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>24.27 ha</td>
</tr>
<tr>
<td><strong>Waterways barrier works – stream</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category 1 - Low</td>
<td>-</td>
<td>107.65 m</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>107.65 m</td>
</tr>
<tr>
<td><strong>Mapped essential habitat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Fish habitat areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Queensland protected flora trigger area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Strategic environmental areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Vegetation management mapped wetlands</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Wetland Areas HES</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Bauxite Hills Project  • Matters of National Environmental Significance

<table>
<thead>
<tr>
<th>MSES Trigger</th>
<th>VM Act or NC Act Status</th>
<th>Direct Impact Area of Estimated Disturbance (ha; max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland Management Area (HES)</td>
<td>-</td>
<td>0.15 ha (RoRo Facility)</td>
</tr>
<tr>
<td>Wetland Management Area (HES)</td>
<td>-</td>
<td>9.57 ha (Southern Haul Road)</td>
</tr>
<tr>
<td>Wetland Management Area (HES)</td>
<td>-</td>
<td>9.23 ha (Northern Haul Road)</td>
</tr>
<tr>
<td>Wetland Management Area (HES)</td>
<td>-</td>
<td>0.25 ha (BLF)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>19.20 ha</strong></td>
</tr>
</tbody>
</table>

**Wetland protection area trigger**

None

<table>
<thead>
<tr>
<th>Endangered and Vulnerable fauna species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-footed Tree-rat</td>
</tr>
<tr>
<td>Beach stone-curlew</td>
</tr>
<tr>
<td>Estuarine crocodile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Endangered and Vulnerable flora species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate tea tree orchid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE3.1.1 Closed forest of <em>Rhizophora stylosa</em> ± <em>Bruguiera gymnorrhiza</em>. Occurs as outer mangroves.</td>
</tr>
<tr>
<td><strong>Total: 9.74 ha</strong></td>
</tr>
<tr>
<td>RE3.1.1/3.1.3 Closed forest of <em>Rhizophora stylosa</em> ± <em>Bruguiera gymnorrhiza</em>. / <em>Ceriops tagal</em> ± <em>Avicennia marina</em> low closed forest. Extensive on intertidal area.</td>
</tr>
<tr>
<td><strong>Total: 10.72 ha</strong></td>
</tr>
<tr>
<td>RE3.1.6 Sparse herbland or bare saltpans. Associated with salt plains and saline flats</td>
</tr>
<tr>
<td>Seagrass communities</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Existing offset areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

*To be confirmed. Detailed surveys for the presence of seagrass within the proposed footprint will be undertaken during the final design phase.*
Offset Delivery Evaluation

Based on the biodiversity values required to be offset an evaluation of the factors that influence the preferred offset delivery approach has been undertaken. The following describes key considerations that have been taken into account:

- The Project is within the Cape York Peninsula bioregion, and Weipa Plateau sub-region. The subregion is highly vegetated with 97.4% consisting of remnant vegetation. Vegetation is predominantly eucalypt and melaleuca woodlands with Darwin Stringybark as the dominant species. This is also the dominant ecological community on the Project site. Offsetting with non-remnant or regrowth vegetation is highly constrained. A land-based offset is likely to consist of remnant vegetation, where the vegetation contains the biodiversity attributes required to be offset, and conservation gains are achieved through improved land management practices to increase habitat quality and reduce threats (e.g. weed management, pest animal management, fire management); and

- The range of biodiversity values required to be offset include of concern RE consisting of melaleuca wetlands, estuarine wetlands, riparian vegetation and marine plants including mangroves, saltflats and seagrass. Across the Cape York bioregion and Weipa Plateau sub-region land clearing is a minor threat to the longevity of these values. In particular there are extensive areas of estuarine wetlands including mangroves in the local area (approximately 732 km² within the Weipa Plateau subregion) (Wetland Info, 2016) that are not under threat from development and are in good ecological condition.

Key natural resource management issues in Cape York include introduced pest fauna species, weeds and fire. Feral pigs are of particular concern in the region due to their impacts on riparian and wetland vegetation, and on turtle nesting sites. Feral pigs are responsible for high levels of nest-predation of some marine turtle species, such as the Flatback Turtles (Natator depressus), with 90% of nests predated in west Cape York (Cape York Turtle and Dugong Taskforce, 2013). Four pest fauna species were recorded during ecology surveys for the Bauxite Hills Mine, including feral pig, feral cat, feral dog/dingo and cane toads:

- Therefore the offset package needs to take into consideration for each offset value, what are the key threatening processes and the scale, intensity and duration of the impact. Then propose offset measures that can reduce those threats, and deliver a conservation outcome that improves or maintains the viability of the offset value;

- Approximately half of the bioregion is used for pastoralism. Land tenure in Cape York is either leasehold land, owned by traditional owner groups or under mining leases. In the Project area land is owned and managed by Mapoon Aboriginal Shire Council. Therefore legally securing land on the title for offsets would need to be supported by the landowner or lease-holder;

- Offsetting marine plant communities, such as mangroves, can present challenges when looking at direct, land based offsets. These communities are in tidal areas and predominantly under State ownership and management. In these remote regions they are also generally in pristine condition and under few threats. Therefore flexibility in offset actions needs to be granted through use of compensatory measures that have a positive impact on these estuarine ecosystems and species they support;

- There are significant opportunities to deliver social and environmental co-benefits with offsets for this Project. Indigenous people play a vital role in managing large proportions of the land and sea on Cape York. There are a number of existing natural resource management programs being implemented in the local region. Some of these are administered by government and
others by Traditional Owner groups. The Cape York NRM Group has prepared a ‘Cape York NRM Regional Investment Strategy 2013-2018’. This resulted in an overall program logic for five themes, (fire, water, soils, livelihoods and integrated pest management). Metro Mining wants to ensure that resources and funding invested towards biodiversity offsets for the Project are maximised by supplementing existing programs where possible; and

- Metro Mining is currently in consultations with the Mapoon Land and Sea Rangers. The Mapoon Land and Sea Rangers started in 2008/2009. The team has a ranger coordinator, senior rangers and seven rangers - three women and four men. The Ranger Base is located at the Jean Jimmy Centre next to the Council in Mapoon. The Rangers look after 183,000 ha of Mapoon DOGIT (Deed of Grant of Land in Trust) lands including 70 km of coastline and three main river catchments. The DOGIT is the traditional lands of Tjungundji, Yupungatti, Warrangku, Toeprthiggi and Mpokwithic clans. Metro Mining is committed to working with this group and providing them with support to achieve improvements to natural resource management outcomes in the Mapoon region.

**EPBC Act Offset Requirements**

The Project has been identified through the environmental impact assessment process as not having a 'significant' impact on MNES including marine and terrestrial species and communities. Therefore no offsets are proposed under the EPBC Act Environmental Offsets Policy, Oct 2012. However, it should be recognised the proposed offset delivery approach for MSES will provide significant conservation benefits for MNES, including marine and migratory species.

**Queensland Offset Requirements**

Three primary options are provided for offset delivery. These are:

- Financial settlement offsets;
- Land-based offsets; and
- Direct benefit management plans.

Further information on the offset delivery options is presented below.

**7.13.3 Financial Settlement**

All MSES proposed to be offset can be acquitted by a financial settlement. The online financial payment calculator has been applied based on the MSES required to be offset, and extent of impact with a final calculated figure of approximately $4.5 million. The breakdown of the estimated financial payments are summarised in Appendix A of the Biodiversity Offsets Strategy (Appendix C).

**7.13.4 Land-based Offsets**

Land based offsets are generally a vegetated area that contains the prescribed MSES to be offset, is legally secured on title, and actively managed to improve condition and reduce threats. This is an option being explored by Metro Mining. However, as noted previously the loss of vegetation is not a major threat in the region. Threats are primarily from feral animals, weeds, fire and land use that reduces habitat quality and impacts on a species ability to breed such as feral pig predation on turtle eggs and a loss of hollows from fire. Legally securing areas will also require the landowner’s consent.

Where the biggest conservation gains can be achieved is through the reduction of threatening processes at a broader landscape scale that will provide a direct, tangible benefit to the offset values.
It should also involve local Traditional Owners who currently manage vast areas of this region to support them and increase their participation in these conservation measures and outcomes. The land based offset measures not only would look to reduce threats but improve condition of ecosystems and increase species survival rates. The offset package could include a combination of land-based offsets and in-direct compensatory measures.

7.13.4.1 Direct Benefit Management Plans

Metro Mining are exploring this offset delivery option. The DBMP will provide greater flexibility to use a combination of direct and compensatory measures in an offset package. It will describe the environmental programs and actions proposed to be implemented (supported in-kind or funded) by Metro Mining for the life of the Project and what conservation benefits they will achieve. The information to be provided will be guided by the EHP ‘DBMP Checklist.’

Further consultation will occur with regulators and stakeholder groups during the EIS public consultation period to discuss the DBMP approach and discuss the suitability of the proposed actions, funding and roles and responsibilities that would be required.

The intent is that these programs will focus on the biodiversity values required to be offset (e.g. Of Concern RE 3.3.12, riparian vegetation, wetlands and mangroves/saltantz) and where possible enhance existing environmental programs to maximise conservation gains that can be achieved, and support local Traditional Owner groups such as the Mapoon Land and Sea Rangers. Key biodiversity issues include feral animal control (including reducing predation on marine turtle eggs), fire management, conserving migratory bird habitats and ghost nets. Initial recommendations are outlined in Table 7-48.

Table 7-48 Potential offset actions

<table>
<thead>
<tr>
<th>MSES Offset Value</th>
<th>Offset Approach</th>
</tr>
</thead>
</table>
| Of Concern RE 3.3.12  
__(M. quinquenervia) open forest associated with scattered coastal swamps__) | Metro Mining are evaluating the potential to legally secure and manage an area of palustrine wetland including Of Concern RE 3.3.12 to the west of the Project. It is a large coastal wetland system on freehold land. The offset would be an area of approximately 2.4ha (1:4 ratio) and located outside of any MLAs. Management would include weed management, feral animal control program and fire management.  
To supplement this land based offset Metro Mining are proposing to actively manage and conduct ongoing ecological monitoring of Big Footprint Swamp. This palustrine wetland includes an area of Of Concern RE 3.3.12 of 19ha in size. Management for the duration of the Project will include eradication of weeds, feral animals particularly targeting feral pigs, implement an appropriate fire regime and an ecological monitoring program. Discussions with Old Mapoon Aboriginal Council will be held regarding these proposed measures and the area over which they will occur.  
The purpose of these management actions will be to maintain and enhance the condition of vegetation and habitats, reduce threatening processes, and learn more about the flora and fauna species that reside in these wetlands. A monitoring program for Big Footprint Swamp will include monitoring groundwater, native vegetation extent, diversity and condition (through BioCondition assessments), fauna species present, and seek to identify any changes that occur over time. |
| Palustrine wetlands of HES |  |
| HES Wetlands and Watercourse vegetation | Metro Mining would like to work in collaboration with the Mapoon Land and Sea Rangers to conduct a landscape scale fire management and feral animal control program to enhance the conservation and regeneration of native vegetation communities and also reduce the likelihood of hot damaging wildfires. This will also have a conservation benefit for fauna and flora species, as it will protect fire |

7-166
MSES Offset Value | Offset Approach
--- | ---
sensitive communities such as *Melaleuca* from damaging hot fires, and protect old hollow bearing trees in which fauna species nest. This will include wetlands and riparian areas within and adjacent to the Project site (e.g. Big Footprint Swamp and vegetation adjacent to Skardon River). Feral pig control will reduce degradation of riparian vegetation and wetlands and improve water quality. Controlling foxes and feral cats will also reduce predation on native animals. This action would result in conservation outcomes for a much larger area, than limiting the offset to only a small area of riparian vegetation and wetlands.

Mangroves | It is proposed that some flexibility be provided when looking to offset impacts to mangroves. There are large areas of mangroves remaining in the Skardon River and broader region in good condition that are not under threat predominantly due to the remoteness of this region. Therefore Metro Mining are looking to put their offset investment into providing a conservation outcome for marine turtles which utilise the estuarine environments in the Project’s local area. Marine turtles are under significant threat from issues such as nest predation and ghost nets. Metro Mining are investigating supporting the following programs:

- **Support Mapoon Land and Sea Rangers Annual Turtle Camp:** Mapoon Land and Sea Rangers complete an annual Turtle Camp on Flinders Beach working with EHP staff. Flinders Beach is a remote beach 25km in length that runs from Janie Creek to Pennefather River on western Cape York. Rangers spend approximately 3 weeks on the beach removing Ghost Nets and Ropes, foreign timbers, marine debris and monitoring turtle nest predation.

  In 2014 over 500 nests were recorded and monitored. Data collected included, predation rates and what the predators were, hatchling emergence rates as well as egg numbers and size. Two Olive Ridley Turtles were tagged with satellite trackers to follow their journey from Mapoon to their feeding grounds.

  Mapoon Turtle Camp has been operating for many years and a large amount of coordination and resources are needed to ensure the success of the camp. Metro Mining are investigating providing support in the way of hosting rangers in accommodation, providing meals, allowing access through the mine lease, as well as support to barge vehicles etc. Additional resources may also be made available.

- **Provide an annual financial contribution to the Western Cape Turtle Threat Abatement Alliance (WCTTAA) Nest to Ocean Turtle Protection Program:** The alliance was formally established in May 2013 following 12 months of regional discussions for the future of turtle management on Cape York. Land and Sea Managers recognised that local coordination led to effective outcomes for turtle conservation and would be further enhanced by regional coordination.

  WCTTAA’s vision is “to seek to efficiently manage threats to coastal habitats and enhance opportunities for nesting marine turtle populations of the Western Cape”. The mission of WCTTAA states they are “a partnership of on ground land and sea owners and managers, formed to set priorities, seek solutions and share knowledge to maximise the use of resources for coastal management on Western Cape York.”

  The Queensland and Commonwealth governments have each committed matching funds of up to $3.5 million over the next four years to the ‘Nest to Ocean Turtle Protection Program’ to help reduce the threat of feral predation on marine turtle nests. Approximately $5 million remains for investment in predator control programs that will develop collaborative partnerships across governments and the community to enhance the incubation success of turtle eggs in Queensland.
Salt pans

It is proposed that some flexibility is provided when looking to offset impacts to salt pans. There are large areas of salt pans in the local area that are in good condition and not under significant threat predominantly due to the remoteness of this region. Therefore Metro Mining are looking to put their offset investment into conserving shorebirds which utilise salt pans for foraging and breeding habitat. Metro Mining are investigating supporting the following program:

- **Support nomination for East Asian – Australasian Flyway Site Network Mapoon Shire Council is working to have a migratory shorebird area nominated in the East Asian – Australasian Flyway Site Network. The area extends from Skardon River in the north, south to Pennefather River and takes in Port Musgrave. This is an important shorebird area containing extensive areas of migratory bird habitats. This is a non-legal, collaborative project involving over 90 sites across thirteen countries. The Flyway Site Network has been operating since 1996 and it is now supported by the East Asian – Australasian Flyway Partnership.**

  The Flyway Site Network represents a unique opportunity for Site Managers in the Flyway to work together to achieve more effective conservation and protection of migratory waterbirds. The Network provides for internationally important sites to be included in a broad-based conservation arrangement across the Flyway. Through the Flyway Site Network, national governments, site managers and local stakeholders can work cooperatively to achieve positive conservation outcomes to protect migratory waterbirds.

  Site Managers are expected to ensure that the waterbird values of their site are maintained and enhanced where possible. Recognising that waterbird values are one of the range of management objectives for a site, managers are expected to encourage the adoption of sustainable land use practises at the site with the range of stakeholders including local communities, industries and governments. Opportunities to work with other Site Managers in the conservation of shared species will also be an important aspect of the management of the site.

Sawfish and Speartooth Shark

While offsets are not required, Metro Mining are exploring the potential to contribute to a broader project in the region that will support the sawfish and Speartooth Shark. While these species are not likely to occur in the Skardon River they are an important group of species in the region in which the Project will be operating. Further evaluation for this Project will be explored during the EIS assessment phase.

### 7.13.5 Next Steps

During the Project’s EIS public consultation phase further consultation with stakeholders and government agencies will occur to discuss the possibility for an offset package to consist of a combination of direct and compensatory measures. These natural resource management programs will be conducted in the local region in collaboration with local indigenous groups and traditional owners to provide both conservation and social outcomes.

Following endorsement of the Biodiversity Offsets Strategy and Project approvals being issued, Metro Mining will prepare a DBMP and Offsets Delivery Plan that sets out the proposed offset actions for approval by EHP. The documents will be approved by EHP prior to Project commencement.

Metro Mining is seeking that the Project’s EA conditions will include that significant, residual MSES impacts be offset. A condition of approval will be to submit a DBMP and Offset Delivery Plan to the Chief Executive at least three months prior to Project commencement.
For further details on this assessment refer to the Biodiversity Offsets Strategy Report (Appendix C) (Amec Foster Wheeler, 2015).

7.14 Qualitative Risk Assessment

A qualitative risk assessment associated with potential terrestrial and freshwater ecological impacts is summarised in Table 7-49. An analysis of initial risk, without mitigation, was considered for terrestrial and freshwater ecology. The residual risk considers the mitigation and management measures developed for this element and put forward in this assessment.

Table 7-49 Qualitative risk assessment – MNES

<table>
<thead>
<tr>
<th>Potential Impacts</th>
<th>Initial Consequence</th>
<th>Initial Likelihood</th>
<th>Initial Risk</th>
<th>Management and Mitigation Measures</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land clearance and resulting habitat loss for Chocolate Tea Tree Orchid, Palm Cockatoo and Black-footed Tree-rat</td>
<td>Moderate</td>
<td>Almost Certain</td>
<td>Extreme</td>
<td>▪ Minimise vegetation clearance along drainage features; ▪ SSMP developed and implemented; ▪ Preclearing surveys for orchids and relocation strategy; ▪ Provide exclusion fencing between the Skardon River riparian zone and the edge of the mining footprint; and ▪ Rehabilitation Management Plan to incorporate progressive rehabilitation and the provision of nest hollows and nest boxes.</td>
<td>Medium</td>
</tr>
<tr>
<td>Marine habitat disturbance</td>
<td>Minor</td>
<td>Almost Certain</td>
<td>High</td>
<td>▪ Conduct seagrass surveys pre-construction when construction footprint is finalised; ▪ Implement appropriate vegetation monitoring programs including long-term biannual seagrass monitoring program for the Skardon River; ▪ Minimise required clearing and limit access over seagrass habitats; ▪ Minimise adjacent seagrass damage during construction by managing the buffer around the development; ▪ Restrict unnecessary access to saltmarsh and mangrove habitats; ▪ Clearing activities subject to offset program; and ▪ During construction consider deployment of ‘silt curtains’ to screen off known habitat areas (seagrass) from intermittent passage of sediment plumes.</td>
<td>Medium</td>
</tr>
</tbody>
</table>
### Potential Impacts

<table>
<thead>
<tr>
<th>Potential Impacts</th>
<th>Initial Consequence</th>
<th>Initial Likelihood</th>
<th>Initial Risk</th>
<th>Management and Mitigation Measures</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fauna mortality from land clearing and vehicle collisions (Black-footed tree-rat)</td>
<td>Moderate</td>
<td>Possible</td>
<td>High</td>
<td>▪ SSMP developed and implemented; ▪ Have a qualified spotter available during clearing activities; ▪ Implement speed limits; ▪ Fauna crossing structures to assist movement of fauna between habitats; and ▪ Avoid riparian corridors and wetlands.</td>
<td>Low</td>
</tr>
<tr>
<td>Physical interaction with fauna species during construction and operations (Speartooth Shark, Sawfish, Dugong, dolphin, marine turtles)</td>
<td>Minor</td>
<td>Possible</td>
<td>Medium</td>
<td>▪ Exclusion of fishing at Metro Mining controlled premises; ▪ Vessel exclusion zones over shallow water; ▪ Set speed limits for vessel movements in estuary; ▪ SSMP developed and implemented including staff education; ▪ Exclusion of site personnel from beaches adjacent to Skardon River; and ▪ Noise abatement.</td>
<td>Low</td>
</tr>
<tr>
<td>Change in feeding and breeding behaviours of nocturnal terrestrial fauna as a result of increased noise</td>
<td>Minor</td>
<td>Possible</td>
<td>Medium</td>
<td>▪ Covers and enclosures; ▪ Silencers on safety valves; ▪ General restriction of construction to daytime; and ▪ Operational procedures introduced to reduce noise; and ▪ Refer to Chapter 13 – Noise and Vibration.</td>
<td>Low</td>
</tr>
<tr>
<td>Changed behaviours as a result of marine noise and vibration during construction</td>
<td>Moderate</td>
<td>Unlikely</td>
<td>Medium</td>
<td>▪ Piling operations to be carried out during the day only; ▪ Safety zone to be established at 1,000 m prior to piling activity; ▪ Trained marine fauna observer to inspect area for 30 minutes prior to start; ▪ Soft startup of piling operations; ▪ Shut-down procedure in place during construction in the event marine fauna is sighted during construction activity; ▪ Unnecessary ship movements avoided; ▪ Vessel speeds reduced as slow as practicable; and ▪ Shallow water habitats avoided and vessel management plan implemented.</td>
<td>Low</td>
</tr>
<tr>
<td>Potential Impacts</td>
<td>Initial Consequence</td>
<td>Initial Likelihood</td>
<td>Initial Risk</td>
<td>Management and Mitigation Measures</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Changed behaviours as a result of marine noise and vibration during operation</td>
<td>Minor</td>
<td>Possible</td>
<td>Medium</td>
<td>▪ Vessel speeds reduced as low as practicable within estuary;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Unnecessary ship movements avoided; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Shallow water habitats avoided and vessel management plan implemented.</td>
<td></td>
</tr>
<tr>
<td>Propeller wash causing increase in ambient turbidity and damage to benthos</td>
<td>Insignificant</td>
<td>Possible</td>
<td>Low</td>
<td>▪ Establish ambient water quality monitoring program prior to construction;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Establish annual hydrographic surveys of the channel offshore of the mouth of the Skardon River;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Minimise vessel speed to as low as practicable;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Vessel operations to control vessel movement to minimise propeller wash by targeting upper tidal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>range for barge movements;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Limit passage over or immediately adjacent to seagrass habitats; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Utilise defined shipping routes and follow proposed vessel access plan.</td>
<td></td>
</tr>
<tr>
<td>Disrupted fauna feeding and breeding behaviour due to light spill</td>
<td>Moderate</td>
<td>Unlikely</td>
<td>Medium</td>
<td>▪ Lights directed away from bushland where practicable;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Lighting will be limited to only that which is essential;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Ground-level path lighting will be used, where practicable; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Intense lights, or cluster of light, will be avoided, where practicable.</td>
<td></td>
</tr>
<tr>
<td>Altered ecosystems as a result of fires</td>
<td>Major</td>
<td>Possible</td>
<td>High</td>
<td>▪ Retain vegetation on site for fuel load and conduct appropriate fire regimes; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Develop and implement a site specific Fire Management Plan.</td>
<td></td>
</tr>
<tr>
<td>Introduction and spread of weeds and introduction of pests</td>
<td>Moderate</td>
<td>Possible</td>
<td>High</td>
<td>▪ Develop and implement a site specific PWMP;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Monitor management measures;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Appropriate disposal and management of wastes; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ Refer to Chapter 8 – Biosecurity.</td>
<td></td>
</tr>
<tr>
<td>Potential Impacts</td>
<td>Initial Consequence</td>
<td>Initial Likelihood</td>
<td>Initial Risk</td>
<td>Management and Mitigation Measures</td>
<td>Residual Risk</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Reduced water quality and surface water inflows to the swamps and wetlands associated with the Skardon River</td>
<td>Minor</td>
<td>Possible</td>
<td>Medium</td>
<td> Apply buffer zones to watercourses;  Implement suitable spill containment around potential pollutant stores;  Prepare a site ESCP;  Stormwater from mining operations directed to sediment ponds;  Implement a site Surface Water Management Plan;  Implement a REMP including water quality monitoring program; and  Refer to Chapter 9 – Water Quality.</td>
<td>Low</td>
</tr>
<tr>
<td>Change in water levels and impacts downstream as a result of Project activities</td>
<td>Minor</td>
<td>Unlikely</td>
<td>Low</td>
<td> Develop a REMP;  Monitor Big Footprint Swamp annually; and  Where unacceptable risks are identified apply direct intervention/s in an adaptive management program (within the REMP).</td>
<td>Low</td>
</tr>
<tr>
<td>Impacts on groundwater</td>
<td>Minor</td>
<td>Possible</td>
<td>Medium</td>
<td> Establish Groundwater Monitoring and Management Plan; and  Refer to Chapter 10 – Water Resources.</td>
<td>Low</td>
</tr>
<tr>
<td>Erosion and sediment runoff</td>
<td>Moderate</td>
<td>Unlikely</td>
<td>Medium</td>
<td> Establish long-term water quality monitoring;  Project will not operate during the wet season;  Maintain a buffer around riparian vegetation in accordance with relevant guidelines; and  Prepare an ESCP which incorporates rehabilitation monitoring and trials.</td>
<td>Low</td>
</tr>
<tr>
<td>Acid sulfate soil mobilization into estuarine system</td>
<td>Moderate</td>
<td>Possible</td>
<td>High</td>
<td> Establish Acid Sulfate Soil Management Plan prior to construction activity if considered warranted following further site investigations.</td>
<td>Low</td>
</tr>
<tr>
<td>Establishment of marine pests in Project area</td>
<td>Moderate</td>
<td>Likely</td>
<td>High</td>
<td> All vessels will follow National Biofouling Guidelines;  Preferred supplier of marine support services required to demonstrate compliance with the Guidelines;  OGVs to complete ballast water exchange as per Quarantine Act 1908; and  Establish Marine Pest Monitoring Program with Gulf Alumina and Ports North.</td>
<td>Medium</td>
</tr>
</tbody>
</table>
7.15 Conclusion

The study area is located largely on the Weipa Plateau subregion of the Cape York Peninsula Bioregion and occupies part of the Skardon River catchment draining westward into the Gulf of Carpentaria. A small portion of the Project area lies within Jardine-Pascoes Sandstones subregion. Mining and cattle grazing are the predominant post-European settlement land uses in the immediate vicinity of the Project; however, the majority of the Project area and surrounds retains extensive remnant vegetation cover.

The Project area is located in the Skardon River catchment, or drainage sub-basin. While the Skardon River is perennial, many associated watercourses within the Project area are ephemeral and flow only after sustained or intense rainfall. The Skardon River catchment is part of the broader Skardon River-Cotterell River wetland aggregation, which is listed under the DIWA. The majority of the aggregation occurs north of the Skardon River and Project area; however, wetlands associated with the aggregation do occur within the Project area and MLAs, and overlap some of the infrastructure footprint (haul roads and BLF).

The configuration of the Skardon River ranges from a relatively narrow 300 m width at the river entrance, quickly expanding to approximately 1 km upstream. The site of the BLF is located approximately 10 km upstream of the mouth, and is off the main arm of the river with a width of approximately 350 m at this point. The Skardon River and adjacent inshore and offshore areas encompass several marine habitats, including abundant saltmarsh and mangroves, several small patches of seagrass, small rock and oyster reefs within the estuary, offshore coral reef and broad areas of intertidal and subtidal soft substrates that are either bare or variably colonized by macroinvertebrates and macroalgal communities.

The Project area supports a relatively low diversity of vegetation communities and terrestrial flora and fauna species. There are no EPBC Act-listed TECs in or near the Project area. Two fauna species listed as Vulnerable under the EPBC Act have been recorded during site surveys for the Bauxite Hills Project and SRBP: Palm Cockatoo has been recorded on several occasions; and Black-footed Tree-rat was recorded on a single occasion on a remote camera trap. The Project is predicted to clear approximately 1,466 ha of remnant vegetation. Clearing is dominated by Darwin Stringybark woodland (approximately 97.5% of all clearing). The adjacent SRBP will clear an additional 1,313 ha of this habitat. Darwin Stringybark woodland provides habitat for both species. This is the most widespread vegetation community in the Cape York bioregion (refer Table 7-23) and supports a range of flora and fauna species. The proposed clearing represents 6.27% of this habitat existing within a 20 km radius of the Projects (44,280 ha). With abundant similar habitat surrounding the Project and appropriate mitigation measures applied, including a SSMP, no significant residual impacts on these species are expected.

One threatened flora species, Chocolate Tea Tree Orchid, listed as Vulnerable (under the NC Act and EPBC Act) is considered likely to occur in the Project area. The Project will have negligible impact on suitable habitat for this species as its preferred Melaleuca swamp habitat lies outside of the Project footprint for the most part (16.5 ha of clearing predicted) and no orchid species have been recorded in the Project footprint.

Nine bird species listed as Migratory (under the EPBC Act) have been recorded in the Project surrounds. Three species have been recorded in Big Footprint Swamp. Rainbow Bee-eater was recorded in Darwin Stringybark woodland. The remaining species occur outside of the Project footprint and suitable habitat will not be impacted.
The Project will result in no removal of permanent water sources but will result in minor areas of riparian habitat being removed and up to 20.5 ha of mangrove and intertidal areas being lost to accommodate haul roads and the proposed BLF/RoRo on the Skardon River. Mangroves provide habitat for Whimbrel. There is abundant mangrove habitat in the Skardon River system that will remain undisturbed. Big Footprint Swamp will be potentially impacted by an increase of groundwater flows during mining operations, followed by a possible very slight decrease of groundwater flows following mining operations. During mining activities the seasonal size and depth of water in Big Footprint Swamp is likely to increase (average modelled rise of 0.15 m), returning to close to baseline conditions at the completion of mining. No significant residual impacts to Migratory species are considered likely.

The mitigation measures proposed as part of the Project will minimise additional indirect impacts to terrestrial fauna and flora communities within and surrounding the Project area from construction and operational activities. These measures include fauna crossing infrastructure to minimise fauna traffic collisions along the transport corridor and a detailed ecological monitoring program to monitor the health of vegetation and fauna communities adjacent to the Project for indirect impacts such as dust and surface water contamination. With control measures in place indirect impacts to fauna and flora are not expected to be significant. Buffer zones will be placed around sensitive areas including riparian habitat and Big Footprint Swamp. Surface water flows and water quality will be the subject of a Project-specific Receiving Environment Management Plan that includes annual monitoring of Big Footprint Swamp.

A number MNES-listed threatened marine fauna are considered likely or have potential to occur in the waters surrounding the Project area including five marine turtles, three sawfish and Speartooth Shark. Flatback Turtle is known to regularly nest on the local coastline to the west of the Project area. In addition, four species of marine fauna listed as Migratory under the EPBC Act are known (Estuarine Crocodile, Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin recorded previously) or have potential to occur: Dugong recorded on a single occasion in 2003.

The Project will also remove 20.5 ha of mangroves which may provide minor habitat for Estuarine Crocodile and Sawfish species; however, abundant mangroves will remain in the surrounding area.

Other Project-related impacts to MNES marine fauna include underwater noise and vessel strike. Underwater noise is thought to impact dolphin species in particular, although both species are known to occur in port areas with vessel traffic. Underwater noise will result from construction of the BLF and RoRo; however, this noise will be transient (i.e. only during construction) and localised. The Project area is located 12 km upstream of the river mouth and there is abundant habitat for marine fauna in the surrounding area. Vessel movements will largely be restricted to necessarily slow-moving barges carrying bauxite to the offshore loading vessel. The use of these vessels requires no dredging in the Skardon River estuary for the Project. Should MNES marine fauna occur in the estuary the slow vessel speeds are expected to mitigate the potential for vessel strikes. Similarly, dolphin species are likely to simply avoid the local area of noise impacts caused by transient vessel movements.

A cumulative impact assessment was carried out based on the joint development of the Project and Gulf Alumina’s SRBP. Cumulative impacts to terrestrial MNES values arise from the clearing of a total of over 2,700 ha of Darwin Stringybark woodland and the associated value to MNES fauna. However, this is the most widespread vegetation community in Cape York with over 520,000 ha remaining in the bioregion and over 44,000 ha within a 20 km radius of the Project area. The greatest cumulative impact to the marine environment may arise from the increased boat traffic in the Skardon River estuary and potential impacts to increased turbidity, erosion of benthic communities and banks, and collision and noise impacts on marine fauna.
None of these impacts are considered significant with the appropriate mitigation measures proposed as part of the Project and in partnership with SRBP. These will minimise additional indirect impacts to marine fauna and habitat within and surrounding the Project area during construction and operational activities. Metro Mining will implement an EMP that will mitigate, manage and monitor the potential impacts described in this assessment. This document will be regularly updated to reflect the current status of the Project mitigation actions, and allow for adaptive improvement of actions where considered necessary. The EMP will incorporate SSMPs and a range of monitoring programs that will add to the body of knowledge of threatened fauna and habitat in the Skardon River and surrounds.

To fully address the Project's offset requirements a Biodiversity Offsets Strategy Report that details the Project’s estimated extent of significant, residual impacts to MSES has been prepared and is included as Appendix C. No impacts to MNES are expected and as such no offsets are required. However, under impacts to MSES potential MNES habitat such as mangroves will be required to be offset. Offset measures to be investigated include collaboration with the Mapoon Land and Sea Rangers to conduct a landscape scale fire management and feral animal control program. Feral pigs are known to occur in the area and predate the nests of threatened marine turtles known to occur along the local coastline. Thereby this program will provide benefit to MNES-listed fauna in the area.

### 7.16 Commitments

In managing potential impacts to terrestrial and aquatic ecology, Metro Mining’s commitments are provided in Table 7-50.

#### Table 7-50 Commitments – MNES

<table>
<thead>
<tr>
<th>Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop and implement a Project Environmental Management Plan that addresses the construction, operational and decommissioning phases of the Project. The Project Environmental Management Plan will manage the overall site and refer to several specific management plans and monitoring programs including the following.</td>
</tr>
<tr>
<td>• A site Rehabilitation Management Plan will be developed which incorporates rehabilitation monitoring and trials and use of native species for rehabilitation;</td>
</tr>
<tr>
<td>• A Receiving Environment Monitoring Program will be developed and implemented and will incorporate measures to monitor water levels and quality and Big Footprint Swamp;</td>
</tr>
<tr>
<td>• Establish a long-term ambient estuarine water quality monitoring program prior to the commencement of Project construction as part of the Project Environmental Management Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Surface Water Management Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Groundwater Management Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Rehabilitation Management Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Fire Management Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Erosion and Sediment Control Plan;</td>
</tr>
<tr>
<td>• Develop and implement a Project – specific Vegetation Clearing Plan;</td>
</tr>
<tr>
<td>• Establish SSMP to include worker education on local threatened fauna, observation reporting procedures and exclusion zones;</td>
</tr>
<tr>
<td>• Develop and implement a Project-specific Acid Sulphate Soils Management Plan should Potential Acid Sulfate Soil be designated a risk during construction; and</td>
</tr>
<tr>
<td>• Develop and implement a Project-specific Pest and Weed Management Plan in coordination with the Mapoon Land and Sea Rangers, and in accordance with the Cook Shire Council Pest Management Plan.</td>
</tr>
<tr>
<td>Develop and implement a Marine Pest Monitoring Program in collaboration with Gulf Alumina and Ports North (refer Chapter 8 – Biosecurity).</td>
</tr>
<tr>
<td>Vegetation clearing for the Project will only be carried out in the dry season.</td>
</tr>
<tr>
<td>Maintenance of retained areas of existing mangrove vegetation surrounding Project activities.</td>
</tr>
<tr>
<td>Conduct seagrass surveys within and near the Project footprint prior to any construction.</td>
</tr>
<tr>
<td>Implement a seagrass monitoring program for the Skardon River that will survey seagrass abundance, distribution and species composition biannually for the duration of the Project.</td>
</tr>
<tr>
<td>Prior to any vegetation clearing an ecological pre-clearance survey will be undertaken by an experienced environmental professional/fauna spotter.</td>
</tr>
</tbody>
</table>
Commitments

During vegetation clearing fauna spotters will be present to identify any fauna, breeding places, or relocate fauna where possible.

Where clearing of riparian vegetation is required this will be minimised to the greatest extent possible including investigation of alternate siting of haul road crossings.

Include fauna crossing structures (such as culverts) in Project construction design to assist movement of fauna between habitats and reduce road mortality.

The on-site Environmental Representative will be notified of any injured native fauna and will be trained to treat these animals accordingly.

Large, hollow-bearing trees will be selectively felled ahead of general clearing and will be relocated within the rehabilitation areas to provide immediate breeding and nesting locations for some species.

Use of fallen logs and rocks will be put into adjacent habitats to retain fauna micro-habitats in the surrounding area.

The total area of disturbance will be minimised at any particular time and progressive rehabilitation will be implemented over the life of the Project.

Monitoring of rehabilitation success will be conducted at locations representative of the range of conditions on the rehabilitating areas and reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness.

Maintenance of retained areas of existing vegetation surrounding Project activities to assist in providing a source of seed for mine rehabilitation works.

Speed restrictions will be imposed on the haul roads.

Piling noise during construction of the BLF will be attenuated by:

- A 500 m safety exclusion zone will be established around piling works;
- Observations by a suitably trained marine megafauna observer will be conducted during piling works;
- All impact and vibratory piling works will adopt a soft start approach;
- Marine-based pile driving activities will take place during daylight hours; and
- Shut-down procedures in the event of marine fauna occurring during piling.

Observations of marine fauna will be recorded (including species and location) and incidences of direct interaction such as vessel strike, or near vessel strike reported to the site environmental officer.

Establish defined vessel access channels that avoid benthic communities and seagrass habitats, go slow zones and speed limits for Project vessels traversing the Skardon River estuary with a preference for vessel movements in the upper tidal range.

The channel offshore of the mouth of the Skardon River will be hydrographically surveyed every year (at the end of the wet season).

Buffers zones to watercourses have been mapped in accordance with the defined distances as stipulated under the Environmental Offsets Policy 2014 for the Cape York Peninsula Bioregion. Buffers will be retained on designated sensitive environmental areas including:

- 50 m for stream order 1 or 2 watercourses;
- 100 m for stream order 3 or 4 watercourses; and
- 200 m for stream order 5 or greater watercourses.

It is proposed that a minimum 100m buffer width is maintained between mining pits and designated wetlands (i.e. Big Footprint Swamp).

Regular watering of active mining areas, stockpiles areas and haul roads that are subject to frequent vehicle movements

Adopt Project light management strategies to minimise potential light spill on adjacent fauna habitat and turtle nesting habitat.

Establish stormwater and chemical/fuel spill management procedures and an Erosion and Sediment Control Plan (refer Chapter 8 – Biosecurity).

All commercial vessels involved with the Project will observe the National Biofouling Management Guidelines.

The preferred supplier of marine support services will be required to demonstrate compliance with the relevant requirements of both of the above guidelines.

Discharge of ballast water by Ocean Going Vessels will be completed outside of Australia’s territorial seas (12 nm of the Australian coastal baseline) in accordance with the Quaranitne Act 1908.

Submit a Project Biodiversity Offsets Plan to EHP a minimum of three months prior to Project commencement (refer Chapter 5 – Terrestrial and Freshwater Ecology).
7.17 ToR Cross-reference

## Table 7.51 ToR cross-reference – MNES

<table>
<thead>
<tr>
<th>Terms of Reference</th>
<th>Section of the EIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Background and description of the action</strong></td>
<td></td>
</tr>
</tbody>
</table>
| The Assessment Documentation must provide background to the action and describe in detail all components of the action for example (but not limited to), the construction, operational and (if relevant) decommissioning components of the action. This must include the precise location of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on matters of national environmental significance (MNES). | Section 7.4.1  
Chapter 2 – Description of the Project  
Section 7.4.4  
Chapter 2 – Description of the Project                                                                 |
| The description of the action must also include details on how the works are to be undertaken (including stages of development and their timing) and design parameters for those aspects of the structures or elements of the action that may have impacts on MNES. |                                                                                                                                                   |
| The Assessment Documentation must include how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action. | Section 7.4.5                                                                                                                                 |
| The Assessment Documentation must also provide details on the current status of the action as well as the consequences of not proceeding with the action. | Page 7-1  
Section 7.4.3.1                                                                                                                                 |
| **2 The environment including MNES**                                               |                                                                                                                                                   |
| The Assessment Documentation must include a description of the environment and management practices of the proposal site and the surrounding areas and other areas that may be affected by the action. Include the relevant MNES protected by controlling provisions of Part 3 of the EPBC Act. | Page 7-1  
(controlling provisions)  
Section 7.4.7.1  
Section 7.4.7.2                                                                 |
| Listed threatened species and communities (including suitable habitat) that are or are likely to be present in the vicinity of the site, including the following details: |                                                                                                                                                   |
|  - Details of the scope, timing/effort (survey season/s) and methodology for studies or surveys used to provide information on the listed species/community/habitat at the site (and in areas that may be impacted by the project). Include details of: |                                                                                                                                                   |
|   - best practice survey guidelines are applied                                    | Section 7.7                                                                                                                                         |
|   - how they are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements. | Table 7-10                                                                                                                                     |
|  - Include reference to any relevant plans/agreements.                           | Table 7-22  
Table 7-27  
Table 7-34                                                                 |
| Listed migratory species (including suitable habitat) that are or are likely to be present in the vicinity of the site, including the following details: |                                                                                                                                                   |
|  - Details of the scope, timing/effort (survey season/s) and methodology for studies or surveys used to provide information on the listed species/habitat at the site (and in areas that may be impacted by the project). Include details of: |                                                                                                                                                   |
|   - best practice survey guidelines are applied                                    | Section 7.7.1  
Section 7.7.1.4                                                                                                                             |
|   - how these are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements. | Not applicable                                                                                                                                 |
Table 7-34                                                                                                                             |
## Terms of Reference

- A description of the environment relevant for part of the Commonwealth Marine and for actions outside the Commonwealth marine area that may impact the environment in the Commonwealth marine area. Note: whole of the marine environment must be considered—refer to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines—Matters of National Environmental Significance (2013).

### Impacts

The Assessment Documentation must include a description of all of the relevant impacts of the action on MNES (identified in Section 2). Impacts during the construction, operational and (if relevant) the decommissioning phases of the project must be addressed, and the following information provided:

- a description of the relevant direct, indirect and consequential impacts of the action
- a detailed analysis of the nature and extent of the likely direct, indirect and consequential impacts relevant to MNES, including likely short-term and long-term impacts
- a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible
- any technical data and other information used or needed to make a detailed assessment of the relevant impacts.

The Assessment Documentation should identify and address cumulative impacts, where potential project impacts are in addition to existing impacts of other activities (including known potential future expansions or developments by the proponent and other proponents in the region and vicinity).

The Assessment Documentation should also provide a detailed assessment of any likely impact that this proposed action may facilitate on the relevant MNES at the local, regional, state and national scale. Reference should be made to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines—Matters of National Environmental Significance (2013).

### 4. Avoidance and mitigation measures/alternatives

#### 4.1 Avoidance and mitigation measures

The Assessment Documentation must provide information on proposed avoidance and mitigation measures to manage the relevant direct, indirect and consequential impacts of the action on MNES.

The Assessment Documentation also must take into account relevant agreements and plans that cover impacts on MNES including but not limited to:

- approved conservation advice for relevant listed threatened species and communities
- Marine Bioregional Plans relevant to the proposed action—with reference to the Marine Bioregional Plan for the North Marine Region.

The Assessment Documentation must discuss how the proposed action is not inconsistent with:

- any relevant threat abatement plan for listed threatened species and communities
- any relevant recovery plan for listed threatened species and communities
- relevant conventions and agreements of which a migratory species is listed, including the Bonn Convention, CAMBA, JAMBA and agreements relevant to the conservation of the species.

The Assessment Documentation must include, and substantiate, specific and detailed descriptions of the proposed avoidance and mitigation measures, based on best available practices and must include the following elements:
Terms of Reference

a) A consolidated list of avoidance and mitigation measures proposed to be undertaken to prevent or minimise for the relevant impacts of the action on MNES, including:

- a description of proposed avoidance and mitigation measures to deal with relevant impacts of the action, including mitigation measures proposed to be taken by State/Territory governments, local governments or the proponent
- assessment of the expected or predicted effectiveness of the mitigation measures, including the scale and intensity of impacts of the proposed action and the on-ground benefits to be gained through each of these measures
- a description of the outcomes that the avoidance and mitigation measures will achieve
- any statutory or policy basis for the mitigation measures

b) A detailed outline of a plan for the continuing management, mitigation and monitoring of relevant MNES impacts of the action, including a description of the outcomes that will be achieved and any provisions for independent environmental auditing.

c) Where appropriate, each project phase (construction, operation, decommission) must be addressed separately. It must state the environmental outcomes, performance criteria, monitoring, reporting, corrective action, contingencies, responsibility and timing for each environmental issue.

d) The name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.

4.2 Alternatives

The Assessment Documentation must include any feasible alternatives to the action to the extent reasonably practicable, including:

a) if relevant, the alternative of taking no action
b) a comparative description of the impacts of each alternative on the triggered MNES protected by controlling provisions of Part 3 of the EPBC Act for the action
c) sufficient detail to make clear why any alternative is preferred to another

Short, medium and long-term advantages and disadvantages of the options must be discussed.

5 Residual impacts/offsets

5.1 Residual impacts

The Assessment Documentation must provide details of:

a) the residual significant impacts on MNES that are likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account:
   - include the reasons why avoidance or mitigation of impacts is not reasonably achieved
   - identify the residual significant impacts on MNES

5.2 Offset package (if relevant)

The Assessment Documentation must include details of an offset package proposed to be implemented to compensate for the residual significant impact of the project, as well as an analysis about how the offset meets the requirements in the Department’s EPBC Act Environmental Offsets Policy October 2012 (EPBC Act Offset Policy).

The offset package can comprise a combination of direct offsets and other compensatory measures, so long as it meets the requirements of the EPBC Act Offset Policy. Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain.

Offsets should compensate for an impact for the full duration of the impact

Offsets must directly contribute to the ongoing viability of the MNES impacted by the project and deliver an overall conservation outcome that improves or maintains the viability of the MNES as compared to what is likely to have occurred under the status quo, that is, if neither the action nor the offset had taken place.
<table>
<thead>
<tr>
<th>Terms of Reference</th>
<th>Section of the EIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offsets required by the State/Territory can be applied if the offsets meet the Department’s EPBC Act Offset Policy. The Assessment Documentation must provide:</td>
<td></td>
</tr>
<tr>
<td>a) details of the offset package to compensate for residual significant impacts on MNES</td>
<td></td>
</tr>
<tr>
<td>b) an analysis of how the offset package meets the requirements of the EPBC Act Offsets Policy, including a discussion on the feasibility and the working outlined in the Offsets Assessment Guide.</td>
<td></td>
</tr>
<tr>
<td>C) details of the offset package to compensate for residual significant impacts on MNES</td>
<td></td>
</tr>
</tbody>
</table>

**6 Environmental record of person(s) proposing to take the action**

Provide details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:

a) the person proposing to take the action
b) for an action for which a person has applied for a permit, the person making the application

If the person proposing to take the action is a corporation — details of the corporation’s environmental policy and planning framework.

**7 Economic and social matters**

The economic and social impacts of the action, both positive and negative, must be analysed. Matters of interest may include:

a) details of any public consultation activities undertaken, and their outcomes
b) details of any consultation with indigenous stakeholders
c) projected economic costs and benefits of the project, including the basis for their estimation through cost/benefit analysis or similar studies
d) employment opportunities expected to be generated by the project (including construction and operational phases)

**8 Information sources/conclusion**

For information given in the assessment documentation, state:

a) the source of the information
b) how recent the information is
c) how the reliability of the information was tested
d) what uncertainties (if any) are in the information
e) what guidelines, plans and/or policies did you consider

An overall conclusion as to the acceptability of impacts on each MNES including:

a) a discussion on the consideration with the requirements of the EPBC Act, including the objects of the EPBC Act, the principles of ecologically sustainable development and the precautionary principle.

b) Reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures.

c) If relevant, a discussion of residual significant impacts and any offsets and compensatory measures proposed or required for residual significant impacts on MNES, and the relevant degree of compensation and acceptability.

### Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-14</td>
<td>Throughout document</td>
</tr>
<tr>
<td>7-17</td>
<td>Table 7-14</td>
</tr>
<tr>
<td>7-22</td>
<td>Table 7-17</td>
</tr>
<tr>
<td>7-27</td>
<td>Table 7-22</td>
</tr>
<tr>
<td>7-34</td>
<td>Table 7-27</td>
</tr>
<tr>
<td>7-12</td>
<td>Section 7.12</td>
</tr>
<tr>
<td>7-15</td>
<td>Section 7.15</td>
</tr>
<tr>
<td>7-13</td>
<td>Section 7.13</td>
</tr>
</tbody>
</table>