



Abbot Point Growth Gateway Project
Terrestrial Ecology Report
Matters of National Environmental Significance

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Abbreviations and glossary

| Abbreviation | Description |
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| ASS | Acid Sulphate Soils |
| Beneficial reuse area | Dredged material placement ponds and associated infrastructure. |
| CEMP | Construction environmental management plans |
| CIA | Cumulative Impact Assessment |
| Direct impact | Physical disturbance of environmental values within the development footprint (e.g. clearing of vegetation or fauna mortality from vehicle strike). |
| DIWA | Directory of Important Wetlands in Australia |
| DoE | Commonwealth Department of the Environment |
| DMCP | Dredged Material Containment Ponds |
| ELA | Eco Logical Australia Pty Ltd |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| IBRA | Interim Biogeographic Regionalisation for Australia |
| Indirect impact | An impact which occurs indirectly from the Project's activities (e.g. introduction of weeds from construction machinery). |
| NGBR Project | North Galilee Basin Rail Project |
| NQBP | North Queensland Bulk Ports Corporation Ltd |
| OEMP | Operational environmental management plans |
| Off-site impact | An impact occurring outside of the development footprint of the Project, usually in adjacent areas (e.g. noise or dust produced by construction activities) |
| PASS | Potential Acid Sulphate Soils |
| Project Area | The footprint of the proposed Dredged Material Containment Ponds and temporary pipeline alignment |
| RE | Regional Ecosystem |
| Regional ecosystems | per the Regional Ecosystem and Remnant Mapping, Version 8, DEHP 2014 |
| SEVT | Semi-evergreen Vine Thicket (a type of ecological community) |
| Study Area | The Port of Abbot Point and adjacent coastal woodlands, foreshore habitats, and the Caley Valley Wetland complex. |
| TEC | Threatened Ecological Community |
| The Project | Abbot Point Growth Gateway Project |

Executive summary

The Port of Abbot Point is located approximately 25 km north of Bowen on the North Queensland coast. The Port comprises an existing coal export facility that has been in operation since 1984. In 2008, the surrounding area was defined as a State Development Area by the Queensland Government and several developments have been proposed and approved in recent years.

The Abbot Point Growth Gateway Project (the Project) has been identified by the State of Queensland as an option to beneficially reuse dredged material as landfill within the Port of Abbot Point. The Project involves the construction of dredged material containment ponds on land, avoiding direct disturbance to the Caley Valley Wetland and the placement of dredged material at sea within the Great Barrier Reef World Heritage Area.

The Project comprises the construction of dredged material containment ponds within the Terminal 2 area of the port, capital dredging of the Terminal 0 berth pocket and apron areas using a cutter suction dredge, pumping of dredged material ashore to the dredged material containment ponds via a temporary pipeline, discharge of return water from the ponds to the Coral Sea, and ongoing management of the settled dredged material for various purposes including beneficial reuse.

This report provides information on terrestrial ecology to support the Environmental Impact Statement (EIS) for Commonwealth matters. The report addresses all threatened ecological communities, threatened species, and migratory species identified in the project referral (EPBC 2015/7467) and through a subsequent assessment. Potential impacts of the Project on aquatic and marine fauna (excluding shorebirds) are outside of the scope of this report.

The Project Area (where on-shore development works are proposed) is highly disturbed and consists primarily of non-remnant vegetation, with some patches of regrowth. The Squatter Pigeon is the only threatened species likely to utilise habitats within the Project Area. The pipeline alignment from the dredged material containment ponds to the Coral Sea is located 50 m from small patches of the Semi-evergreen Vine Thicket Threatened Ecological Community (SEVT TEC).

Several other Matters of National Environmental Significance (MNES) are known to occur adjacent to the Project Area and are relevant environmental values for the assessment of off-site impacts of the Project. These values are mostly associated with the Caley Valley Wetland and surrounding coastal foreshores, which provide important feeding and roosting habitat for several species of migratory shorebirds, including three nationally important populations. The Endangered Australian Painted Snipe also utilises these habitats.

Potential impacts of the Project on MNES were assessed in accordance with the EPBC Act and associated guidelines. Consideration was given to the impacts of vegetation clearing, habitat fragmentation, earthworks, vehicle movements, dust and light emissions, construction noise, waste disposal, increased human presence and the alterations to surface hydrology, water quality and ground water. Impacts associated with ongoing management and periodic use of the dredged material containment ponds, following the completion of construction works, were also assessed.

The assessment identified there would be no direct impact of the Project on the SEVT TEC from vegetation clearing activities. Management measures are recommended to reduce the risk of indirect impacts from fire, weeds and pests. Similarly, impacts on threatened flora species are not expected as there are no such species known or predicted to occur within the Project Area or surrounding areas.

While there have been a small number of Squatter Pigeon sightings within in the Abbot Point region, potential impacts on the species were assessed to be low. The Squatter Pigeon is ubiquitous in this part of its geographic range and the species is not restricted by habitat availability, as it is a habitat generalist. While the Project involves the disturbance of 75 ha of potential Squatter Pigeon habitat, it is unlikely to be utilised by large numbers of individuals and Abbot Point is not an important location for the species in terms of range expansion and recovery. Mitigation measures are proposed to reduce impacts on Squatter Pigeon.

The Caley Valley Wetland was assessed as important habitat for migratory shorebirds under relevant Commonwealth guidelines. Fifteen migratory shorebird species and the Australian Painted Snipe have been recorded at the site, and for three species, an ecologically significant proportion of the population utilises the wetland's habitats. There will be no direct disturbance of the Caley Valley Wetland from the Project. Assessment of impacts on the wetland and shorebirds was therefore focussed on off-site and indirect impacts on habitat associated with lighting, noise, dust, human disturbance, hydrology, ground water and water quality.

An area of terrestrial land between 50 and 300 m will be established between the Project Area and the Caley Valley Wetland. This will buffer the wetland from direct impacts within the Project Area, and will be subject to off-site impacts from noise, dust and light. This width of the buffer is greater than the distance at which a flight response has been recorded for most migratory shorebird species. Impacts of lighting the construction site at night are also likely to be completely contained with the buffer area. An analysis of sightings data for all shorebird species was completed, with habitat preferences across the wetland mapped to inform a detailed impact assessment.

Modelling of dust deposition and concentrations produced by earthworks indicates that sediment deposition will be below the criterion at which impacts on vegetation can be expected. Predicted dust concentrations within the wetland were below relevant criteria for human health for two of the three variables modelled. In the absence of dust concentration guidelines for fauna such as shorebirds, human health criteria are expected to be conservative for environmental impact assessment purposes. While there is some uncertainty about the interpretation of modelled dust concentrations for the protection of shorebird health, on balance, the assessment concluded that impacts from dust are unlikely to be significant. Measures in place to protect the health of workers on site are likely to also be sufficient for shorebirds utilising the adjacent wetland.

Noise created by all stages of the Project's construction and operation were modelled, with criteria for the disturbance of fauna mapped in relation to the Caley Valley Wetland. A maximum of 21.9 ha (0.4% of the wetland) of shorebird habitat was predicted to overlap with the disturbance criteria when conservatively plotted for all weather scenarios and Project Stages together. However, impacts on shorebirds were assessed to be unlikely, when the factors affecting the influence of noise were further considered. These include habitat preferences of species, the timing of various construction stages, the ephemeral nature of the wetland (with wetland edge habitats often dry), the availability of similar habitat nearby and the potential for, and evidence of, habituation to noise from existing port and rail activities. Modelling of hydrology and water quality indicated that there would be no impact from the Project on wetland habitats.

Several mitigation and monitoring measures were recommended to further reduce impacts on migratory shorebirds. Overall off-site impacts of the Project on migratory shorebirds and the Australian Painted Snipe were assessed to be low, with no net residual impact. Therefore, offsets are not required.

The assessment was expanded to consider impacts on migratory waterbird species for which an ecologically significant proportion of the population is present (Great Egret, Little Tern and Caspian

Tern). The assessment concluded that impacts would be insignificant and that mitigation measures in place for shorebirds would be sufficient to address those on migratory waterbirds.

1 Introduction

1.1 Proposed Action

The Port of Abbot Point is located approximately 25 km north of Bowen on the North Queensland coast (Figure 1). The Port comprises an existing coal export facility that has been in operation since 1984. In 2008, the surrounding area was defined as a State Development Area by the Queensland Government, to facilitate large-scale industrial development of regional, state and national significance.

The existing Abbot Point coal terminal (Terminal 1; T1) is under long-term lease (99 years) to Mundra Port Holdings Pty Ltd and currently operated by Abbot Point Bulkcoal Pty Ltd under contract. North Queensland Bulk Ports Corporation Ltd (NQBP) is the port authority for the Port of Abbot Point. T1 is strategically located to provide export capacity from coal mines in the northern Bowen Basin, with coal supplied to Abbot Point by rail. There are two approved port expansion proposals at Abbot Point – Terminal 0 (T0; Adani Abbot Point Terminal) and Terminal 3 (T3; GVK Hancock). However, construction of these projects is yet to commence.

The Queensland Government intends the Port of Abbot Point to be declared as a Priority Port Development Area, under the Sustainable Ports Development Bill 2015 introduced into parliament in June 2015. Declaration is intended to concentrate the State's future port developments in five locations, rather than support development of many small ports along the coast, whose cumulative impacts would exceed those from a fewer number of larger ports.

Several developments have been identified in master planning processes for the proposed Abbot Point Priority Port Development Area. A substantial amount of dredging will be required to complete these developments. Placement of dredged material on land is preferred to offshore placement, to protect the World Heritage values of the Great Barrier Reef (GBR; Commonwealth of Australia 2015).

The proposed action: the Abbot Point Gateway Project (hereafter referred to as 'the Project') has been identified by the State of Queensland as an option to beneficially reuse dredged material as landfill within the Port of Abbot Point and the Abbot Point State Development Area. The Project involves the construction of a management area for dredged material on land, avoiding direct disturbance of the Caley Valley Wetland.

The Project components (Figure 2) include:

- Construction of onshore dredged material containment ponds (DMCPs) within the area previously allocated for the development of T2 and adjoining industrial land. The DMCPs will be comprised of earth embankments constructed on the existing ground profile using on-site cut and fill operations and suitable materials from onshore sources (quarries)
- Capital dredging of approximately 1.1 million m³ *in situ* volume of previously undisturbed seabed for new berth pockets and ship apron areas required to support the development of T0. The bulked volume of dredged material (comprising sediments entrained with water and air) once pumped to the DMCPs is expected to be approximately 2.2 million m³
- Relocation of the dredged material to the DMCPs and offshore discharge of return water via the construction and dismantling of temporary pipelines
- Ongoing management of the dredged material including its removal, treatment and beneficial reuse within the port and State Development Area, where appropriate.



Figure 1 Map showing the location of the Project Area within the Port of Abbot Point on the central coast of Queensland



Figure 2 Project Elements (pipeline route is indicative)

Marine sediment studies have identified a mix of sand, clay, silt and some gravel within the area to be dredged. Sediments have been analysed in accordance with the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009) and were found to have contaminants below the concentrations at which impacts on aquatic organisms can be anticipated. While there are potential acid sulphate soils (PASS) within the sediments, they have a neutralising capacity greater than their acid generating capacity (GHD 2012).

A cutter suction dredge will be used to relocate dredged material onshore, by pumping a slurry of sediment and marine waters through a temporary pipeline to the DMCPs. Return water will be discharged from the DMCPs to the ocean via a temporary discharge pipe. It is expected that a liner (e.g. Low Density Polyethylene liner or similar) will be installed on the inside face of the DCMP embankments to prevent piping failure, to provide erosion control during dredging, and to minimise potential lateral seepage from the DCMPs. The floors of the DMCPs will be unlined.

The design of the DMCPs will allow for the beneficial reuse of dredged material subject to the future needs of the port. Dredged material may be treated within the DMCPs prior to its beneficial reuse or removal from the site. Pipework or other infrastructure will be incorporated into the DMCP design to manage stormwater runoff following the completion of dredging.

1.2 Designated Proponent

The designated proponent for the Project is the State of Queensland, represented by the Department of State Development.

1.3 Purpose and Scope of this Report

The purpose of this report is to provide information on terrestrial ecology (i.e. threatened and migratory species) to support the Environmental Impact Statement (EIS) for Commonwealth matters. The report addresses all threatened ecological communities (TECs), threatened species, migratory species and World Heritage values relating to birds identified in the Project referral (State of Queensland 2015; EPBC 2015/7467) and through a subsequent assessment undertaken in generating this report. Detailed analysis is provided of impacts on listed threatened species, migratory species or TECs that are assessed as potentially, likely or known to occur within the Project Area or surrounding habitats which may be indirectly affected by the Project.

These environmental values include:

- one TEC
- four threatened species
- 19 listed migratory shorebirds
- 16 other listed migratory species
- World Heritage values relating to birds

Potential impacts of the Project on aquatic and marine fauna (excluding shorebirds) are outside of the scope of this report, and have been addressed in separate technical reports (BMT WBM 2015; WorleyParsons 2015). Potential impacts on marine plants are also outside of the scope of this report, except where such impacts relate to the provision of habitat and ecosystem services for shorebirds. State matters relevant to the Project have also been addressed separately (ELA 2015), to simplify the Commonwealth assessment process.

This report seeks to provide information in a manner which is appropriate to support the Commonwealth Department of the Environment (DoE) in its decision-making process for the Project regarding controlling provisions for TECs, threatened species and migratory species.

2 Legislative Framework

2.1 Commonwealth Regulatory Framework

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as Matters of National Environmental Significance (MNES).

A person must not take an action that has, will have or is likely to have a significant impact on any of the MNES without approval from the Australian Government Minister for the Environment (the Minister).

2.2 Commonwealth Assessment Process

A referral under the EPBC Act regarding the Project was lodged with DoE on 15 April 2015. On 14 May 2015, the Project was determined to be a Controlled Action under the EPBC Act, requiring further assessment via an EIS, and subject to the following six controlling provisions:

- World Heritage Properties (sections 12 and 15A)
- National Heritage Places (section 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth marine areas (sections 24 and 24A); and
- Great Barrier Reef Marine Park (sections 24B and 24C)

3 Methodology

3.1 Nomenclature and Terminology

Within this report, the conservation status of a species or ecological community is described as 'Critically Endangered', 'Endangered', 'Vulnerable', 'Near Threatened', 'Least Concern' and 'Migratory', pursuant to the EPBC Act.

Vegetation type descriptions are based on the structural types described by Neldner *et al.* (2012). Names of flora follow the Census of Queensland Flora (Bostock and Holland 2013), whilst names of fauna follow listings in the EPBC Act.

Within this report, the term 'database search results' refers to results from the Protected Matters Search Tool, Wildlife Online Search and Atlas of Living Australia Search.

The term 'migratory shorebird' is used in this report to describe a shorebird that migrates to Australia from other parts of the world (see overview in Section 8.1). There are 36 international migratory shorebird species that regularly visit Australia each year (DEWHA 2009a). While Australia has additional species of shorebird that are listed as 'Migratory' under the EPBC Act, they migrate within Australia and are not referred to as migratory shorebirds within this report.

Within this report, impacts are generally described as direct, off-site or indirect. Direct impacts are from the disturbance of environmental values within the Project's development footprint, such as clearing vegetation or fauna mortality from vehicle strike. Off-site impacts occur as a direct consequence of the Project's activities, but occur outside of the development footprint, in adjacent areas (e.g. from dust or noise). Indirect impacts occur as a consequence of the Project's activities and may occur within or outside of the development footprint (e.g. introduction of weeds on construction machinery).

3.2 The Study Area and Project Area

Within this report, the 'Project Area' and the 'Study Area' represent two different areas. The Project Area includes the development footprint, which includes the area required for:

- The onshore DMCPs and associated infrastructure;
- The construction compound and materials laydown area;
- A temporary pipeline for the transport of dredged material to the DMCPs;
- The temporary return water pipeline from the DMCPs to a sub-tidal discharge location in the Coral Sea; and
- The pipework or other infrastructure built to manage stormwater runoff at the completion of dredging.

When determining the Study Area relevant to this ecological assessment, conservative consideration was given to the likely geographical extent of potential impacts (direct and indirect) on terrestrial ecology. The Study Area within this report generally includes the Project Area, other locations where expansion of the Port of Abbot Point is planned (T0 and T3), adjacent coastal woodlands and foreshore habitats, and the Caley Valley Wetland complex.

3.3 Available information

The following databases and maps were reviewed to determine ecological values that were known to occur, likely to occur or have potential to occur within the Project Area and Study Area:

- Regional Ecosystem Mapping (version 8.0)
- Environment Protection and Biodiversity Conservation Act Protected Matters Search
- Wildlife Online Database Search
- Atlas of Living Australia Database Search
- Essential Habitat Mapping
- Protected Plants Survey Trigger Map
- Queensland Herbarium HERBRECS Database Search
- Queensland Museum Zoology Database Search
- Aerial Imagery.

The Port of Abbot Point and adjacent Abbot Point State Development Area have been the subject of extensive environmental studies completed as part of the Abbot Point Cumulative Impact Assessment (CIA; ELA and Open Lines 2012) and other projects that have sought approval under the EPBC Act and Queensland legislation. Numerous environmental impact assessment investigations have been completed and used by the Commonwealth Government in the assessment of these proposed projects (Table 1).

These studies have generally been made publicly available and subject to community consultation. Many of the studies were completed in support of projects that have now been approved by Commonwealth and State agencies, giving confidence that the information available is suitable for impact assessment purposes.

Table 1 Summary of relevant assessments and surveys in and around the Project Area

| | Study | Description | Survey timing |
|----|--------------------------------|---|--|
| 1. | Ecoserve 2007 | Unpublished report for Ports Corporation of Queensland. General terrestrial flora and fauna survey undertaken within limited Ecoserve study area covering only part of Abbot Point Project Area (mainly in and around Caley Valley Wetlands). | Wet season: 28 Mar – 4 Apr 2007 (8 days / 7 nights) |
| 2. | Lewis Consulting Services 2009 | Associated with Proposed Water for Bowen Project. This report was not available for review. However, several documents outline the details, survey effort, and results, including a potential record of Black-throated Finch <i>Poephila cincta cincta</i> at Splitter's Creek. | Pre-wet season: 13 – 18 Oct 2007 (6 days) Post-wet season: 14 – 25 April 2008 (11 days) |
| 3. | GHD 2009 | Associated with Proposed Abbot Point Multi Cargo Facility EIS. General terrestrial flora and fauna surveys within limited GHD study area covering only part of Abbot Point Project Area (mainly in and around Caley Valley Wetlands). Targeted searches for Black-throated Finch <i>Poephila cincta cincta</i> . | Dry season: 20 Oct – 1 Nov 2008 (13 days) Wet season: 22 Mar – 4 Apr 2009 (13 days) |
| 4. | Coordinator General 2010 | The Department of State Development commissioned Parsons Brinckerhoff Australia Pty Ltd (PB) to undertake background investigations and prepare baseline information to inform the location of an infrastructure corridor within the APSDA, linking the northern part of the industry precinct with the proposed Multi Cargo Facility at the port. The Australian Centre for Tropical Freshwater Research was sub-contracted by Parsons Brinckerhoff for wetlands assessment. Field assessment focused on transect-based flora survey methods, targeted searches and vegetation mapping. | Wet season: Jan 2009 (4 days) |
| 5. | PB 2009 | Associated with Proposed Water for Bowen Project. Targeted survey for Black-throated Finch (southern) within the proposed water for Bowen project area. Undertaken in response to Lewis Consulting Services 2009 report which observed a pair of Black-throated Finches. Targeted survey of breeding, foraging and watering points. | Dry season: June/July 2009 (4 days) |

| | Study | Description | Survey timing |
|-----|--------------------|---|--|
| 6. | GHD 2010 | Associated with Abbot Point Multi Cargo Facility EIS. General terrestrial flora and fauna survey and targeted threatened species surveys at the end of the wet season. Flora and fauna assessment at One Tree Hill in the dry season, in response to corridor alignment changes. | Wet season: March/April 2010 Dry season: July 2010 |
| 7. | Unidel 2011 | Terrestrial Flora and Fauna Report prepared for the Waratah Coal Pty Ltd's China First EIS at Abbot Point. The study included a desktop assessment. Eight flora and fauna sites were surveyed in October. An aerial survey for avifauna was undertaken in November 2009 via helicopter (3 hours total survey effort). | Dry season: October 2009 (2 days) Early wet season: November 2009 (3 days) |
| 8. | GHD 2011 | Surveys undertaken for Hancock Prospecting Pty Ltd Alpha Coal Project (Rail) Supplementary EIS. Surveys covered the proposed Rail Loop only (and adjacent habitat), which includes part of the Study Area associated with the Abbot Point Growth Gateway Project. Involved habitat assessments, water quality sampling and freshwater flora and fauna surveys. | Wet season: 23 – 25 Feb 2011 (3 days) |
| 9. | Austecology (2011) | Active searches for Black-throated Finch and Water Mouse and their habitat in the far western Caley Valley Wetlands and adjacent areas to the south-west. | Dry season: 20 – 22 May 2011 (3 days) |
| 10. | HCIPL 2012 | Associated with Abbot Point Coal Terminal 3. General terrestrial flora and fauna surveys included standardised bird surveys at six sites during the dry season, and two thirty-minute bird censuses in early morning and late afternoon. During the wet season, transects and census points set up around the Caley Valley Wetland, 10 hours total survey effort. | Dry Season: 10-11 Nov 2008 (2 days) Wet Season: 4 April 2009 (1 day) 23-25 Feb 2011 (3 days) |
| 11. | BAAM 2012 | Migratory Shorebird and Waterbird Surveys within Caley Valley Wetlands for the Abbot Point Cumulative Impact Assessment. Five comprehensive field surveys for migratory shorebirds and other waterbirds were undertaken in 2012 to identify habitat values and species presence within and surrounding the proposed Abbot Point Port expansion. Field surveys covered the wetland area within and surrounding the Abbot Point Port and Wetland Project development footprint; but did not cover pasture or woodland ecosystems. Coastal habitat transects, wetland perimeter transects, open water area searches, kayak transects, and soak swamp or settling pond surveys were undertaken. | Wet season (2012): 21 – 24 Feb (4 days) 5 – 10 Mar (6 days) 19 – 21 Nov (3 days) 12 – 13 Dec (2 days) Dry season: 26 – 29 Jun 2012 (4 days) |

| | Study | Description | Survey timing |
|-----|-----------------------------|---|--|
| 12. | BMT WBM 2012 | Kaili (Caley) Valley Wetlands Baseline Report. This report provides a comprehensive description of the environmental values (including wetland dependant fauna) of the Caley Valley Wetlands and adjacent areas, with a focus on the Abbot Point State Development Area. It was based on desktop information and included results of two high level fauna and flora surveys. | Late dry season: 25 – 30 Oct 2010 (6 days) Early wet season: 8 – 12 Nov 2010 (5 days) |
| 13. | ELA and Open Lines 2012 | Abbot Point Cumulative Impact Assessment. No field surveys were undertaken as part of the project. | N/A |
| 14. | CDM Smith 2013 | Terrestrial fauna surveys were carried out by CDM Smith for Terminal 0. Opportunistic bird surveys in conjunction with aquatic surveys. Good wetland condition during surveys due to higher than average rainfall earlier that year. | Dry season: 31 Jul – 3 Aug (4 days) |
| 15. | ELA 2014a (Dredge Disposal) | Desktop and field assessment for onshore dredged material disposal options in and around Caley Valley Wetlands. Parts of the assessments study area overlap with footprint for this project. Field assessment involved quaternary surveys, Regional Ecosystem (RE) validation assessments, habitat assessments, targeted searches for threatened flora species and incidental fauna observations. | Dry season: 18 – 20 Aug 2014 (3 days) |
| 16. | ELA 2014b (SEVT) | Technical memo assessing the extent and ecological condition of Semi-evergreen Vine Thicket (SEVT) in the patch adjacent to Dingo Beach (north-west of the current Project Area). | Dry conditions: 11 Dec 2014 (1 day) |
| 17. | ELA 2014c (Offsets) | Field surveys covered the impact and potential offset sites (in areas surrounding the Caley Valley Wetland) for the superseded beneficial reuse area. Determined habitat quality for marine plants and REs intersecting with Caley Valley Wetlands. | Dry conditions: 11 – 13 Dec 2014 (2 days) |
| 18. | ELA 2014d (Owl & Bat) | Targeted field surveys for the Coastal Sheath-tail Bat <i>Taphozous australis</i> and the Rufous Owl <i>Ninox rufa</i> . The survey covered SEVT, <i>Melaleuca</i> and eucalyptus woodlands in the superseded beneficial reuse area (west and north-west of the current Project Area). | Dry conditions: 10 – 12 Dec 2014 (3 days) |
| 19. | ELA 2014e (Protected Plant) | Timed meander flora surveys were undertaken for the section of the now superseded beneficial reuse area that overlapped with the Protected Plants Trigger Area, west of the current Project Area. The survey identified all species observed, though specifically targeted <i>Croton magneticus</i> and <i>Ozothamnus eriocephalus</i> . | Dry conditions: 10 Dec 2014 (1 day) |

| | Study | Description | Survey timing |
|-----|--------------------------------|---|---|
| 20. | ELA 2014f (Eastern Beach) | A small patch of vegetation mapped as RE11.2.2 located on the eastern beach of Abbot Point (at the location of where the proposed dredging pipeline crosses the beach) was surveyed in December 2014. | Dry conditions: 11 Dec 2014 (1 day) |
| 21. | State of Queensland 2015 | The Abbot Point Growth Gateway Project EPBC Act Referral (Department of State Development 2015). No field surveys were undertaken as part of the referral. | N/A |

The BAAM (2012) survey of shorebirds and waterbirds is particularly relevant to this assessment, as it was completed recently (3 years ago) and at a time when there was significant quantities of water within the Caley Valley Wetland (leading to large numbers of shorebirds). Further details of the BAAM (2012) survey results and their relevance to the assessment of Project impacts is provided in Section 4.

3.4 Field Assessments

ELA has completed field work to validate Regional Ecosystem (RE) mapping of parts of the Study Area, and an on-ground terrestrial ecological survey was completed over parts of the Study Area including sites within the Project Area (ELA 2014d). This work was further supplemented by a field survey of saltmarsh habitats adjacent to the Project Area in June 2015 (BMT WBM 2015). ELA worked closely with BMT WBM to incorporate results of the field work into this report, where relevant to the assessment of impacts on terrestrial ecology (including shorebirds).

3.5 Impact Assessment Methodology

3.5.1 Risk Assessment

A risk assessment approach has been applied to assess potential environmental impacts associated with the Abbot Point Growth Gateway Project. The approach (Figure 3) is primarily based on the International Standard ISO 31000:2009: Risk Management – Principles and Guidelines and draws on a number of guidelines and standards to assist in conducting risk identification and assessment for the EIS:

- AS/NZS ISO 31000-2009 Risk management – Principles and guidelines
- Handbook 436-2004 – Risk management guidelines
- Handbook 89:2012 – Risk management guidelines on risk assessment techniques.
- GBRMPA Environmental Assessment and Management (EAM) Risk Management Framework
- Department of Environment Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE 2013).

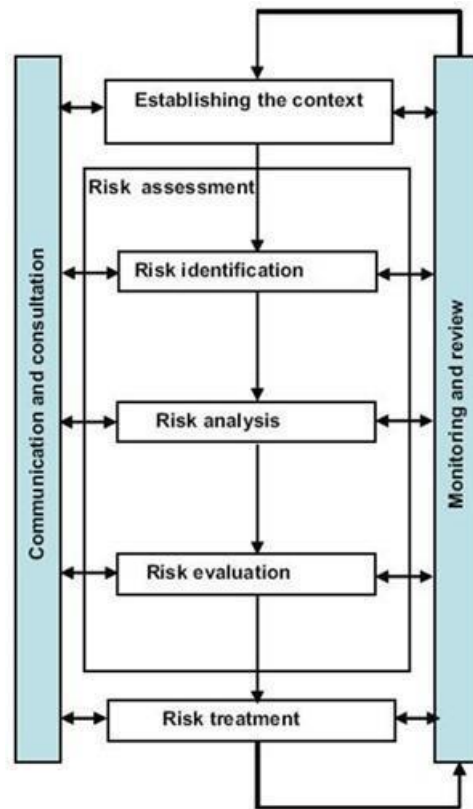


Figure 3 Risk Management Process (Source: AS/NZS ISO 31000 2009)

The risk assessment process involved the following key steps:

1. Context establishment – Confirm the project description, its environmental setting, policy and regulatory context, stakeholders that may be potentially affected by the project activities or interested in the environmental impacts of the proposal and stakeholder values associated with the environmental setting.
2. Risk identification – Risks were systematically identified and classified by linking them to project phases, project activities, technical assessment areas and controlling provisions (MNES). This step informed the technical assessment in relation to the potential impacts and allowed incorporation of the evaluation of the impacts/risks and their mitigation measures in the respective assessments.
3. Risk analysis and evaluation – Project specific risk matrix (Figure 4), consequence and likelihood descriptors (Table 2 and Table 3) were utilised. The environmental consequence rating considers direct and indirect impacts, short and long term, temporary and irreversible impacts for the Project's lifecycle. The magnitude of potential environmental impacts was derived from the analysis of the amount and type of change and the sensitivity of the receiving environment. Risks were rated based on the consequence of the risk and the likelihood of the risk occurring (e.g. Extreme, High, Moderate, Low). This allowed prioritisation of risks and identification of those which required additional mitigation measures to reduce their risk ratings to acceptable levels.
4. Risk treatment/mitigation – Mitigation measures were identified to reduce the potential for consequences to occur and/or to reduce their severity if they do occur. Risks were re-rated (residual risk) taking into consideration the adequacy and effectiveness of the mitigation measures.

Table 2 Consequence definition for terrestrial ecology

| | Insignificant | Minor | Moderate | Major | Severe |
|---------------------|---|--|--|--|--|
| Natural environment | <p>Minor, no or positive impacts to ecological structure and function.</p> <p>Minor degradation of habitat and/or increased disturbance leading to a small and/or short-term reduction in habitat use by fauna/flora, at a local scale.</p> <p>No disturbance of threatened ecological communities or species.</p> <p>Recovery expected to occur over a period of months.</p> | <p>Minor to moderate disturbance to ecological structure and function.</p> <p>Minor degradation of important habitat and/or increased disturbance leading to a small and/or short-term reduction in habitat use by fauna/flora at a local scale, including threatened or migratory species.</p> <p>Minimal disturbance of threatened ecological communities or species.</p> <p>Recovery expected to occur over a period of one year.</p> | <p>Moderate disturbance to ecological structure and function.</p> <p>Degradation of important habitat and/or increased disturbance leading to a reduction in habitat use by fauna/flora at a local or regional scale, including threatened and migratory species.</p> <p>Minor disturbance of threatened ecological communities or species.</p> <p>Recovery expected to occur over a period of one to three years.</p> | <p>Moderate to major change to ecological structure and function.</p> <p>Degradation of important habitat and/or increased disturbance leading to a temporary and substantial reduction in habitat use by fauna/flora at a regional scale, including threatened and migratory species.</p> <p>Moderate disturbance of threatened ecological communities or species.</p> <p>Recovery expected to occur over a period of five years.</p> | <p>Fundamental change to ecological structure and function.</p> <p>Degradation of important habitat and/or increased disturbance leading to a substantial reduction in habitat use by fauna/flora at a regional scale, including threatened and migratory species.</p> <p>Major disturbance of threatened ecological communities or species.</p> <p>Recovery unlikely to occur completely, or to occur over a period of 10+ years.</p> |

Table 3 Likelihood definition

| Likelihood of Impact Occurring | Definition |
|--------------------------------|---|
| Almost Certain | <ul style="list-style-type: none"> It is known that the impact will occur, or 95 – 100% chance of occurring |
| Likely | <ul style="list-style-type: none"> Impact is likely to occur on this Project, or 71 – 95% chance of occurring |
| Moderate | <ul style="list-style-type: none"> Impact has occurred on a similar Project, or 31 – 70% chance of occurring |
| Unlikely | <ul style="list-style-type: none"> Given current practices and procedures, this impact is unlikely to occur on this Project, or 5 – 30% chance of occurring |
| Rare | <ul style="list-style-type: none"> Highly unlikely to occur on this Project, or 0 – 5% chance of occurring |

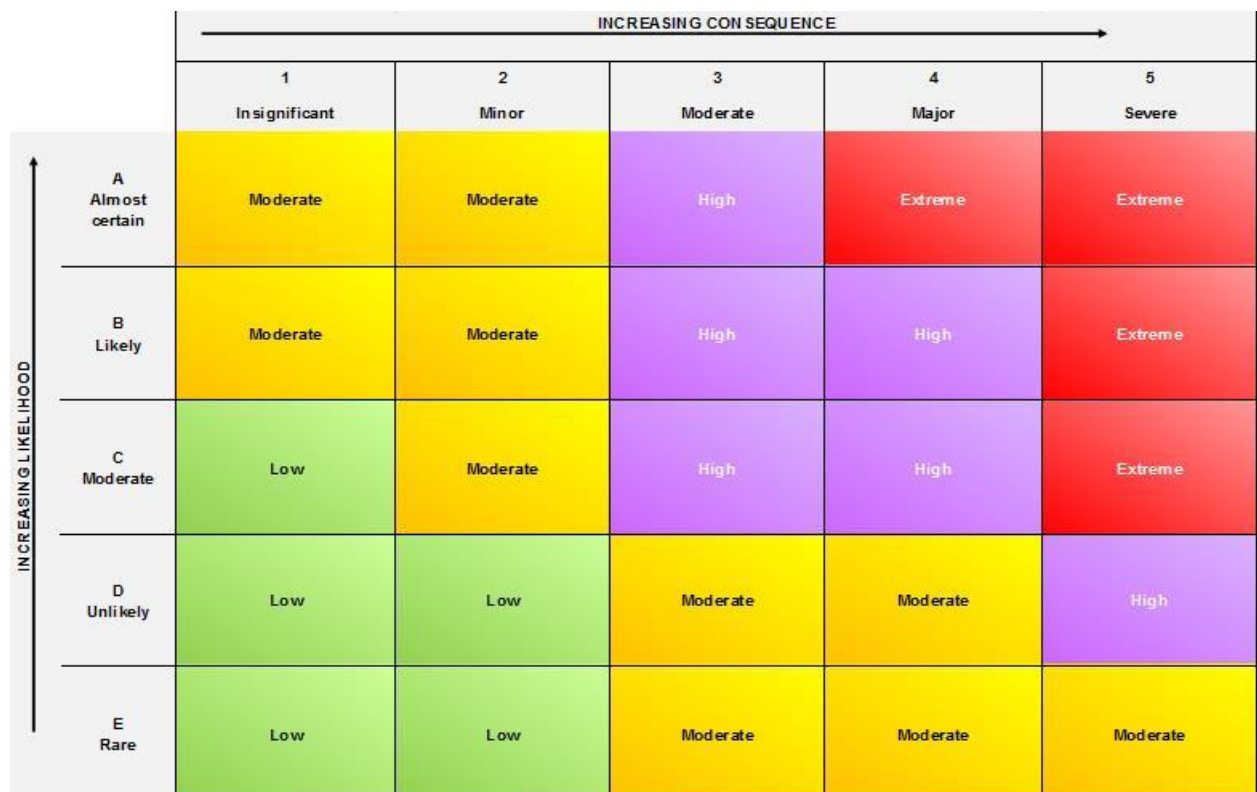


Figure 4 Risk Matrix

A summary of the results of the risk assessment (risk register) is included in (Section 5.2).

3.5.2 Project impacts

Potential impacts on listed species that are known, likely or have the potential to occur within the Project Area and Study Area were given detailed consideration in the impact assessment. The species' ecology was described, potential impacts within the Project Area and adjacent areas were considered, mitigation and management measures were developed and residual impacts and outcomes were assessed. The impact assessment was conducted in a manner consistent with the EIS Guidelines published by DoE in June 2015 (DoE 2015a).

Migratory shorebirds are often treated as a group for impact assessment purposes, as they can be ecologically similar and may occupy similar habitats. Where possible, species specific habitat requirements were considered, particularly for those species for which the site is considered important habitat (according to EPBC Act policy statement 3.21, DEWHA 2009a). Patterns in the utilisation of the Caley Valley Wetland among key shorebird species were given detailed consideration when assessing the potential significance of off-site and indirect impacts of the Project.

Section 527E of the EPBC Act defines impacts as:

- Events that are a 'direct consequence of the action', or
- Events that are an 'indirect consequence of the action', including impacts which are facilitated, to a major extent, by that action.

There are several concepts which are commonly applied under the EPBC Act to assess the significance of impacts on MNES. These are defined in *Matters of National Environmental Significance Significant impact guidelines 1.1* (DoE 2013). In accordance with these guidelines, the assessment in this report of listed threatened species and ecological communities is presented within the context of the following key concepts:

- Habitat critical to the survival of a species or ecological community
- An important population; this relates particularly to species listed as Vulnerable under the EPBC Act. Impacts on species listed as Endangered or Critically Endangered are considered in relation to 'population'.

The meaning of these two concepts is defined in the text box below.

WHAT IS HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES OR ECOLOGICAL COMMUNITY?

Habitat critical to the survival of a species or ecological community refers to areas that are necessary:

- *for activities such as foraging, breeding, roosting, or dispersal;*
- *for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);*
- *to maintain genetic diversity and long term evolutionary development; or*
- *for the reintroduction of populations or recovery of the species or ecological community.*

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/ or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

WHAT IS AN IMPORTANT POPULATION OF A 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.

Source: DoE 2013.

The assessment in this report of listed migratory species is presented within the context of the following concepts:

- Important habitat
- Ecologically significant proportion of the population.

The meaning of these two concepts is defined in the text box below.

WHAT IS IMPORTANT HABITAT FOR A MIGRATORY SPECIES?

An area of 'important habitat' for a migratory species is:

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

WHAT IS AN ECOLOGICALLY SIGNIFICANT PROPORTION?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

Source: DoE (2013)

3.5.3 Consequential impacts

Separate consideration was given to consequential impacts of the Project, which are those that result from further actions made possible or facilitated by the Project. Activities facilitated by the Project are those Adani Projects which will be dependent upon the Project to export coal, as summarised below:

- Carmichael Coal Mine and Rail Project (EPBC 2010/5736)
- North Galilee Basin Rail Project (EPBC 2013/6885)
- Abbot Point Terminal 0 Project (EPBC 2011/6194)

Each of these projects have previously been assessed and approved under the EPBC Act with respect to potential impacts on MNES. Therefore, the assessment of consequential impacts involved consideration of the assessment outcomes of these projects with respect MNES, including (where relevant) MNES-related conditions of each Project.

3.5.4 Cumulative impacts

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones (IFC 2013). For the purposes of the terrestrial ecology components of the EIS it was considered that the cumulative impact assessment must consider the impacts of the following projects:

- Adani Carmichael Coal Mine and Rail Project (EPBC 2010/5736)
- Adani North Galilee Basin Rail Project (EPBC 2013/6885)
- Adani Abbot Point Terminal 0 Project (EPBC 2011/6194)
- GVK Hancock Terminal 3 Project (EPBC 2008/4468)
- GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648)
- GVK Hancock Kevin's Corner Project (EPBC 2009/5033)

These projects were considered to the extent that they may have cumulative impacts on the specific MNES that were identified as potentially impacted by the Project. For the purposes of the assessment of cumulative impacts, it was assumed that dredged material for the GVK Hancock Terminal 3 project will be placed and managed within the GVK Hancock project's proposed rail loop and outside of the Caley Valley Wetland.

The assessment of cumulative impacts has relied upon assessment material developed for the other projects (Adani 2012, 2013; HCIPL 2012; Hancock Prospecting 2010, Hancock Galilee 2011). Where it was identified that there is a potential cumulative impact on an MNES, the impact assessment applied to Project impacts was reapplied to the assessment of cumulative impacts.

3.6 Reliability of Information

Information utilised in the preparation of this report has been prepared by suitably qualified and experienced consultants, published in peer reviewed journals or prepared and reviewed by State or Commonwealth governments. The information utilised in this document is considered to be fit for purpose and of a nature appropriate for the assessment of impacts relating to the Abbot Point Growth Gateway Project.

4 Existing Environmental Values

4.1 Regional Ecological Context

Abbot Point is located within the Brigalow Belt North Bioregion, an environmentally sensitive area that supports a range of environmental values. The bioregion is characterised by rugged ranges and alluvial plains, with the vegetation primarily being acacia open forests and eucalypt woodlands (DoE 2008).

The Project Area is located on a cleared sandy plain broadly surround by:

- An existing operating coal terminal (T1), railway and rail loop to the east and north
- Induced grasslands to the west

- The Caley Valley Wetlands to the west and south

The Study Area:

- Occurs within and adjacent to the GBR World Heritage Area (GBRWHA) and Marine Park
- Includes the Caley Valley Wetland (a largely ephemeral wetland system) which is important for many bird species (including both threatened and migratory species)
- Supports a variety of vegetation types in different conditions including:
 - the Endangered Semi-evergreen Vine Thicket (SEVT) TEC
 - remnant coastal dune systems and beaches
 - woodland, riparian, mangrove and coastal areas
 - extensive areas previously used for farming
- Includes cleared areas that are used for existing industrial uses.

The current state of the environmental values at Abbot Point reflects both its proximity to some ecologically-important areas, as well as its existing use as an industrial port and previous use for agricultural purposes.

Abbot Point experiences a dry tropical climate with annual rainfall of between 1,000 mm to 1,600 mm across the region (BoM 2015) and a pronounced wet season between November and March. The area is characterised by Quaternary alluvial and colluvial plains fringed by coastal and estuarine deposits, with volcanic outcrops forming low hills. The most prominent ecological feature is the Caley Valley Wetland which covers an area of approximately 5,154 ha (Section 4.4).

The Study Area and surrounds are located within the Bogie River Hills Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion, a subregion of the Brigalow Belt North Bioregion. The sub-region has been subject to broad scale clearing primarily for agricultural activities. Despite considerable modifications to the landscape, natural habitats do persist and include areas of fragmented and connected remnant vegetation, watercourses and wetlands.

The nearest protected areas are Mount Aberdeen National Park (located 40km to the south-west), Cape Upstart National Park (located 30 km to the north-west), and Gloucester Island National Park (located 40 km to the south-east). A wildlife corridor extends in an east–west direction across the Caley Valley Wetlands. This corridor forms part of a larger wildlife movement corridor, connecting the wetlands to Mount Aberdeen National Park, 40 kilometres southwest of Bowen (BMT WBM 2012).

Remnant vegetation to the west and south of the Abbot Point Coal Terminal also forms part of a wildlife corridor, and the largely intact coastal vegetation provides relatively good habitat connectivity between the wetland and Cape Upstart National Park to the north-west (BMT WBM 2012). However, there is poor connectivity in a direct line (north to south) between the Wetlands and the ranges, due to extensive clearing for cattle grazing (BMT WBM 2012).

The terrestrial environment of Abbot Point consists of a variety of vegetation communities including sclerophyll woodland to open forest, beach scrub, saline and freshwater wetlands (NQBP 2010). Seasonal climatic variations and diverse landscape features provide a broad range of habitats for vegetation communities, plants and animals, including migratory bird species.

The condition of habitat within the Study Area varies substantially according to historical land management practices (e.g. grazing) and the abundance of weed species. For example, GHD (2009) found that the vine thicket on rocky headlands, pasture grasslands, and highly saline wetland areas had

lower species diversity than the beach scrub, melaleuca regrowth, *Eucalyptus crebra* woodlands and the ephemeral creeks. Weed species occur throughout the Study Area including: Prickly Acacia (*Acacia nilotica* subsp. *indica*), Rubber Vine (*Cryptostegia grandiflora*), Chinese Apple (*Ziziphus mauritiana*) and Lantana (*Lantana camara*; Unidel 2011).

4.2 Vegetation

The Project Area is an allocated Port Infrastructure Zone that was heavily disturbed in the past for cattle grazing. Historical vegetation clearing in this area has created induced grasslands with regrowth woodland patches of various sizes and heights. The northern section of the Project Area contains a large patch of moderately dense regrowth woodland that is 5 to 6 m tall (Figure 5). This patch is dominated by Swamp Teatree *Melaleuca dealbata*. A second, sparser patch of regrowth woodlands occurs in the central section of the Project Area, and is dominated by both *Melaleuca dealbata* and Carbeen *Corymbia tessellaris*. A small patch of approximately 10 mature *Corymbia tessellaris* trees occurs adjacent to the central patch of woodland regrowth, near the eastern boundary of the Project Area.

Prior to disturbance, the Project Area was formerly the Least Concern Regional Ecosystem 11.2.5, which is defined as *Corymbia-Melaleuca* woodland complex of beach ridges and swales.

Remnant vegetation and wetlands occur adjacent to, and within 500 m of the Project Area, in all directions. These areas include (Figure 5; Table 4):

- Remnant SEVT on coastal dune (RE11.2.3) and igneous rock (11.12.4a) within 300 m to the north and north-west, within 150 m to the south-east, and adjacent to the dredging pipeline corridor.
- Remnant grassland and herbland on fore dunes (RE11.2.2) within 300 m to the north-west, and within 150 m to the south-east
- Remnant *Corymbia tessellaris* woodlands (RE11.2.5) within 250 m to the west
- Remnant *Corymbia tessellaris* and *Melaleuca dealbata* woodlands (RE11.2.5) within 50 m to the east, south-east, and southwest
- Remnant samphire within 300 m to the west
- Remnant Marine Couch *Sporobolus virginicus* (RE11.1.1) grasslands within 50 m of the south-western edge, and within 300 m to the west
- Palustrine wetlands (RE11.3.27x1c) within 50 m of the south-western edge, within 300 m to the west, and within 250 m to the south

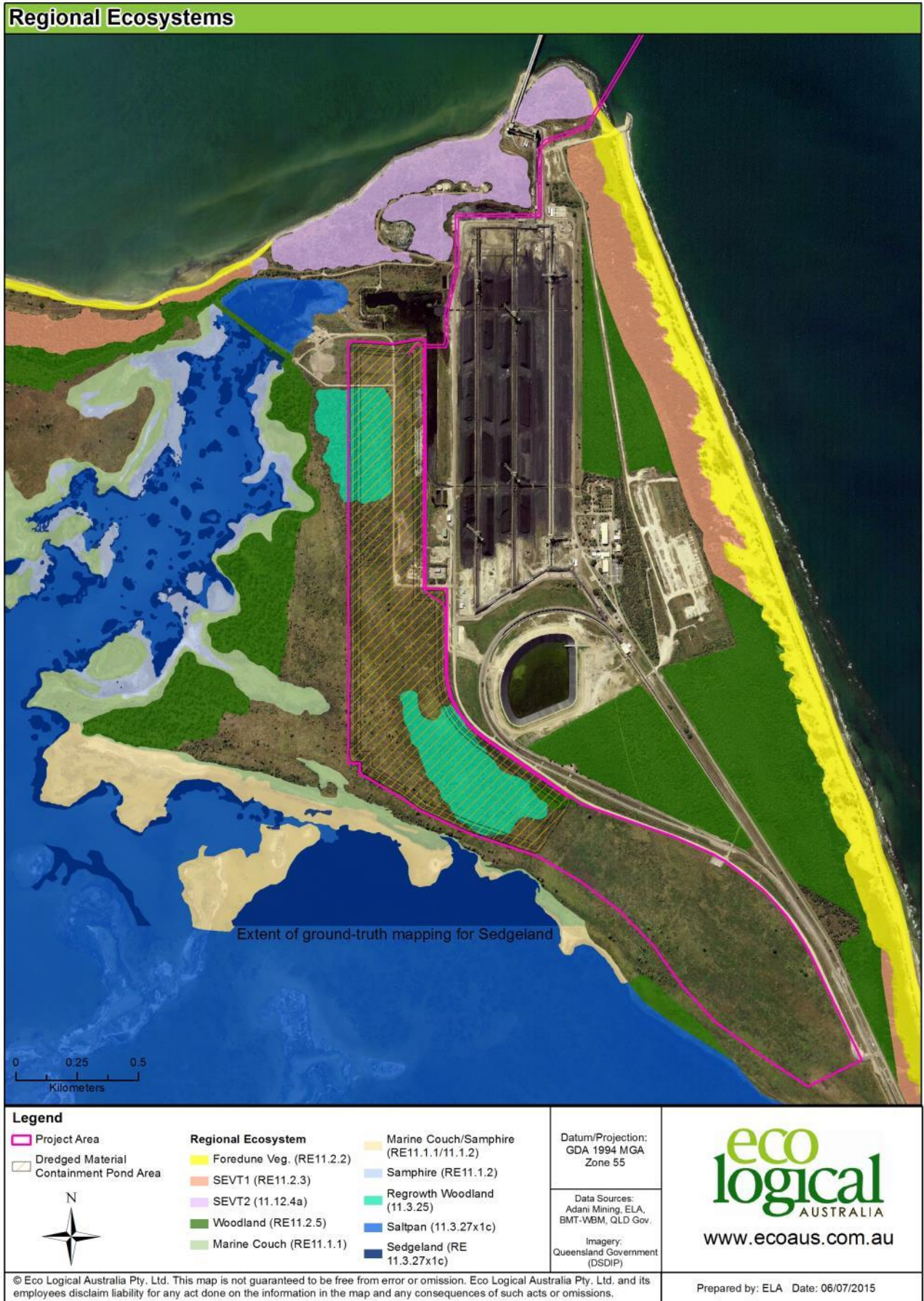


Figure 5 Remnant vegetation in the vicinity of the Project Area (pipeline route is indicative)

Table 4: Descriptions for Regional Ecosystems in and near the Project Area.

| RE ID | RE Description | VM Class ¹ | BD Status ² |
|------------|--|-----------------------|------------------------|
| 11.1.1 | <i>Sporobolus virginicus</i> grassland on marine clay plains | Least concern | No concern at present |
| 11.1.2 | Samphire forbland on marine clay plains | Least concern | No concern at present |
| 11.2.2 | Complex of <i>Spinifex sericeus</i> , <i>Ipomoea pes-caprae</i> and <i>Casuarina equisetifolia</i> grassland and herbland on foredunes | Of concern | Of concern |
| 11.2.3 | Microphyll vine forest ('beach scrub') on sandy beach ridges and coastal dunes | Of concern | Of concern |
| 11.2.5 | <i>Corymbia-Melaleuca</i> woodland complex of beach ridges and swales | Least concern | Not of concern |
| 11.3.27x1c | Palustrine wetland (e.g. vegetated swamp). Sedgelands to grasslands on Quaternary deposits | Least concern | Of concern |
| 11.12.4 | Semi-evergreen vine thicket and microphyll vine forest on igneous rocks | Least concern | No concern at present |

Note: 1 = VM –vegetation management class, 2: BD – biodiversity status

Field surveys have validated vegetation in the Project Area, and remnant vegetation to the north, west and south of the Project Area (ELA 2014b). The remnant SEVT and woodland areas near the Project Area are generally in good condition, with some weed infestations (ELA 2014b).

4.3 Fauna Habitat

There is a broad diversity of flora and fauna species within the Study Area. For example, fauna surveys conducted by GHD (2009) during a previous EIS of the area found 212 terrestrial wildlife species (152 birds, 29 mammals, 24 reptiles and seven amphibians). Additional species have also been observed in the other relevant studies. Several EPBC Act listed threatened terrestrial species and ecological communities are among those known to occur at Abbot Point.

A total of twelve terrestrial habitat types were identified by GHD (2009) when undertaking terrestrial flora and fauna studies for the previously proposed Multi Cargo Facility EIS. This study provides an indication of the range of terrestrial habitat values present in the vicinity of the Project Area, which include:

- Beach and beach scrub
- Rocky shore
- Vine thicket on rocky substrate
- Grassland
- Saltwater and freshwater wetland
- Melaleuca
- Ephemeral and pandanus creek
- Open woodland with grassy understorey
- Rocky hillside.

The Project Area predominately provides habitat values for generalist fauna of open areas and grasslands. The small patch of remnant *Corymbia tessellaris* woodlands in the Project Area provides potential nesting and sheltering opportunities for arboreal mammals such as bats and possums, as well as nesting and perching sites for birds such as raptors, owls, and parrots (ELA 2014a). A whistling kite nest has also previously been identified in this patch (ELA 2014a).

Regrowth *Melaleuca dealbata* woodlands provide food resources for local nectivorous birds such as honeyeaters (ELA 2014a). Regrowth *Corymbia tessellaris* and *Melaleuca dealbata* woodlands provide perching and hunting sites for insectivorous and carnivorous birds such as magpies, kookaburras, and bee-eaters, as well as shelter areas for small passerines such as wrens and finches. The induced grasslands provide potential food resources for local granivorous birds such as finches and pigeons, and shelter sites for grassland-adapted reptiles such as dragons, *Ctenotus* skinks, and elapid snakes (ELA 2014a).

The soils of the Project Area and wider Study Area are characteristic of alluvial floodplain environments, with a thick accumulation of alluvial sands deposited with lenses of silty sand and clayey sand. These soils, with their tussocky grasses, provide burrowing opportunities for fossorial fauna such as goannas, skinks, and native rodents.

4.4 Caley Valley Wetland

4.4.1 Location and physical values

The Caley Valley Wetland is located to the south west of the existing coal terminal and immediately adjacent to the Project Area. The wetland covers an area of approximately 5,154 ha and is one of the largest intact wetland systems between Townsville and Bowen (BMT WBM 2012). The wetland is listed under the Directory of Important Wetlands in Australia (DIWA) as a palustrine system (modified from an original brackish wetland since the 1950s).

The wetland has gently sloping margins, separated from the Coral Sea on two sides by a beach dune barrier system to the north and east and on the western side by estuarine systems. It comprises a diversity of complex and dynamic habitat types, with three distinct wetland types or functional zones (Figure 6; BMT WBM 2012; BAAM 2012):

- Coastal water and estuarine (intertidal) zone
- Hypersaline or Open Pan Zone
- Wetland Basin Zone, comprising the:
 - Open Marsh Zone; and
 - Closed Marsh Zone.

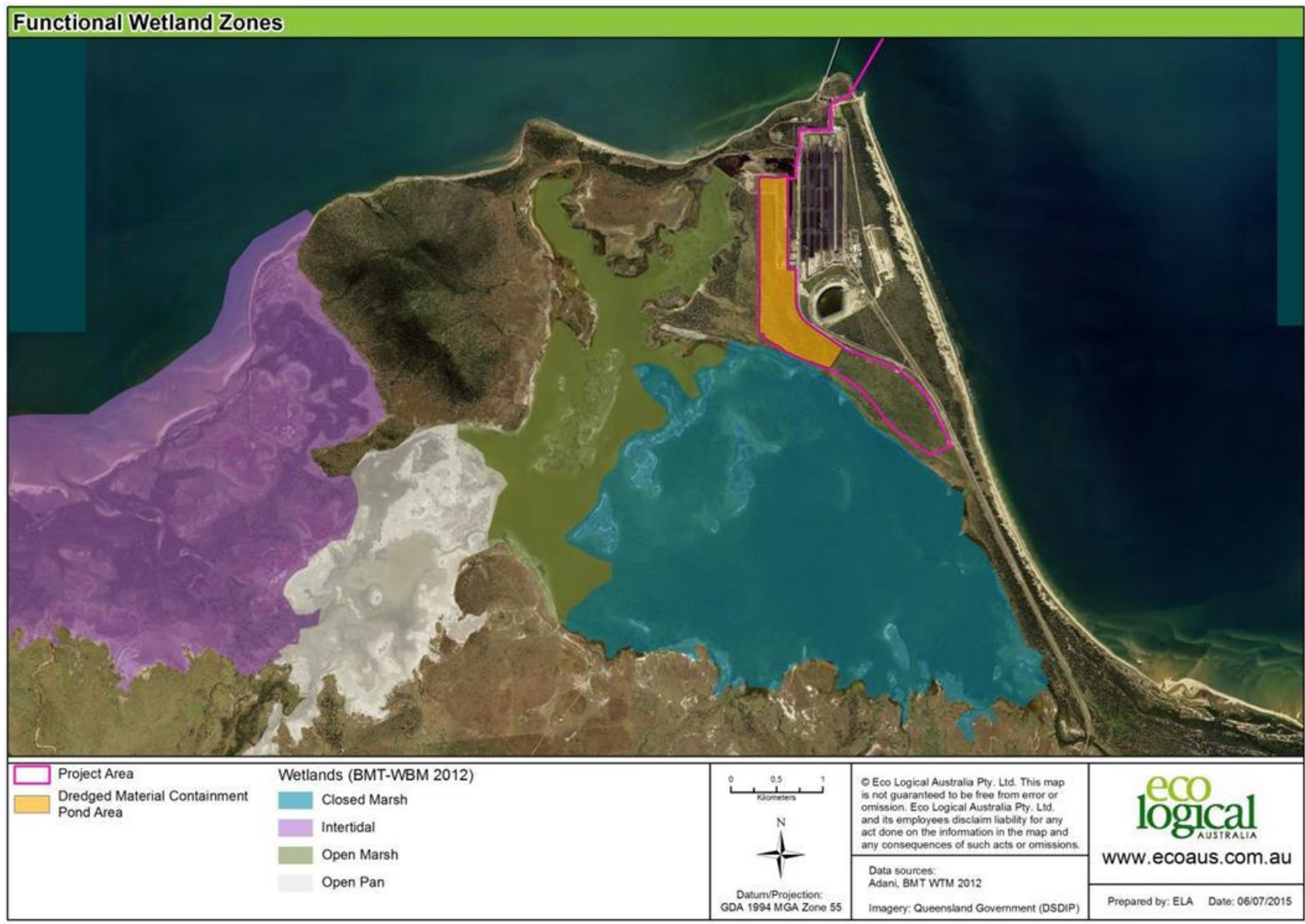


Figure 6 Map showing functional zones within the Caley Valley Wetland (BMT WBM 2012; BAAM 2012)

Excess treated surface water from the existing Coal Terminal's stormwater treatment ponds enters the wetland from the north. Runoff from the elevated dunes and ridges within the Coal Terminal site enters the wetland from the east. Saltwater Creek, south east of the main body of the wetland, provides the connection between the wetland and Euri Creek. During the dry season, tidal movements dominate the system and saline water enters the wetland from Curlewis Bay.

The Caley Valley Wetland consists of both subtidal and intertidal marine and estuarine wetlands, including one large fresh and brackish water wetland contained within a partially artificial impoundment (BMT WBM 2012). A freshwater impoundment has been created by four artificial bund walls which were constructed in 1956 to enhance duck shooting opportunities (Peter Hollingsworth and Associates 1979 and 1981). The abundance and diversity of wetland birds began increasing shortly after the bund walls were constructed (BMT WBM 2012).

Tidal flushing of the wetland is partly constrained by the western bund and causeway and totally constrained by the two eastern bunds that restrict inflows from Euri Creek. The western bund partially isolates the site from tidal influences. It has also resulted in localised mangrove die-back, due primarily to root anoxia which is caused by excessive ponding of water. Tidal flows have been observed occurring both around and overtopping the western bund (WBM 2006). Similarly, the causeway is overtopped during spring tide events as well as having a culvert located at the southern end that allows water exchange between the two main areas of the wetland (GHD 2009). The Project Area is located above the level of tidal influence.

4.4.2 Seasonal trends

The hydrology of the wetland undergoes dramatic seasonal and inter-annual variability. Water levels can vary substantially both among years and within the same year, being influenced by the frequency of tropical cyclones and subject to significant rainfall variability within the catchment. Seasonal changes between the wet and dry seasons greatly influence the ecology of the wetland.

Increased rainfall and flow of water from the catchment during the wet season results in filling of the eastern wetland area and the return of substantial vegetation such as reeds, sedges and rushes (GHD 2010). In turn, this provides foraging and nesting habitats and refuge for a wide range of birds, reptiles, amphibians, fish and aquatic invertebrates. During the wet season there tends to be a reversible movement of fresh and brackish waters westwards from the wetland into Curlewis Bay.

During the dry season, however, tidal movements tend to dominate the system (GHD 2010). With very limited freshwater inflow, much of the wetland dries and loses vegetative cover. Under such dry conditions, the wetted expanse of the wetlands can contract to the area known as Lake Caley (or the Lake), in the south eastern part of the wetland. Lake Caley provides one of the only semi-permanent non-tidal waterbodies in the area.

4.4.3 Habitat values

The Caley Valley Wetland is an important habitat for many local terrestrial fauna species, providing a relatively intact environment in an otherwise disturbed landscape (BMT WBM 2012). The wetlands have high ecological value for waterbirds, and are considered a significant aggregation site for migratory shorebirds and other waterbirds (State of Queensland 2015). The wetland's adjacency to the ocean allows connectivity between the wetland and coastal environments of the GBRWHA, with many of the bird species inhabiting the wetland also using the beaches and intertidal areas for foraging (State of Queensland 2015). The Caley Valley Wetland is considered to contain important and significant natural habitats for *in situ* conservation of bird diversity.

Sections of the Caley Valley Wetland adjacent to the Project Area are in good condition (ELA 2014c). There is minimal grazing disturbance on the north-eastern section of the wetland, due to exclusion fencing for the coal terminal railway (ELA 2014c). In contrast, parts of the southern perimeter of the wetland have been grazed for several years, resulting in the degradation of vegetation and fauna habitat values.

The shallow water areas and fringing mudflats consist of well-vegetated areas of sedges and rushes, around the edges of the open water habitat, and mudflats bordering the wetland itself (ELA 2014a). The well-vegetated areas are used by frogs and cryptic birds such as rails and snipes for foraging, nesting and shelter, while the less-vegetated shallow water areas are used by foraging waders (ELA 2014a, ELA 2014f). Mudflats also provide foraging habitat for waders and resting habitat for shorebird species such as terns (ELA 2014a). Freshwater wetland fringes provide a water source for local birds, mammals, and reptiles (ELA 2014a).

The Study Area provides habitat for an abundance of waterbirds, estimated to be over 24,000 individuals in February and March 2012 and approximately 48,000 individuals in June 2012 (BAAM 2012). The coastal and estuarine habitats, together with the salt pans, provide feeding and roosting areas for migratory and resident shorebird and wetland species. The estuarine/brackish and freshwater sections of the wetland are important waterbird feeding, roosting and breeding areas. Waterbirds, such as ducks, geese and swans can be extremely abundant in the main open water wetland area during the wet season, with hundreds of individuals recorded (ELA 2014a, BMT WBM 2012).

The Caley Valley Wetland is also an important dry season refugia for resident shorebirds and terrestrial fauna, and an important nesting area for some non-migratory shorebird species (BMT WBM 2012). The wetland provides one of Queensland's largest and most northerly coastal nesting areas for the Black Swan *Cygnus atratus* (BMT WBM 2012).

The wetland also provides habitat for a range of other species. Up to fifty species of mammal and reptile (including introduced species) have been found in and adjacent to the wetland, including two species of freshwater turtle. Eleven native frog species and the Cane Toad (*Rhinella marina*) have also been recorded in the wetland and surrounding vegetation (BMT WBM 2012).

Whilst there is limited information about the fish assemblages of the wetland, 25 fish species have been recorded within the wetland to date (BMT WBM 2012). The bunds within the wetland are likely to impede fish movement between the ocean and within the wetland, although there is a small culvert in the southern area of the causeway that allows some fish passage.

4.4.4 Shorebirds

The Caley Valley Wetland provides habitat for several migratory shorebirds listed under the EPBC Act. Surveys of migratory shorebird and other wetland/waterbird species were most recently completed by BAAM in 2012 as part of the Abbot Point CIA (BAAM 2012). These surveys provide detailed information on the abundance of various species within the Caley Valley Wetland. They were focussed on migratory shorebirds and any listed threatened wetland bird species (in particular the Australian Painted Snipe).

The BAAM (2012) survey approach was tailored to consider the guidelines in EPBC Act policy statement 3.21 (DEWHA 2009a, b) for assessing population and habitat importance for migratory shorebirds. The baseline survey objective was to obtain an estimate, based on count data and extrapolation to any unsurveyed areas, of the total abundance of each species of migratory shorebird within the Caley Valley Wetland system. Survey effort concentrated on the central part of the wetland located adjacent to the Project Area, referred to as the Closed Marsh and Open Marsh zones, and

adjacent coastal areas. The surveys comprised five field visits during February, March (wet season), June, November and December (dry season).

There were some limitations to the extent of the BAAM survey, due to the sheer size of the study area, restrictions on access, and time constraints. These limitations include:

- It was necessary to extrapolate the population estimates for the main wetland area to also include unsurveyed areas. This was done according to standard industry practice and involved extrapolating the count results of surveyed sectors to unsurveyed areas using a survey sector most similar in position and habitat characteristics to the unsurveyed area.
- Extrapolation was possible for only four species, which were restricted to the perimeter fringes of the wetland basin.
- It was necessary to provide estimates of shorebird abundance for some species rather than actual counts. Estimates account for factors such as bird movements during survey periods, the cryptic nature of some species and flushing distances. Estimation was conducted by BAAM ecologists in accordance with recognised industry practice.

The BAAM (2012) survey also found the Australian Painted Snipe (Endangered) to be present within the wetland during both the wet and dry seasons. The February component of the wet season survey recorded three individuals and the dry season (June) recorded 24. This latter record was estimated to represent a total of 35 birds after extrapolation to unsurveyed areas.

Rainfall conditions in the 12 month period preceding the BAAM (2012) survey were likely to have resulted in the wetlands experiencing water level conditions that were optimal for migratory shorebirds and the Australian Painted Snipe. This was reflected in the high numbers of birds recorded in the BAAM (2012) surveys when compared with those of previous surveys.

BMT WBM (2012) also conducted shorebird and waterbird surveys during October and November 2010, with the objective of describing patterns in habitat use. These surveys informed a broad baseline environmental study of the Caley Valley Wetland.

The various field surveys at Abbot Point have identified a total of 15 migratory shorebird species, as follows:

- Black-tailed Godwit
- Common Greenshank
- Common Sandpiper
- Curlew Sandpiper
- Eastern Curlew
- Greater Sand Plover
- Latham's Snipe
- Little Curlew
- Marsh Sandpiper
- Oriental Plover
- Pacific Golden Plover
- Red-necked Stint
- Sharp-tailed Sandpiper
- Wandering Tattler
- Whimbrel.

The results of the collective surveys and database records indicate the high diversity of migratory shorebird species using the Caley Valley Wetland. The number of species found at the wetland represents almost half the total number of migratory shorebirds listed under the EPBC Act.

It is significant that over half the species found at Abbot Point were recorded on multiple occasions at Abbot Point. This is perhaps partly because migratory shorebirds exhibit strong site fidelity and will return to the same site year after year (Clemens *et al.* 2008), but may also be indicative of the quality and diversity of local habitat.

4.5 Weeds and Pests

A high cover of perennial weeds occurs across the grassy sections of the Project Area, particularly Buffel Grass *Cenchrus ciliaris*, Passion Flower *Passiflora foetida*, and Flannel Weed *Sida cordifolia*. Other weeds of note include Snakeweed *Stachytarpheta jamaicensis* and Mimosa Bush *Vachellia farnesiana*. Rubber Vine *Cryptostegia grandiflora* and Lantana *Lantana camara* are also likely to be present in this area. Prickly Acacia *Acacia nilotica* and Chinese Apple *Ziziphus mauritiana* are also known to occur in the Study Area (Unidel 2011).

There are no records of pests within the Project Area. However, several exotic fauna species are known to occur in the adjacent Caley Valley Wetlands, including the Cane Toad *Rhinella marinus*, Pig *Sus scrofa*, Rabbit *Oryctolagus cuniculus*, Black Rat *Rattus rattus*, House Mouse *Mus musculus*, Fox *Vulpes vulpes*, Asian House Gecko *Hemidactylus frenatus*, and Northern Mallard *Anas platyrhynchos* (ELA 2014f, Wildlife Online, Unidel 2011).

4.6 Matters of National Environmental Significance

Numerous environmental studies have been undertaken within the Port of Abbot Point and the Abbot Point State Development Area. These reports collectively provide a comprehensive picture of the listed threatened species, their habitats and the ecological communities that occur within the Project and Study areas. The information from these reports, along with the information from the database and literature searches described in Section 3.3 has been compiled into the following sections and tables to assess the likelihood of a threatened terrestrial species or community, or migratory terrestrial species, occurring within the Project Area and broader Study Area. This work has been further supplemented by field assessments of areas immediately adjacent to the Project Area in June 2015 (BMT WBM 2015).

The likelihood category in the following tables is based on the known and predicted distribution of the species, desktop and field-verified habitat attributes and targeted surveys, and the known ecology of the species. Five terms for the likelihood of occurrence are used, and are defined as follows:

- “Known” = the species has been observed within the Study Area and habitat exists within the Study Area
- “Likely” = the species is known from the broader Abbot Point area and potential suitable habitat exists within the Study Area
- “Potential” = Suitable habitat for a species occurs within the Study Area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- “Unlikely” = A very low to low probability that a species uses the Study Area
- “No” = Habitat within the Study Area and in the vicinity is unsuitable for the species

Species and communities that are known, likely or have the potential to occur within the Study Area are considered in more detail in Section 5. Unless otherwise referenced, all information is sourced from the

Species Profile and Threats (SPRAT) Database, maintained by the Commonwealth Department of Environment (DoE 2015b).

4.6.1 Threatened Ecological Community

One TEC occurs within the Study Area: SEVT of the Brigalow Belt (North and South) and Nandewar Bioregions. In the Study Area, the SEVT TEC is represented by RE11.2.3 – Microphyll vine forest "beach scrub" on sandy beach ridges and dune swales (ELA 2014b). One patch of SEVT TEC (RE11.2.3) occurs within 300 m of the Project Area (to the north west), and another patch occurs within 150 m of the south-eastern section (Figure 5). A third patch of SEVT TEC occurs approximately 750 m east of, and runs parallel with, the northern section of the Project Area. The northern border of this SEVT TEC patch lies adjacent to (approximately 50 m from) the proposed temporary pipeline alignment.

4.6.2 Threatened Flora

There are no species of threatened flora known, likely or with potential to occur within the Study Area (Table 5).

4.6.3 Threatened Fauna

On 14 May 2015, the Minister for the Environment made a determination that an EIS was required for the Project on the basis of a referral submitted to the Department of the Environment under the EPBC Act. Listing events following the determination date are not required to be considered as part of the assessment process under the EPBC Act.

On 26 May 2015, the Curlew Sandpiper and Eastern Curlew were listed as Critically Endangered under the EPBC Act. Prior to this date, they were listed as Migratory. The Critically Endangered status of these species is therefore not required to be taken into account when completing an assessment of the Project. The listing status of these species at the time of referral determination has therefore been noted in relevant sections of this report for clarity.

There are two species of threatened bird, the Australian Painted Snipe and the Eastern Curlew (not a threatened species at the time of referral determination), known to occur within the Study Area (Table 6). Approximately 2.3% of the total estimated population of the Australian Painted Snipe has previously been recorded during optimal conditions within the Caley Valley Wetland (CDM Smith 2013).

The Curlew Sandpiper (not a threatened species at the time of referral determination) and Squatter Pigeon are considered likely to occur within the Study Area, based on a small number of previous sightings. There are no species of threatened mammal or reptile known, likely or with potential to occur within the Study Area (Table 7; Table 8).

4.6.4 Migratory fauna

There are 19 migratory shorebirds that are known, likely or have potential to occur within the Study Area (Table 9), including those that are also threatened species. The Caley Valley Wetland is habitat for ecologically significant proportions of the populations of three of these species: Latham's Snipe *Gallinago hardwickii*, Sharp-tailed Sandpiper *Calidris acuminata*, and Red-necked Stint *Calidris ruficollis*.

A further 16 migratory (non-shorebird) bird species are known, likely or have potential to occur within the Study Area (Table 10). An ecologically significant proportion of the Eastern Great Egret *Ardea modesta* population (>1%) occurs in the Caley Valley Wetland (CDM Smith 2013). Survey results of BAAM (2012) also indicate that the wetland provides important habitat for an ecologically significant

proportion of the species, and that sections of the wetland adjacent to the Project Area are utilised by the species.

Survey results also indicate that the Caley Valley Wetland supports ecologically significant populations of the Caspian Tern, although use of the wetland adjacent to the Project Area appears to be limited (BAAM 2012). BMT WBM (2012) also reported more than 300 Little Terns feeding adjacent to the Open Pan Zone of the wetland (6 km west of the Project Area), and 50 Little Terns including nests on a sand spit in the wetland's Intertidal Zone. The wetland therefore has potential to support an ecologically significant proportion of the Little Tern population.

Table 5: Threatened flora and their likelihood of occurrence in the Study Area and Project Area

| Scientific Name | Common Name | EPBC Status | Likelihood | | Justification |
|--------------------------------|-----------------|-------------|--------------|------------|--|
| | | | Project Area | Study Area | |
| <i>Aristida granitica</i> | | Endangered | No | No | Occurs in sandy soil derived from granite sand in eucalypt woodland. Only known population is at the foothills of Mt Pring, 10km west of Bowen. |
| <i>Eucalyptus raveretiana</i> | Black Ironbox | Vulnerable | No | No | Black Ironbox has not been observed within the Abbot Point area, nor has any suitable habitat been recorded (Unidel 2011; GHD 2009; ELA 2014a). |
| <i>Omphalea celata</i> | | Vulnerable | No | No | Only known to occur in three locations, with the nearest being Gloucester Island, 30 km to the south-east. Occurs in SEVT in steep-sided granitic gullies & gorges. Habitat is not known to occur within the Study Area. |
| <i>Ozothamnus eriocephalus</i> | | Vulnerable | No | Unlikely | Margins of disturbed notophyll & microphyll vine forests & gallery forest, and open eucalypt forest (DoE 2015b). Not previously observed within the Abbot Point area (ELA 2014a). |
| <i>Streblus pendulinus</i> | Siah's Backbone | Endangered | No | No | Warm rainforests, chiefly along watercourses. No suitable habitat available in the Study Area and not previously observed within the Abbot Point area (ELA 2014a). |

Table 6: Threatened birds and their likelihood of occurrence in the Study Area and Project Area

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-------------------------------------|---|---|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Calidris ferruginea</i> | Curlew Sandpiper | Critically Endangered (not listed at time of referral determination), Migratory | No | Unlikely | Likely | Observed in the central southern area of the Caley Valley Wetlands. Suitable habitat is intertidal mudflats and non-tidal wetlands near the coast. Occurs adjacent to the DMCP. |
| <i>Erythrotriorchis radiatus</i> | Red Goshawk | Vulnerable | No | No | Unlikely | Sparsely distributed. Inhabits woodlands and forests. Nests in trees >20m tall in wooded and forested areas within 1 km of permanent water. Highly fragmented, but potentially suitable habitat occurs in remnant woodlands (RE11.2.5) within 300 m west of the Project Area (ELA, unpublished data). |
| <i>Fregetta grallaria grallaria</i> | White-bellied Storm-petrel (Tasman Sea/ Australasian) | Vulnerable | No | No | No | Marine. Forages over near-shore waters off the Queensland coast. Unlikely to cross the coast. |
| <i>Geophaps scripta scripta</i> | Squatter Pigeon | Vulnerable | Likely | No | Likely | Observed around the Caley Valley Wetlands, including within 200 m of the Project Area. Suitable habitat comprises grasslands with bare patches which occur across the Project Area and Study Area. |
| <i>Neochmia ruficauda ruficauda</i> | Star Finch (eastern/ southern) | Endangered | No | No | Unlikely | Tall grass and reed beds associated with swamps and watercourses. No confirmed sightings of this sub-species have been made since 1995 despite systematic searches. Not recorded previously from the Study Area or surrounds. Suitable habitat occurs adjacent to the Project Area. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|--------------------------------------|--------------------------|---|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Numenius madagascariensis</i> | Eastern Curlew | Critically Endangered (not listed at time of referral determination), Migratory | No | Likely | Known | Occurs in the central and western sections of the Caley Valley Wetland, including (estuarine environments) 3-4 km from the Project Area. Roosts in the intertidal areas of Dingo Beach (WBM 2006), which is within 500 m of the Project Area. Suitable habitat comprises mudflats and ocean beaches which occur in western and central sections of the wetland, at Dingo Beach, and in the Pipeline foreshore area (ELA 2014e). |
| <i>Poephila cincta cincta</i> | Black-throated Finch | Endangered | No | No | Unlikely | Recorded from Splitters Creek to the south-west of the Study Area (Lewis 2009). Inhabits areas with suitable grasses and hollow bearing trees within 0.5 km of freshwater wetlands and drainages. Not recorded within the Study Area during multiple bird surveys over different years and seasons (e.g. Austecology 2011). |
| <i>Rostratula australis</i> | Australian Painted Snipe | Endangered, Migratory | No | No | Known | Known from the marsh areas of the eastern Caley Valley Wetlands (BAAM 2012). This includes the area immediately adjacent to the south-west edge of the Project Area. Suitable habitat comprises wetland fringes with emergent vegetation which occurs adjacent to the DMCP. |
| <i>Tyto novaehollandiae kimberli</i> | Masked Owl (northern) | Vulnerable | No | No | Unlikely | Not recorded south of Townsville. Suitable habitat comprises woodland near open grassland which occurs within 300 m west of the Project Area. |

Table 7: Threatened mammals and their likelihood of occurrence in the Study Area and Project Area

| Scientific Name | Common Name | EPBC Status | Likelihood | | Justification |
|--|-----------------------------------|-----------------------|--------------|------------|--|
| | | | Project Area | Study Area | |
| <i>Dasyurus hallucatus</i> | Northern Quoll | Endangered | No | Unlikely | Non-rocky beach scrub in central Queensland. Habitat occurs within 300 m to the north and northwest of the Project Area, although no evidence of activity during field surveys (State of Queensland 2015). |
| <i>Onychogalea fraenata</i> | Bridled Nailtail Wallaby | Endangered | No | No | Known from Whitsunday Region. Only known wild population is in acacia scrubland in Taunton National Park and adjacent freehold land. No suitable habitat. |
| <i>Petrogale persephone</i> | Proserpine Rock-Wallaby | Endangered | No | No | Known from Whitsunday Region. Nearest population is Gloucester Island. Rocky areas, and gullies in vine thickets. No suitable habitat. |
| <i>Phascolarctos cinereus</i> | Koala | Vulnerable | No | Unlikely | Errant Wildlife Online record (from on a coal train) within 100 m of the south-eastern section of the Project Area. No evidence of activity in the Study Area or greater Caley Valley Wetlands. No suitable habitat in the Project Area. |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying Fox | Vulnerable | No | No | Only historical camps occur north of Rockhampton. Not detected during multiple fauna surveys across Abbot Point and the Caley Valley Wetlands (BAAM 2012, BMT WBM 2012, ELA 2014a) |
| <i>Rhinolophus philippinensis</i> | Greater Large-eared Horseshoe Bat | Endangered | No | No | Occurs north of Townsville. Southern limit of the distribution yet to be clarified. No suitable roosting habitat comprising caves, mines, culverts occur within the Project Area and surrounds. |
| <i>Saccolaimus saccolaimus nudicluniatus</i> | Bare-rumped Sheath-tailed Bat | Critically Endangered | Unlikely | Unlikely | Coastal lowlands. Woodland, forest, & open environments. Roosts in long, wide hollows in eucalypts. Suitable roosting habitat occurs in the woodlands within 300 m west of the Project Area. Echolocation signature can be confused with three other species, none of which were detected during micro-bat auditory surveys in the Study Area (ELA 2014d). |

| Scientific Name | Common Name | EPBC Status | Likelihood | | Justification |
|------------------------|------------------------------|-------------|--------------|------------|--|
| | | | Project Area | Study Area | |
| <i>Xeromys myoides</i> | Water Mouse, False Water Rat | Vulnerable | No | Unlikely | Generally occurs further south. Suitable habitat comprises mangroves and permanent, densely vegetated freshwater swamps which occur adjacent to the Project Area. Recent surveys in suitable habitat did not find evidence of the Water Mouse (ELA 2014a). |

Table 8: Threatened reptiles and their likelihood of occurrence in the Study Area

| Scientific Name | Common Name | EPBC Status | Likelihood | | Justification |
|---------------------------|------------------|-------------|--------------|------------|---|
| | | | Project Area | Study Area | |
| <i>Denisonia maculata</i> | Ornamental Snake | Vulnerable | No | No | Suitable habitat comprises cracking clay soils which do not occur within the Study Area. |
| <i>Egernia rugosa</i> | Yakka Skink | Vulnerable | Unlikely | Unlikely | Suitable habitat potentially occurs within the Study Area although the species is more commonly found inland of the coast (Ferguson & Mathieson 2014). Diurnal reptile surveys in the Abbot Point region have not detected the species (e.g. CDM Smith 2013). |

Table 9: Migratory Shorebird species and their likelihood of occurrence in the Study Area, DMCP and Pipeline alignment

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|---------------------------|------------------------|-------------|------------|----------|------------|--|
| | | | DMCP | Pipeline | Study Area | |
| <i>Actitis hypoleucos</i> | Common Sandpiper | Migratory | No | Unlikely | Likely | Previously recorded in the western sections of the Caley Valley Wetlands (GHD 2010). Suitable foraging habitat comprises shallow water on bare soft mud at the edges of wetlands, which occur adjacent to the DMCP. |
| <i>Arenaria interpres</i> | Ruddy Turnstone | Migratory | No | Unlikely | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprises rocky shores or beaches and wide mudflats, which occurs within 200 m of the DMCP, at Dingo Beach, and along the foreshore component of the pipeline alignment. |
| <i>Calidris acuminata</i> | Sharp-tailed Sandpiper | Migratory | No | No | Known | Occurs across the Caley Valley Wetlands in moderate to high densities, including adjacent to the DMCP. Suitable habitat comprises muddy edges of wetlands with emergent vegetation, which occur adjacent to the DMCP. |
| <i>Calidris alba</i> | Sanderling | Migratory | No | Unlikely | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising open sandy beaches occurs within 500 m of the DMCP (at Dingo Beach), and at the Pipeline foreshore area (ELA 2014e). |
| <i>Calidris canutus</i> | Red Knot | Migratory | No | Unlikely | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising intertidal zone on sandy beaches occurs within 500 m of the DMCP (at Dingo Beach), and at the Pipeline foreshore area (ELA 2014e). |
| <i>Calidris melanotos</i> | Pectoral Sandpiper | Migratory | No | No | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising coastal wetlands occurs adjacent to the DMCP. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|---------------------------------|----------------------|-------------|------------|-----------|------------|--|
| | | | DMCP | Pipeline | Study Area | |
| <i>Calidris ruficollis</i> | Red-necked Stint | Migratory | No | Known | Known | Recorded mostly in the Open Pan section of the wetland, with a single record adjacent to the DMCP. Also observed on the Eastern Beach in relatively low numbers. Suitable habitat comprises coastal wetlands and ocean beaches, which occurs adjacent to the DMCP, on Dingo Beach, and in the Pipeline foreshore area. |
| <i>Calidris tenuirostris</i> | Great Knot | Migratory | No | No | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising mudflats and sandflats occurs adjacent to the DMCP. |
| <i>Charadrius leschenaultii</i> | Greater Sandplover | Migratory | No | No | Likely | Recorded from the southwest of the Caley Valley Wetlands. Suitable habitat comprising sheltered beaches with large intertidal mudflats or sandbanks occurs within 500 m of the DMCP, at Dingo Beach. |
| <i>Charadrius bicinctus</i> | Double-banded Plover | Migratory | Unlikely | Unlikely | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising open grassy areas, fresh or saline wetlands and sandy beaches occurs in the DMCP, adjacent to the DMCP and at the Pipeline foreshore area (ELA 2014e), respectively. |
| <i>Charadrius mongolus</i> | Lesser Sand Plover | Migratory | No | Unlikely | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprising sandy open beaches occurs at the Pipeline foreshore area (ELA 2014e). |
| <i>Charadrius veredus</i> | Oriental Plover | Migratory | Potential | Potential | Potential | Recorded in the western sections of the Caley Valley Wetlands (GHD 2010). Suitable habitat comprising near-coastal grasslands, sandy beaches and wetlands occurs in and adjacent to the DMCP, and at the Pipeline foreshore area (ELA 2014e). Not recorded within 2 km of the Project Area despite multiple shorebird surveys. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-----------------------------|------------------------|-------------|------------|-----------|------------|--|
| | | | DMCP | Pipeline | Study Area | |
| <i>Gallinago hardwickii</i> | Latham's Snipe | Migratory | No | No | Known | Occurs across the marsh sections of the eastern Caley Valley Wetlands, including adjacent to the DMCP. Suitable habitat comprising ephemeral freshwater and brackish wetlands with vegetation occurs adjacent to the DMCP. |
| <i>Limicola falcinellus</i> | Broad-billed Sandpiper | Migratory | No | No | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. No suitable habitat of estuarine mudflats, saltmarshes, freshwater lagoons with sandbanks within 2 km of the Project Area. |
| <i>Limosa lapponica</i> | Bar-tailed Godwit | Migratory | Unlikely | Potential | Potential | Previously recorded from the southwest of the Caley Valley Wetlands. Primary habitat comprises tidal flats and saltmarshes, located within 2 km of the Project Area. Suboptimal habitat includes sandy beaches and areas of short grass, which occurs in and within 500 m of the DMCP and in the Pipeline foreshore area (ELA 2014e). Not recorded within 2 km of the Project Area despite multiple shorebird surveys. |
| <i>Limosa limosa</i> | Black-tailed Godwit | Migratory | No | No | Known | Occurs in the southern and eastern Caley Valley Wetlands, including adjacent to the DMCP. Suitable habitat comprises shallow, sparsely vegetated, near-coastal wetlands, which occurs adjacent to the DMCP. |
| <i>Numenius minutus</i> | Little Curlew | Migratory | Likely | No | Known | Recorded in the central Caley Valley Wetlands, within 500 m of the DMCP. Suitable habitat comprises short dry grassland, open woodlands with grassy understorey, and seasonally inundated floodplains, which occurs in and adjacent to the DMCP. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-----------------------------|-----------------------|-------------|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Numenius phaeopus</i> | Whimbrel | Migratory | No | Known | Known | Occurs predominately in the central and western sections of the Caley Valley Wetlands (estuarine environments). Also occurs in coastal areas of Abbot Point, including within 500 m of the DMCP (Dingo Beach), and on Eastern Beach, where the Pipeline is located. Suitable habitat comprises open unvegetated mudflats, sandy beaches, and saline grasslands which occurs in the Pipeline foreshore area (ELA 2014f), at Dingo Beach, and adjacent to the DMCP. |
| <i>Pluvialis fulva</i> | Pacific Golden Plover | Migratory | No | Known | Known | Recorded in high densities on Abbot Point Eastern Beach, where the Pipeline is located. Predominately coastal, but also recorded in the far southeast section of the Caley Valley Wetlands. Suitable habitat comprises beaches, mudflats, and fresh and brackish wetlands with muddy margins which occurs in the Pipeline foreshore area (ELA 2014f), at Dingo Beach, and adjacent to the DMCP. |
| <i>Pluvialis squatarola</i> | Grey Plover | Migratory | No | No | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Suitable habitat comprises near-coastal wetlands, which occur adjacent to the DMCP. |
| <i>Tringa brevipes</i> | Grey-tailed Tattler | Migratory | No | No | Potential | Previously recorded from the southwest of the Caley Valley Wetlands. No primary habitat of tidal mudflats within 2 km of the Project Area. Suboptimal habitat of coastal wetlands occur within 500 m of the DMCP. Not recorded within 2 km of the Project Area despite multiple shorebird surveys. |
| <i>Tringa glareola</i> | Wood Sandpiper | Migratory | No | No | Potential | Recorded within 5 km of Project Area (Wildlife Online Search), but not recorded during multiple bird surveys over multiple seasons. Suitable habitat comprises well-vegetated shallow freshwater wetlands and inundated grasslands which occur adjacent to the DMCP. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|---------------------------|-------------------|-------------|------------|----------|------------|--|
| | | | DMCP | Pipeline | Study Area | |
| <i>Tringa incana</i> | Wandering Tattler | Migratory | No | Known | Known | Restricted to the coastal habitats. Known from Abbot Point Eastern Beach and the far western coast of the Caley Valley Wetland area. Suitable habitat comprises beaches, mudflats, and fresh and brackish wetlands with muddy margins which occur in the Pipeline foreshore area (ELA 2014f) and within 500 m of the DMCP (at Dingo Beach). |
| <i>Tringa nebularia</i> | Common Greenshank | Migratory | No | No | Known | Occurs across the Caley Valley Wetlands, including adjacent to the DMCP. Suitable habitat comprising wetlands occurs adjacent to the DMCP. |
| <i>Tringa stagnatilis</i> | Marsh Sandpiper | Migratory | No | Unlikely | Known | Occurs across the Caley Valley Wetlands, including adjacent to the DMCP. Primary habitat of wetlands occurs adjacent to the DMCP. Suboptimal habitat comprising beaches occurs in the Pipeline foreshore area (ELA 2014e) and at Dingo Beach within 500 m of the DMCP. Not recorded using beach areas at Abbot Point despite multiple shorebird surveys. |
| <i>Xenus cinereus</i> | Terek Sandpiper | Migratory | No | No | Unlikely | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple shorebird surveys. Primary habitat comprises intertidal mudflats which do not occur within 2 km of the Project Area. Suboptimal habitat comprises samphire which occurs adjacent to the DMCP. |

Table 10: Other Migratory species and their likelihood of occurrence in the Study Area

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-------------------------------|--------------------------------|-------------|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Anous stolidus</i> | Common Noddy | Migratory | No | No | No | Known from the Whitsundays Region. Not recorded at Abbot Point despite multiple fauna surveys. Primary habitat comprises open ocean and oceanic islands which do not occur in the Study Area. |
| <i>Apus pacificus</i> | Fork-tailed Swift | Migratory | Likely | No | Likely | Recorded within 5 km of the Project Area (Wildlife Online Search). Predominately aerial. Suitable habitat comprises coastal areas with dry and open habitat, including foothills which occur in and adjacent to the DMCP. |
| <i>Ardea ibis</i> | Cattle Egret | Migratory | Likely | No | Known | Recorded in the north and the south of the Caley Valley Wetlands, including adjacent to the DMCP, and in grasslands adjacent to the south of the wetlands (GHD 2010). Suitable habitat comprises wooded areas, terrestrial wetlands, low-lying grasslands which occur in and adjacent to the Project Area. |
| <i>Ardea modesta</i> | Eastern Great Egret | Migratory | No | No | Known | Abundant across the Caley Valley Wetlands, including adjacent to the DMCP. Suitable habitat comprises wetlands which occur adjacent to the DMCP. |
| <i>Chlidonias leucopterus</i> | White-winged Tern | Migratory | Potential | No | Potential | Occurs in the central southern Caley Valley Wetlands, within 2 km of the DMCP. Suitable habitat comprises grasslands, wooded lands, wetlands which occur in and adjacent to the DMCP. Not recorded in or adjacent to the Project Area despite shorebird and other fauna surveys over multiple years and seasons. |
| <i>Crocodylus porosus</i> | Saltwater/ Estuarine Crocodile | Migratory | No | No | Unlikely | No recorded sightings within the Abbot Point region. Possible slides were observed in Saltwater Creek, which drain into the southeast of the Caley Valley Wetlands (BMT WBM 2012). There is some historical evidence of a Saltwater Crocodile on the downstream section of Goodbye Creek, which is near Saltwater Creek (PB 2010). Suitable habitat includes coastal wetlands which occur adjacent to the DMCP. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-------------------------------|---------------------------|-------------|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Egretta sacra</i> | Eastern Reef Egret | Migratory | No | Likely | Known | Recorded in the northern coastal areas of the Caley Valley Wetlands, including within 500 m of the DMCP. Suitable habitat comprises beaches which occur in the Pipeline foreshore area (ELA 2014e) and at Dingo Beach within 500 m of the DMCP. |
| <i>Haliaeetus leucogaster</i> | White-bellied Sea Eagle | Migratory | Known | Likely | Known | Recorded across the Caley Valley Wetlands and coastal areas of Abbot Point. Suitable habitat comprises large areas of open water in coastal habitats and wetlands, coastal dunes which occur adjacent to the DMCP and in the Pipeline foreshore area (ELA 2014e). Suitable nesting habitat comprises tall open forest or woodlands close to water which occur within 200 m of the DMCP. |
| <i>Hirundapus caudacutus</i> | White-throated Needletail | Migratory | Unlikely | No | Unlikely | Known from the Whitsundays Region. Not recorded in the Study Area despite multiple fauna surveys. Predominately aerial species. Suitable habitat comprises wooded areas which occur in and adjacent to the DMCP. |
| <i>Hirundo rustica</i> | Barn Swallow | Migratory | Unlikely | No | Unlikely | Known from the Whitsundays Region. Not previously recorded in the Study Area despite multiple fauna surveys. Suitable habitat comprises freshwater wetlands, coastal lowlands, <i>Melaleuca</i> woodland, mesophyll shrub thickets and tussock grassland which occur adjacent to the DMCP. |
| <i>Hydroprogne caspia</i> | Caspian Tern | Migratory | No | Known | Known | Occurs across the Caley Valley Wetlands and coastal areas, including adjacent to the DMCP and Eastern Beach, where the Pipeline is located. Suitable habitat comprises near-coastal wetlands and shores which occur adjacent to the DMCP and in the Pipeline foreshore area (ELA 2014f). |
| <i>Merops ornatus</i> | Rainbow Bee-eater | Migratory | Known | Known | Known | Observed across the Abbot Point area, including in and adjacent to the DMCP and the temporary Pipeline area. Suitable habitat comprises open forests and woodlands, and cleared or semi-cleared habitats which occur in and adjacent to the DMCP, and adjacent to the Pipeline foreshore area. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-------------------------------|---------------------|-------------|------------|----------|------------|---|
| | | | DMCP | Pipeline | Study Area | |
| <i>Monarcha melanopsis</i> | Black-faced Monarch | Migratory | No | No | Likely | Recorded in the Abbot Point area by Ecoserve (2007). Suitable habitat comprises SEVT and coastal foothills which occur within 500 m of DMCP, and adjacent to the Pipeline foreshore area. |
| <i>Monarcha trivirgatus</i> | Spectacled Monarch | Migratory | No | No | No | Known from the Whitsundays Region. Not previously recorded in the Study Area despite multiple fauna surveys. No suitable habitat of wet gullies, rainforests, and mangroves occurs in the Study Area. |
| <i>Myiagra cyanoleuca</i> | Satin Flycatcher | Migratory | No | No | Likely | Recorded in the Abbot Point area by Ecoserve (2007). Suitable habitat – eucalypt forests near wetlands – occurs within 200 m of the DMCP. |
| <i>Onychoprion anaethetus</i> | Bridled Tern | Migratory | No | No | No | Known from the Whitsundays Region. Not previously recorded in the Study Area. Suitable habitat of open ocean does not occur in the Study Area. |
| <i>Pandion cristatus</i> | Eastern Osprey | Migratory | Likely | Known | Known | Regularly recorded in the north of Abbot Point, including the Caley Valley Wetlands, and coastal areas, including the Pipeline foreshore area. Suitable habitat comprising large areas of open water in coastal habitats and wetlands, beaches occurs adjacent to the DMCP and in the Pipeline foreshore area (ELA 2014e). Suitable nesting habitat comprises dead or partly dead trees and artificial structures which occur within 200 m of the DMCP. |
| <i>Plegadis falcinellus</i> | Glossy Ibis | Migratory | No | No | Known | Occurs across the Caley Valley Wetlands, including adjacent to the DMCP. Suitable habitat comprising wetlands and coastal areas occurs adjacent to the DMCP. |
| <i>Rhipidura rufifrons</i> | Rufous Fantail | Migratory | Likely | No | Likely | Recorded in remnant woodlands west of Dingo Beach. Suitable habitat of SEVT, <i>Melaleuca</i> thickets, regrowth forests occurs in and adjacent to the DMCP. |

| Scientific Name | Common Name | EPBC Status | Likelihood | | | Justification |
|-------------------------------|---------------------|-------------|------------|-----------|------------|--|
| | | | DMCP | Pipeline | Study Area | |
| <i>Sterna dougallii</i> | Roseate Tern | Migratory | No | Unlikely | Unlikely | Known from the Whitsundays Region. Not previously recorded in the Study Area despite multiple shorebird surveys. Rarely recorded in inshore waters or near the mainland. Suitable habitat of sandy beaches occurs within 500 m of the DMCP at Dingo Beach, and in the Pipeline foreshore area (ELA 2014e). |
| <i>Sterna hirundo</i> | Common Tern | Migratory | No | Unlikely | Known | Observed feeding on inshore waters around Abbot Point (WBM 2006). Not recorded again despite multiple shorebird surveys. Suitable habitat comprising ocean beaches and near-coastal wetlands occurs adjacent to the DMCP and in the Pipeline foreshore area (ELA 2014e). |
| <i>Sterna sumatrana</i> | Black-naped Tern | Migratory | No | No | No | Known from the Whitsundays Region. Not previously recorded in the Study Area despite multiple shorebird surveys. No suitable habitat of offshore sand and coral cays, reefs, islands occurs in the Study Area. |
| <i>Sternula albifrons</i> | Little Tern | Migratory | Potential | Likely | Known | Occurs across the Caley Valley Wetlands and Abbot Point coastal areas, including adjacent to the DMCP and Eastern Beach, where the Pipeline is located. Congregates in large numbers in the far west, southwest, and south of the wetlands. Nests on the coastal area in the far west of the wetlands. Suitable habitat comprises beaches and spits on lakes which occur in the Pipeline foreshore area (ELA 2014f), and adjacent to the DMCP. |
| <i>Sula dactylatra</i> | Masked Booby | Migratory | No | No | Unlikely | Recorded within 5 km of Project Area (Wildlife Online Search). No suitable habitat of open ocean occurs in the Study Area. |
| <i>Thalasseus bengalensis</i> | Lesser Crested Tern | Migratory | No | Potential | Potential | Recorded in the coastal area in the far west of the Caley Valley Wetlands. Suitable habitat comprising sandy coasts occurs within 500 m of the DMCP at Dingo Beach, and in the Pipeline foreshore area (ELA 2014e). |

4.7 Synthesis of existing environmental values

In summary, the Project Area is highly disturbed and consists primarily of non-remnant vegetation, with some patches of regrowth and very small patches of remnant *Corymbia-Melaleuca* woodland (DMCPs). There is no clearing of threatened flora or TECs proposed as part of the Project. The pipeline alignment from the DMCP to the Coral Sea is located approximately 50 m from a patch of SEVT TEC, which will not be directly disturbed.

The Squatter Pigeon is the only threatened species likely to utilise habitats within the Project Area. Several threatened and migratory species are known to occur adjacent to the Project Area and are relevant MNES for the assessment of off-site and indirect impacts of the Project. These values are mostly associated with the Caley Valley Wetland and adjacent coastal foreshores, which provide important feeding and roosting habitat for several migratory birds. The Critically Endangered Eastern Curlew and Curlew Sandpiper (not listed at time of referral determination), and Endangered Australian Painted Snipe also utilise these habitats.

5 Potential impacts of the proposed action

5.1 Description of the action

The key elements of the Project that are subject to this terrestrial ecology assessment are:

- Construction of onshore DMCPs comprised of earth embankments on the existing ground profile using on-site cut and fill operations and suitable materials from onshore sources (quarries)
- Installation and removal of temporary pipelines for the purpose of transporting dredged material to the DMCPs and facilitating the offshore discharge of return water
- Ongoing management of the dredged material including its removal, treatment and beneficial reuse within the port area and the State Development Area, where appropriate.

The Project Area comprising the DMCPs and pipeline alignment covers approximately 148 ha, 75 ha of which will be subject to direct disturbance associated with construction works. Of the remaining area to the south, most will remain undisturbed, except for the establishment of a small temporary construction office site. Habitats surrounding the Project Area may be indirectly impacted by Project activities, with the spatial extent of indirect impacts likely to vary according to the habitat requirements and ecology of MNES.

5.2 Results of Risk Assessment

A summary of the risk assessment findings is presented in Table 11. Prior to the consideration of mitigation measures, the risk of impacts on MNES from various Project phases ranged from Low to High. The highest risks were generally associated with the off-site impacts of dust and noise, and the direct impacts of vehicle strike. However, following reassessment of risks taking into account Project mitigation measures, all risks were assessed to be Low. A detailed description of potential Project impacts is provided in Section 5.4, with assessment of impacts on MNES in Section 7 to Section 10.

Table 11 Summary of risk assessment findings (risk register)

| Project Activity | Risk | Initial Risk | Mitigation Measure | Residual Risk | MNES Relevance | | | | |
|---|---|--------------|---|---------------|---|-------------------|---|--------------------------------|---------------------------|
| | | | | | Threatened species and ecological communities | Migratory species | GBR World Heritage Property / National Heritage Place | Great Barrier Reef Marine Park | Commonwealth marine areas |
| Construction of containment pond | | | | | | | | | |
| Footprint clearing and topsoil stripping | Removal of threatened plants, TECs and habitat for threatened fauna | High | Map MNES and design Project footprint to avoid and/or minimise impacts. | Low | x | x | x | | |
| Footprint clearing and topsoil stripping | Dust affecting plants and fauna | High | Wet down stockpiles and roads, model dust impacts to inform management actions, set back Project Area from wetland edge | Low | x | x | x | | |
| Footprint clearing and topsoil stripping | Noise disturbing fauna including shorebirds in wetland | Moderate | Modelling of noise impacts to inform management actions, set back Project Area from wetland edge | Low | x | x | x | | |
| Footprint clearing and topsoil stripping | Human activity disturbing fauna including shorebirds in wetland | Moderate | Set back Project Area from wetland edge and restrict access to this zone during works | Low | x | x | x | | |
| Earthworks including embankment preparation | Dust affecting plants and fauna | High | Wet down stockpiles and roads, model dust impacts to inform management actions, set back Project Area from wetland edge | Low | x | x | x | | |
| Earthworks including | Noise disturbing fauna including | High | Modelling of noise impacts to inform management actions, set back Project Area | Low | x | x | x | | |

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| Project Activity | Risk | Initial Risk | Mitigation Measure | Residual Risk | MNES Relevance | | | | |
|---|---|--------------|---|---------------|---|-------------------|---|--------------------------------|---------------------------|
| | | | | | Threatened species and ecological communities | Migratory species | GBR World Heritage Property / National Heritage Place | Great Barrier Reef Marine Park | Commonwealth marine areas |
| embankment preparation | shorebirds in wetland | | from wetland edge | | | | | | |
| Earthworks including embankment preparation | Human activity disturbing fauna including shorebirds in wetland | Moderate | Set back Project Area from wetland edge and restrict access to this zone during works | Low | x | x | x | | |
| Earthworks including embankment preparation | Disturbance of Acid Sulphate Soils (ASS) | Moderate | Conduct soil testing and implement ASS Management Plan | | x | x | x | | |
| Traffic movements | Vehicle strike on fauna or traffic-related disturbance | High | Use of designated routes and speed limits | Low | x | x | x | | |
| Night work | Disturbance of fauna or wetland habitat from light spill | Moderate | Use of directional lighting, set back Project Area from wetland edge | Low | x | x | x | | |
| Dredging pipeline assembly/installation | | | | | | | | | |
| Pipeline assembly | Indirect effects on SEVT TEC | Low | Weed and pest control, fire mitigation strategies, mark off areas to be cleared | Low | x | x | x | | |
| Footprint clearing and topsoil stripping | Disturbance of fauna and indirect impacts from clearing | Low | Selection of alignment that is already mostly cleared, mark off areas to be cleared, pre-clearance survey | Low | x | x | x | | |
| Onshore dredged material management during dredging | | | | | | | | | |

| Project Activity | Risk | Initial Risk | Mitigation Measure | Residual Risk | MNES Relevance | | | | |
|--|---|--------------|---|---------------|---|-------------------|---|--------------------------------|---------------------------|
| | | | | | Threatened species and ecological communities | Migratory species | GBR World Heritage Property / National Heritage Place | Great Barrier Reef Marine Park | Commonwealth marine areas |
| Night work | Disturbance of fauna or wetland habitat from night spill | Moderate | Use of directional lighting, set back Project Area from wetland edge | Low | x | x | x | | |
| Traffic movements | Vehicle strike on fauna or traffic-related disturbance | Moderate | Use of designated routes and speed limits | Low | x | x | x | | |
| Onshore dredged material management after the completion of dredging | | | | | | | | | |
| Traffic movements | Vehicle strike on fauna or traffic-related disturbance | Moderate | Use of designated routes and speed limits | Low | x | x | x | | |
| Presence of pond embankments | Modifications of surface water and groundwater flows | Moderate | Application of modelling to inform Project design and management plans | Low | x | x | x | | |
| Embankment failure | Spill of dredged material onto adjacent ecological values | Moderate | Use of accepted engineering design principles and on site project management of construction works | | x | x | x | | |
| Establishment of the final landform | | | | | | | | | |
| Earthworks | Dust affecting plants and fauna | High | Wet down stockpiles and roads, model dust impacts to inform management actions, set back Project Area from wetland edge | Low | x | x | x | | |

| Project Activity | Risk | Initial Risk | Mitigation Measure | Residual Risk | MNES Relevance | | | | |
|-------------------|---|--------------|--|---------------|---|-------------------|---|--------------------------------|---------------------------|
| | | | | | Threatened species and ecological communities | Migratory species | GBR World Heritage Property / National Heritage Place | Great Barrier Reef Marine Park | Commonwealth marine areas |
| Earthworks | Noise disturbing fauna including shorebirds in wetland | Moderate | Modelling of noise impacts to inform management actions, set back Project Area from wetland edge | Low | x | x | x | | |
| Earthworks | Human activity disturbing fauna including shorebirds in wetland | Moderate | Set back Project Area from wetland edge and restrict access to this zone during works | Low | x | x | x | | |
| Traffic movements | Vehicle strike on fauna or traffic-related disturbance | Moderate | Use of designated routes and speed limits | Low | x | x | x | | |

5.3 Potential impacts of the proposed action

If left unmanaged, the proposed action has the potential to result in impacts on ecologically sensitive features including MNES during construction and operations. Potential impacts associated with each phase of the Project are described in the following sections. Further discussion of mitigation measures that will be implemented to minimise impacts of the Project is included in Section 6, and further discussion of impacts on specific MNES is provided in Sections 7 to 10.

Impacts resulting from the proposed Project have been broadly grouped into the following categories:

- Direct impacts of construction activities within the Project Area
- Off-site and indirect impacts of construction activities and operations adjacent to the Project Area
- Ongoing human presence
- Periodic and short-term operational use (works within the DMCPs to support transfer or beneficial re-use of dredged material once dried and restoration of final landform).

Overall, the analysis has concluded that the majority of impacts resulting from the Project will be associated with the construction of the DMCP and associated earthworks. Placement of dredged material into the beneficial reuse area will be a short-term activity, occurring over a few months.

Any impacts associated with the placement of dredged material will have been preceded by construction of the DMCP (i.e. vegetation clearing will have occurred prior to the dredging being undertaken). Therefore, it is considered that impacts on terrestrial MNES from the dredging aspects of the Project will be negligible, in comparison with the construction and establishment actions of the DMCP.

Accordingly, the following sections are focused on the construction of the DMCP and temporary pipelines, which have the potential to impact MNES. Potential impacts are primarily limited to:

- Generation of dust and PASS from the dredged material after drying
- Noise during the construction of pond embankments and associated earthworks
- Disturbance from lighting of the development area at night, to support 24 hour construction activities
- Abnormal events from the risk of embankment failure or seepage into the wetland and/or groundwater.

These matters have been addressed in the following sections and a suite of appropriate management and mitigation measures have been considered as part of the relevant technical reports assessing these matters.

5.4 Construction phase impacts

If not appropriately mitigated, the construction phase of the Project is likely to result in impacts on ecologically sensitive features of the environment, primarily through vegetation clearance and works associated with the establishment of the proposed DMCPs and temporary pipelines. Construction activities with potential for significant impacts on MNES include:

- Vegetation clearance
- Fragmentation and edge effects
- Excavation
- Placement of fill

- Vehicle movements
- Dust emissions
- Light emissions
- Construction noise
- Alterations to surface water hydrology and quality
- Alterations to ground water hydrology and quality
- Waste disposal
- Increased human presence and activity

5.4.1 Vegetation clearing

Clearing vegetation to establish the DMCPs and temporary pipeline alignment will reduce vegetative cover and result in the loss of some habitat for fauna dependent on those ecosystems (i.e., cause direct impacts). Table 12 indicates the proposed extent of clearance of each vegetation community in the development footprint. For the purposes of the current assessment, it is assumed that all vegetation within the footprint will be removed.

Table 12. Areal extent of clearing of vegetation communities in the Project Area, from ELA and RE habitat mapping

| Habitat Type | Associated Regional Ecosystems (RE) | Disturbed by DMCP (ha) | Pipeline Alignment (ha) | Total Area Disturbed (ha) |
|---------------------|-------------------------------------|------------------------|-------------------------|---------------------------|
| Grass, weeds, other | Non-Remnant | 50.57 | 0 ¹ | 50.57 |
| Woodland | Regrowth 11.2.5 | 23.14 | 0 | 23.14 |
| Woodland | 11.2.5 | 0.86 | 0 | 0.86 |
| Foredune | 11.2.2 | 0 | 0.01 | 0.01 |

¹ The pipeline alignment includes a variety of land forms, including car parks, laydown areas, settlement ponds and roads. Some of these may comprise non-remnant vegetation in small patches.

A reduction in vegetation cover can reduce the available shelter, nesting, breeding and foraging habitat for MNES fauna (threatened and migratory species). Although there are no threatened flora species known or likely to occur in the Project Area, a number of threatened and migratory bird species are known, likely or can potentially occur (Section 4). Fauna species with narrow habitat preferences may be impacted more than others and may be subject to adverse impacts such as increased competition for limited resources which can result in a reduction in local populations.

No direct clearing of TECs is expected for construction of the DMCPs or the temporary pipeline alignment. One area adjacent to the pipeline alignment supports a patch of SEVT TEC, which is listed as Endangered under the EPBC Act. The narrow range of this TEC makes it vulnerable to local extinction through direct removal and adverse edge effects (e.g. competition from weeds). However, the pipeline alignment is 50 m from the SEVT TEC and will be confined to areas that are already cleared.

5.4.2 Fragmentation and edge effects

There is a relatively low potential for fragmentation of landscape habitat features, due to the location of the Project Area adjacent to an existing industrialised section of the Port of Abbot Point. However, the

relevance, extent and severity of impacts from fragmentation (e.g. weeds, fire, increased exposure to wind and barriers to movement of fauna) need to be considered for each species or community. Most of the threatened and migratory species are birds for which the presence of the DMCP and temporary pipeline alignment are unlikely to comprise a significant barrier to movement.

Edge effects associated with clearing vegetation and site disturbance are important at Abbot Point due to the prevalence of several exotic weed and feral animal species that might be introduced into new areas or increase in extent (e.g. Lantana, *Parkinsonia*, rabbits, pigs, rats and cane toads). In addition, the risk of ignition and spread of fire is increased through the use of machinery and equipment that generate sparks, use of flammable chemicals and changes to the structure or composition of vegetation.

5.4.3 Excavation

The Project design identifies the use of excavation only in relation to establishing the dredged material ponds, and proposes that excavation depth will be to a level of 3.0 m RL. Existing levels on site range from 2.5 m to 5.5 m RL. The pond capacity for the storage of dredged material will be achieved through construction of embankments (to a height of 9 m RL), i.e. ponds will be largely above-ground rather than excavated into the ground. The most serious potential adverse impacts from excavation include:

- Disturbance of ASS or PASS soils, resulting in acid generation which then can indirectly impact MNES species and communities through degradation and loss of vegetation and important habitats
- Entrapment of fauna in open trenches or ponds containing dredged material, resulting in injury or death.

5.4.4 Placement of fill

Establishment of the DMCP will involve a substantial amount of placement of fill. Direct impacts include:

- Direct smothering of vegetation comprising important habitat for MNES fauna species, resulting in degradation or loss
- Direct smothering and destruction of nests and/or unfledged young of MNES bird species (resulting in injury or death).

Off-site impacts include smothering of vegetation, habitats or nests from sediments lost from the embankment walls if they are not adequately stabilised (e.g. with vegetation or geotextile), particularly during the wet season but also during any extended period of strong winds.

5.4.5 Vehicle movements

During construction, a large number of vehicles and heavy plant will enter, traverse and exit the Project Area, to clear vegetation, construct the DMCPs, construct embankments and complete other activities. Potential direct impacts from vehicle and plant movements on MNES species and communities include:

- Damage or destruction of vegetation or fauna habitat by traversing these areas
- Fauna strike
- Interference/perturbation of MNES fauna through noise generated by machinery, affecting feeding, roosting, breeding or nesting behaviour.
- Damage or destruction of SEVT vegetation and fauna habitat through smothering from dust generated by vehicles traversing the Project area.

Potential indirect impacts include introducing and/or spreading weeds or feral animals carried on or in vehicles, resulting in deterioration or loss of SEVT vegetation and important fauna habitat.

5.4.6 Dust emissions

Project activities have the potential to generate dust emissions, most of which will be temporary during construction. The main sources of dust will be:

- Dust lift-off from exposed surfaces such as stockpiles and other exposed areas
- Construction of the embankments, including moving, dumping and shaping material
- Vegetation and soil clearing of the land
- Wheel-generated dust from the haul roads created for the construction phase.

Excessive deposition of dust on leaves of plants can suppress growth and photosynthesis and result in reduced habitat quality for fauna. High levels of airborne dust particles can irritate the respiratory systems of fauna and potentially result in ingestion of dust-coated seeds and other foods.

Excessive deposition of dust on open water bodies may also degrade water quality, and overall habitat quality for fauna. Wetland habitats surrounding the Project Area may be particularly vulnerable. High levels of dust settling in permanent or ephemeral waterways or picked up in tidal or stormwater run-off may flow through to the shore and reduce near-shore water quality of the GBRWHA.

During construction, dust lift-off from exposed surfaces is more likely to occur after periods of hot, dry weather, particularly under strong winds. The placement and drying of dredged material within the DMCPs is not expected to be a factor in the generation of dust, due to the moisture within sediments and the formation of a crust on the surface layers of dredged material.

Sensitive receptors surrounding the Project Area will potentially be affected by dust emissions from construction if relevant air quality objectives are exceeded. Katestone Environmental (2015) noted that effects on plants from dust deposition may occur where the maximum monthly rate of deposition exceeds 200mg/m²/day for a 120 day rolling average.

There is limited information available on the potential for dust to irritate the respiratory systems of fauna, and there are no guidelines for the avoidance of impacts on fauna. In lieu of such guidelines, human health guidelines provide some reference criteria which are likely to be conservative for the purposes of environmental assessment. These criteria are:

- TSP – 90 µg/m over an annual averaging period.
- PM₁₀ – 50 µg/m over a 24 hour averaging period.
- PM_{2.5} – 8 µg/m over an annual averaging period and 25 µg/m a 24 hour averaging period

Katestone (2015) undertook dispersion modelling to predict dust concentrations and deposition rates generated by Project construction activities (with and without existing background dust) in the Freshwater and Estuarine sections of the Caley Valley Wetland. The modelling assumed the application of standard dust management practices such as the wetting of soil stockpiles and haul roads.

Maximum dust deposition levels were predicted to be below the vegetation criterion of 200 mg/m²/day (Katestone 2015). Impacts of dust deposition on vegetation including TECs and wetland flora supporting MNES are therefore not anticipated as a result of construction works.

Results of the dispersion modelling in relation to dust concentrations and human health criteria were varied. The PM_{2.5} criteria were not exceeded for 24 hour or annual exposure. This is a positive result, as PM_{2.5} is known to cause greater respiratory problems than the other criteria modelled. Likewise, the TSP result was below the relevant human health criterion of 90 µg/m. However, the modelled PM₁₀

result was predicted to exceed the human health criterion of 50 µg/m for a distance of approximately 600 m into the wetland.

There is a moderate to high degree of uncertainty in assessing the significance of the predicted exceedance of PM₁₀ dust emissions from the Project. The criteria used in the modelling are considered to be conservative when applied to human health and can also therefore be assumed to be conservative for the purposes of assessing impacts on the environment (ELA and Open Lines 2012). However, localised emissions of dust may have the potential to affect fauna utilising the eastern fringe of the wetland during the period of construction works.

Further assessment of the impacts of dust generated by the Project on migratory shorebirds is provided in Section 8.4.3.

5.4.7 Light emissions

Artificial light can affect both nocturnal and diurnal animals by disrupting natural behaviour, with quality of light (e.g. wavelength, colour), intensity and duration of exposure potentially evoking different responses. Impacts from increased light levels include disorientation from or attraction toward artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also influence the abundance and behaviour of predators.

The presence and intensity of artificial light within the Project Area will temporarily increase during the construction phase and vary according to the type of work being undertaken. Construction of the pond embankments will occur for at least 12 hours a day, seven days a week, and may be extended to 24 hours a day, seven days a week, if required to achieve Project schedules. The placement of dredged material will occur at night as part of a 24 hour work cycle. The disturbance footprint and surrounding areas will therefore be subject to artificial lighting for a period of several months during construction phases of the Project. Some ongoing lighting may also be required to support long-term management of the dredged material.

Lighting will be provided by mobile light towers which provide directional lighting from a mast extending a maximum of approximately 10 m in height. Light towers will generally comprise either four or six directional metal halide (or equivalent) lights ranging from 1,500 to 12,000 watts. Lights are adjustable and will be directed towards the area of construction activities to provide approximately 100 lux of illumination.

Some spillage of light to adjacent areas will be inevitable, with the area affected determined by the height, intensity and orientation of lights used. Manufacturers specifications indicate that for lights oriented directly at the ground from above, ambient light levels are expected to be similar to background levels at a distance of approximately 60 m from the source. For lights that are oriented towards construction activities (away from the wetland), the distance over which light spill is anticipated will be significantly reduced.

In this context, any effects from artificial lighting are most likely to be contained primarily within the buffer area between the pond embankments and the wetland, which is a minimum of 50 m at the southern edge of the DMCPs and several hundred metres in other locations. Mitigation and management measures will be applied (Section 6) to the use of lighting. Potential impacts associated with light emissions will be temporary and are unlikely to be significant. However there is potential for them to act cumulatively with other impacts (e.g. noise) to disturb shorebirds from wetland habitats immediately adjacent to the Project Area.

5.4.8 Construction noise

Noise levels greater than existing ambient levels are expected within and adjacent to the Project Area during construction of the DMCP and temporary pipeline alignment, during dredging operations and at stages during long term management of the dredged material. Sources of noise are likely to consist of noise in short, intense pulses from mobile plant equipment, and more prolonged noise, with consistent vibration, pitch and volume from generators and pumps, in addition to from noise from vehicles.

Both steady continuous and single noise events have the potential to lead to impacts on fauna. SLR (2015) noted the following key thresholds for potential impacts on shorebirds:

- 60 dBA LA_{max} for single noise events
- 65 dBA LA_{eq} for steady continuous noise.

These thresholds are likely to be conservative in relation to potential impacts on migratory shorebirds and the Australian Painted Snipe and provide an indication of the noise levels which may cause alarm.

SLR (2015) modelled the predicted distribution of cumulative noise (which includes that produced by existing operations at T1) under three different weather conditions (neutral, inversion and inversion with a south east wind) for seven stages of the Project.

The results of noise modelling indicated that:

- noise exceeding the thresholds will extend into the Caley Valley wetland for some Project stages.
- there is only minor variability predicted in the distribution of noise contours in response to differing weather conditions.

Construction noise is expected to elicit some response from MNES utilising the wetlands and may therefore have an impact (particularly on behaviour and possible localised shifting of more noise-sensitive species and individuals away from the sources of noise). There is no potential for impact on MNES utilising the wetland during pond liner installation and dredging of the sea bed, as the model outputs predicted that noise created by the Project during these stages would be confined to the Project Area.

As construction of the DMCPs may occur during the period when migratory shorebirds visit the Caley Valley Wetland, an assessment of impacts of noise on migratory shorebirds is provided in Section 8.4.2 and for other MNES where relevant.

5.4.9 Alterations to surface hydrology

Changes to hydrology (e.g. through installation of embankments that comprise obstacles to surface flows or additional stormwater run-off) can potentially impact the extent of catchments, run-off characteristics, intensity of flood flows and stability of waterways. Elevated levels of erosion transport of sediments across the Caley Valley Wetland may result in reduced biodiversity in affected areas. Sediment runoff into aquatic habitats can cause increased turbidity, decreased oxygen levels, reduced light penetration, changes in channel morphology and altered sediment composition in substrates. In addition, interference with flows may alter the local wetting and drying regime, including water heights, flow paths, retention times and ponding. Such changes can have flow-on effects on aquatic habitats, resulting in their loss or alteration and a reduction in the quality and/or quantity of important food sources.

Results of hydrological modelling indicate that there will be minimal impact of the Project on surface water quality (BMT WBM 2015). Changes in salinity of up to 2 ppt are expected within the wetland adjacent to the Project Area, with the magnitude of change reducing over a period of several months. Such changes are small in comparison with natural variations in the wetland environment (BMT WBM 2015).

The key infrastructure components of the Project that may impact the hydrology of surface waters of the wetlands include the DMCP and associated infrastructure for managing stormwater. However, this influence has been assessed to be low and localised in relation to factors that may influence terrestrial ecology values (BMT WBM 2015). As the Project does not involve the construction of infrastructure within the Caley Valley Wetland, there is unlikely to be any impact on hydrological function of the wetland. With the application of standard mitigation and management measures (Section 6), impacts from stormwater releases will be localised and small in scale.

5.4.10 Alterations to ground water quality, movement and storage

Construction and operational activities can have adverse impacts on ground water in and adjacent to the Project Area, including water movement and aquifer storage. If impacts on ground water quality and availability are substantial, this can have significant impacts on the health of dependent ecosystems, including SEVT TEC and wetland habitats of threatened and migratory species.

The acid sulphate potential of the dredged material has been assessed by Golder Associates (2015) for this Project. It has been assumed that the dredged material will be self-neutralising or actively managed in accordance with an approved Acid Sulphate Soils Management Plan.

Excavation activities during construction may intersect groundwater and expose ASS, resulting in acidification of ground water. Golder Associates (2015) investigated material underlying the site and found that no PASS were present. No management of ASS will be required.

5.4.11 Liquid and solid waste disposal

Inappropriate disposal of liquid and solid wastes, including spills and leaks from transfers (fuel, chemicals) and inadequate storage could result in point-source contamination of surrounding land, including wetlands, SEVT TEC and habitats of threatened and migratory species. Direct adverse impacts include contamination of vegetation (resulting in degradation or loss of SEVT and habitats), toxic effects on MNES fauna (from contact, inhalation or ingestion) or indirect impacts on threatened and migratory species from habitat loss. Direct adverse impacts on surface and groundwater quality are also possible from spills and leaks.

With the application of standard mitigation and management measures (Section 6), impacts from liquid and solid waste disposal will be avoided or localised and small in scale. Accordingly these impacts are not considered further in analysis of impacts on MNES in Sections 7, 8 and 9.

5.4.12 Increased human presence and activity

Increased activity by people within the Project Area and surrounds has the potential to disturb fauna, with wetland birds roosting or foraging in adjacent areas being particularly vulnerable. This may be associated with aggregations of workers during certain construction or operational activities or use of adjacent areas during breaks. Impacts can include disruption to foraging and roosting efficiency or deterring birds from using particular areas (resulting in a reduction in habitat availability). Vehicles deviating from established access roads can also damage habitats (indirect impact on threatened and migratory species) or kill or damage birds on impact (direct impact, vehicle strikes).

Mitigation measures have been proposed to reduce off-site disturbance of fauna from increased human presence and vehicles. These are described in Section 6 and with reference to migratory shorebirds, in Section 8.4.

5.5 Potential impacts from the ongoing presence of infrastructure

After completion of construction, the ongoing presence of infrastructure can continue to have potential for adverse direct and indirect impacts on TECs and threatened and migratory fauna. The key continuing risks are from:

- Dust emissions (e.g. blow-off from inadequately stabilised embankments and access roads)
- Erosion of embankments, access roads or other areas of ground disturbance, resulting in substantial transfer into sensitive habitats by surface flows.

With the application of standard mitigation and management measures (Section 6) impacts from the ongoing presence of infrastructure is expected to be localised and small in scale. Accordingly these impacts are not considered further in analysis of impacts on MNES in Sections 7, 8 and 9.

5.6 Potential impacts from periodic and short term operational use

After construction of the new onshore facility, periodic short-term operational use will occur, including:

- Deposition of dredged material into ponds in the DMCPs and removal or relocation of fill once sediments have settled and return waters have been discharged
- Periodic release of stormwater in retention ponds
- Periodic maintenance work on the embankments, dredged material ponds and pipework
- Removal of DMCP and establishment of the final landform.

Any future projects that require the use of the dredged material will be subject to an appropriate level of impact assessment as required under relevant Commonwealth and State legislation.

These operational activities will involve vehicle movements, earth works, dust emissions, noise/vibration emissions and increased human presence and activity. All of these increase the risk of adverse direct and indirect impacts on threatened and migratory species (e.g. vehicle strike and interference with behaviour) and degradation of habitats of MNES species and TECs (e.g. introduction and spread of weeds and feral animals). The nature of these potential impacts is described in Section 5.3 and will be reflective of impacts during the operational phases.

As mentioned previously, potential impacts arising from the placement of dredged material will be primarily limited to:

- Dust and PASS from the dredged material after drying
- Noise during the dredging and pumping activity
- Abnormal events from the risk of embankment failure or seepage to wetland and/or groundwater.

Mitigation measures have been considered as part of the relevant technical reports assessing these matters. With the implementation of suitable measures the potential risk of impacts from these matters is considered low.

6 Mitigation and Management

The previous section indicated that the Abbot Point Growth Gateway Project has a number of unavoidable adverse impacts (e.g. vegetation clearance) and a number of other potential adverse impacts (e.g. mortality of threatened species through vehicle strike) that can be avoided or minimised through appropriate management and mitigation measures. The assessment has assumed a worst-case scenario where all habitat within the DMCP and temporary pipeline alignment (75 ha in area) will be removed, reclaimed or otherwise lost. The focus for mitigation and management measures to be implemented during the Project is to minimise impacts on threatened and migratory fauna and communities adjacent to the Project Area. Where it is possible to protect these values within the development footprint, relevant management measures are presented.

6.1 Mitigation of impacts from clearing vegetation

Because of the potential for vegetation clearing to have adverse impacts on MNES species, the following measures are required to avoid or minimise the extent and severity of these impacts in adjacent areas:

- The minimum amount of clearing will be undertaken that still enables effective completion of the construction elements and subsequent operation (to retain, if possible, vegetation and habitats within the Project Area, including the temporary pipeline alignment)
- Management actions will be implemented to reduce impacts on TECs and threatened species habitats (see Sections 7, 8 and 9 for relevant species), including allowing perturbed fauna to relocate naturally or with assistance from spotter catchers
- Residual impacts on environmental values (if present) will be adequately compensated through the provision of suitable offsets
- The severity of impacts from clearing vegetation will be minimised through the following measures:
 - Where possible, maximise the use of degraded or less sensitive environmental areas when siting infrastructure, including the temporary pipelines; and
 - Areas to be cleared must be surveyed in advance, marked-out and authorised by an appropriate person prior to clearing, to ensure no unapproved areas are inadvertently disturbed and no excessive clearing occurs.

6.2 Mitigation of impacts from habitat fragmentation and edge effects

Clearing of vegetation has the potential to fragment habitats of MNES and exacerbate adverse impacts through edge effects, in particular, the introduction and spread of weeds and feral animals. Suitable mitigation, management and monitoring measures are required, including the following:

- Measures will be taken to re-establish connectivity to the greatest realistic extent following construction and/or consolidate existing fragmented areas through restoration, with consideration for areas that are required for future port development
- Development areas will be provided with adequate firefighting equipment and on-site staff will be adequately trained to use such equipment
- Vegetation clearance procedures will be implemented that minimise the potential to introduce and/or spread weeds or to increase the risk of subsequent disturbance, including by feral animals and fire.

The Construction Environmental Management Plan (CEMP) and Operations Environmental Management Plan (OEMP) will include development and implementation of a Weed Management Plan, Feral Animal Management Plan and Fire Management Plan, targeting protection of SEVT and habitat of threatened and migratory species.

6.3 Mitigation of impacts from excavation

To avoid or minimise impacts associated with excavation, the CEMP and OEMP will be required to contain measures to ensure landform stability and avoid fauna mortality or injury.

Such measures may include:

- Deep pits and trenches (greater than 0.5 m depth) to be fenced, have infrastructure components installed in a timely fashion, be filled/rehabilitated and/or be monitored throughout each day to locate and remove any trapped fauna
- Surface of disturbed ground to be stabilised as soon as practicable (e.g. by geotextile or vegetation) to avoid erosion and transport of sediments off-site
- All construction activities will be monitored routinely for compliance with the plans above and to ensure effectiveness. Monitoring will also take place to allow detection at an early enough stage to implement effective mitigation and resolution before unacceptable and/or irreversible adverse impacts occur.

6.4 Mitigation of impacts from placement of fill

To avoid or minimise impacts associated with the placement of fill, the CEMP and OEMP will be required to contain measures to address hydrological and water quality impacts, erosion and sediment controls.

Such measures may include:

- Stabilising embankment surfaces with geotextile or vegetation as soon as practicable
- Engaging fauna handlers to monitor pits or trenches deeper than 0.5 m, to locate trapped animals and remove them in a timely manner.

6.5 Mitigation of impacts from vehicle movements

To avoid or minimise impacts associated with vehicle movements, the CEMP and OEMP will be required to contain measures to address traffic-related issues. Such measures may include:

- Appropriate speed limits should be sign-posted, included in staff inductions and enforced
- Vehicles to be limited to traversing approved roads and tracks
- No unauthorised access by vehicles unless required for construction, operation, maintenance or inspections
- In high risk areas, establishment of vehicle wash/blow-down areas and procedures, to remove weeds and their propagules
- If possible, use temporary fencing around construction areas, with no barbed wire in fencing
- All personnel operating vehicles in and adjacent to the Project Area should be made aware of the potential for Squatter Pigeon and other threatened and migratory species to occur on-site and be encountered on vehicle tracks. Personnel should also be alerted to the Squatter Pigeon's tendency to freeze in position when danger approaches
- Prevention of fire ignition and uncontrollable fires through appropriate measures, including fire arrestors on earth-moving equipment.

6.6 Mitigation of impacts from dust emissions

Construction activities are expected to generate temporary dust emissions. To avoid or minimise impacts associated with dust, the CEMP and OEMP will be required to contain measures to address dust-related issues. Measures are expected to include:

- Ensure that all significant earthworks are avoided where practicable during unfavourable meteorological conditions (e.g. high winds)
- Watering of haul roads to minimise wheel-generated dust
- Watering of exposed areas including cleared areas and stockpiles to minimise dust lift-off
- Minimise exposed area through progressive clearing
- Designation of appropriate maximum speed limits during construction
- Erection of physical barriers such as bunds and/or wind breaks around stockpiles
- Water spraying of nearby sensitive vegetation if visible dust deposition is occurring
- Use of hydraulically applied polymer agents and organic mulch to protect some surfaces.

6.7 Mitigation of impacts from light emissions

To avoid or minimise impacts associated with light emissions, the CEMP and OEMP will be required to contain measures to minimise artificial lighting of the wetland. Such measures may include:

- Use directional lighting and shrouds to protect the Caley Valley Wetland from direct light
- Use mobile light towers which can be moved and adjusted to provide lighting for construction purposes, while minimising lighting of unused areas
- Maintain a buffer area between construction lighting and the Caley Valley Wetland
- Point directional lights away from the Caley Valley Wetland

6.8 Mitigation of impacts from construction noise

To avoid or minimise impacts associated with construction noise, the CEMP and OEMP will be required to contain measures to minimise noise generation within close proximity to the Caley Valley Wetland. Such measures may include:

- 50 m set back of the DMCP from the wetland to protect wetland values
- Use of plant with efficient muffler design.
- Vehicles, plant and equipment will be maintained in accordance with manufacturer's specifications.
- Adjustment of reversing alarms on plant to limit the acoustic range to the immediate danger area.
- Plant and equipment of appropriate size / capacity for the task will be used.
- Use of quieter engines and newer, quieter equipment where practicable.

6.9 Mitigation of impacts from alterations to surface water

To avoid or minimise impacts associated with alterations to surface water resulting from stormwater release, a stormwater management plan is expected to be developed to the following principles:

- The DMCP has been designed with a spillway which will accommodate a 1:20 year three day storm event.
- Beyond this event a fuse plug on the south eastern corner of the pond will be utilised for emergency discharge

6.10 Mitigation of impacts from alterations to ground water

Placement of the dredged material and resultant seepage is expected to have a low to negligible impact on the existing groundwater below the DMCP (AGE 2015). Contingency management measures (for example treatment with fine ground agricultural lime) will be employed if construction measures do result in excavation of ASS and/or PASS materials. These would be expanded upon in an Acid Sulphate Soils Management Plan incorporated into the CEMP and OEMP.

6.11 Mitigation of impacts from liquid and solid waste disposal

To avoid or minimise impacts associated with waste, the CEMP and OEMP will be required to contain measures to address spills and waste management. Such measures may include:

- Package treatment plants to treat sewage from construction workers on-site
- Solid waste transported to approved facilities outside the Project Area
- Spill management procedures
- Spill kits and appropriately trained staff available on site.

6.12 Mitigation of impacts from increased human presence and activity

Adverse impacts associated with increased human presence and activity can be avoided or minimised through implementing the following mitigation measures:

- Speed limits to reduce collisions with MNES species
- Fence off habitat areas to prevent unplanned impacts outside the Project Area (no barbed wire)
- Educate construction crews to avoid disturbance of sensitive habitats in the Study Area.

6.13 Monitoring requirements for proposed mitigation and management

Compliance with the requirements, agreed procedures, locations and extent of vegetation clearance in approval conditions and the CEMP and OEMP must be monitored, documented and subject to compliance audits. A reporting schedule will be required to be included in the CEMP for both routine documentation (of planned and executed clearing) as well as incident reporting (e.g. clearance outside agreed areas).

7 Assessment of impacts on TECs and threatened species

This section assesses impacts of the Project on the SEVT TEC and one threatened species (Squatter Pigeon) known, likely or with potential to occur within the Study Area. The remaining threatened species are also migratory or resident shorebirds and are addressed in Section 8.

7.1 SEVT TEC

7.1.1 Community overview

The SEVT of the Brigalow Belt are listed nationally as Endangered under the EPBC Act. In Queensland, four of the Regional Ecosystems (REs) that comprise the listed ecological community are listed as Endangered under the *Vegetation Management Act 1999* (VMA; McDonald 2010; Table 13).

Table 13: Regional ecosystems that comprise the SEVT TEC vegetation community

| RE number | RE description | VMA Act status | Recorded in study area |
|-----------|---|----------------|------------------------|
| 11.2.3 | Microphyll vine forest ("beach scrub") on sandy beach ridges | Of concern | Yes |
| 11.3.11 | SEVT on alluvial plains | Endangered | No |
| 11.4.1 | SEVT ± <i>Casuarina cristata</i> on Cainozoic clay plains | Endangered | No |
| 11.5.15 | SEVT on Cainozoic sand plains/remnant surfaces. | | No |
| 11.8.13 | SEVT and microphyll vine forest on Cainozoic igneous rocks | Endangered | No |
| 11.8.3 | SEVT on Cainozoic igneous rocks | | No |
| 11.8.6 | <i>Macropteranthes leichhardtii</i> thicket on Cainozoic igneous rocks. | | No |
| 11.9.4 | SEVT on Cainozoic fine-grained sedimentary rocks. | Of concern | No |
| 11.9.8 | <i>Macropteranthes leichhardtii</i> thicket on Cainozoic fine-grained sedimentary rocks | | No |
| 11.11.18 | SEVT on old sedimentary rocks with varying degrees of metamorphism and folding | Endangered | No |

SEVT communities are comprised of dry seasonal subtropical rainforest (McDonald 2010), and are known to contain 11 plant species and five animal species listed as threatened under Commonwealth or Queensland legislation.

SEVT is distributed from Townsville (Queensland) to just south of the NSW border (DoE 2015b). In Queensland remnant vine thicket patches are mostly scattered from coastal dunes and river deltas in the vicinity of Townsville and Ayr through to the south eastern part of the bioregion between Jandowae and Killarney on the Queensland/New South Wales border (TSSC 2001).

In 2003, it was estimated that 146,000 ha of SEVT remained in the Brigalow Belt Bioregion with approximately 37,000 ha represented in conservation areas. In this region, remnant SEVT occurs in patches from less than 2 ha to greater than 1,000 ha. However, the majority of patches occur in areas of 50 ha or less and only a very small percentage of patches are larger than 100 ha (McDonald 2010).

Greater than 50% of SEVT is found within six subregions of the Brigalow Belt North and Brigalow Belt South bioregions. Areas greater than 500 ha occur within the subregions of Arcadia, Buckland Basalts, Claude River Downs, Dawson River Downs, Northern Bowen Basin and Southern Downs (McDonald 2010).

7.1.2 Occurrence within the Project Area

Within the Abbot Point region (from Cape Upstart south to Bowen) the occurrence of SEVT corresponds to only one of the REs identified above. That is 11.2.3 Microphyll vine forest ('beach scrub') on sandy beach ridges. No other REs identified as SEVT TEC occur within this region.

Three flora field assessments conducted within the Study Area provide information relevant to SEVT:

- Terrestrial fauna and flora surveys were undertaken by GHD during the dry season in 2008 and wet season in 2009. The dry season survey was conducted over a 13 day period October/November 2008. The wet season survey was conducted over a 14 day period March/April 2009. Sampling during both the wet and dry seasons consisted of one 30 m x 30 m quadrat within

SEVT known to occur in the northern extent of the Abbot Point area (GHD 2009). This area was confirmed to support the EPBC Act-listed community.

- Flora surveys were undertaken by Unidel in October 2009. This survey was conducted over two days in October 2009 and examined the presence and absence of threatened flora species and communities with one site located within the northern extent of the known area of SEVT (Unidel 2011). This area was confirmed to support the EPBC Act-listed community.
- ELA (2014b) conducted surveys of SEVT areas adjacent to Dingo Beach in December 2014 to assist with the assessment of another project within the Port of Abbot Point. The survey identified SEVT meeting the description of RE 11.2.3 being a low microphyll rainforest occurring on quaternary coastal dunes and beaches. This area was confirmed to support the EPBC Act-listed community.

Within the Study Area, SEVT was generally assessed to be in good condition. However, some areas had been heavily invaded by Rubber Vine (*Cryptostegia grandiflora*) and were in poor condition (GHD 2009). Characteristics of the ecological community are described as:

- Sandy substrate
- Sparse canopy vegetation
- Dense woody shrub layer
- Abundance of vines
- Little understorey vegetation
- Abundant leaf litter and woody debris (GHD 2009).

There is no SEVT within the footprint of the DMCPs or the pipeline alignment. A strip of vegetation mapped as a SEVT (RE 11.2.3) occurs along the eastern beach dune system and is located approximately 50 m from the proposed pipeline alignment (Figure 5).

7.1.3 Potential impacts of the project on SEVT

Section 5 provides detailed descriptions of the direct and indirect impacts relevant to the Project. Those impacts relevant to SEVT are indirect only, as no vegetation mapped as SEVT will be cleared for the Project. Potential threats include edge effects associated with weeds and fire.

Weeds

Weeds are a key threat to SEVT leading to impacts through:

- Direct competition with established plants
- Restricting native plant regeneration through competition.

Parts of the Study Area are already heavily impacted by weeds and pest animals (GHD 2009). Rubber Vine (*Cryptostegia grandiflora*) is a significant problem throughout the Study Area and has been identified within the current extent of SEVT (GHD 2009).

The Project has the potential to introduce new weeds and exacerbate existing weed problems, thereby reducing the quality of SEVT. Mitigation and management measures (as outlined in Section 6) to reduce the potential impacts of weeds should be implemented across the Project Area.

Fire

Fire is considered a general threat to SEVT communities and RE 11.2.3 in particular is considered to be a fire-sensitive ecosystem (TSSC 2001). While the moisture holding capacity of SEVT communities does provide some protection from fire, the impacts of fire can include:

- A reduction in the extent (total area) of SEVT
- Loss of biodiversity
- Loss of connectivity between patches of SEVT and other vegetation communities;
- Loss of soil and nutrients
- The promotion of weeds and the encroachment of exotic grasses.

Fire protection is also reduced when the buffering effect of surrounding fire-adapted native vegetation has been removed. Areas at most risk of impacts from fire include those surrounded by exotic pasture species as these produce higher fuel loads than native pasture species. In addition, smaller patches of SEVT are more susceptible to fire than larger patches, due to them having a greater exposed edge length (McDonald 2010).

Management measures to reduce fire risk are recommended.

7.1.4 Mitigation and management measures

Based on the above analysis, impacts of the Project on SEVT are expected to be minor, with indirect impacts associated with establishment of the pipeline alignment that are temporary and short-term in nature. Mitigation measures have been established to minimise impacts on the TEC, as outlined below:

- Areas to be cleared within the Project Area will be surveyed, marked out and authorised by an appropriate person prior to clearing to ensure no areas of SEVT TEC are inadvertently disturbed
- All high risk materials (e.g. imported soil) should be certified as weed-free prior to acceptance on-site
- Soil and fill material from weed-affected areas within the Project should not be transported to clean sites within the Project Area
- Flammable materials should be stored correctly to avoid spills
- Fire prevention measures should be employed, which may include fitting spark arresters to equipment; avoiding where practicable the use of spark-generating machinery and equipment on all total fire ban days; and restricting employee smoking to specific areas
- Development areas should be provided with adequate firefighting equipment.

These measures are considered adequate to avoid significant impacts on the SEVT TEC.

7.1.5 Consequential impacts

One approved project facilitated by the Abbot Point Growth Gateway Project involves the disturbance of approximately 55.7 ha of SEVT TEC (Table 14). This clearing is required to establish the North Galilee Basin Rail (NGBR) Project from Mistake Creek (located 50 km west of Moranbah) to Abbot Point.

Table 14 Summary of impacts on SEVT TEC by projects facilitated by the Abbot Point Growth Gateway Project

| Project | Area of SEVT TEC to be disturbed (ha) |
|--|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 0 ⁽¹⁾ |
| North Galilee Basin Rail Project (EPBC 2013/6885) | 55.7 (disturbance limit) ⁽²⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 0 ⁽³⁾ |

Source: (1) Carmichael Coal Mine and Rail Project EIS; (2) EPBC Act Approval 2013/6885 Condition 3; (3) EPBC Act Approval 2011/6194 Condition 2.

EPBC Act approval conditions for the NGBR (Conditions 4 and 5) project require the development of management plans to adaptively manage and mitigate impacts on SEVT TEC.

7.1.6 Cumulative impacts

There are no direct impacts and minimal indirect impacts of the Project on SEVT TEC. There is therefore no potential for the impacts of the Project on SEVT TEC to act cumulatively with those of other projects relevant to the Abbot Point region.

7.1.7 Residual impacts and outcome

There are no direct impacts on SEVT TEC from the Project, and indirect impacts have been assessed as minor. Therefore, the overall impact on SEVT TEC is unlikely to be significant. A range of mitigation measures will nonetheless be implemented to manage any minor impacts and facilitate the continued presence of the TEC within the Study Area. Offsets are not considered necessary.

7.2 Squatter Pigeon

7.2.1 Species overview

The Squatter Pigeon is a medium-sized ground-dwelling pigeon listed as Vulnerable under the EPBC Act. The 2010 Action Plan for Australian Birds (Garnett *et al.* 2011) downgraded the species from near threatened (per the 2000 action plan, Garnett and Crowley 2000) as there have been no recent declines and the species persists at numerous sites across a broad distribution. The IUCN Red List Guidelines (BirdLife International 2012) categorise the Squatter Pigeon as of least concern and state that the species has a very large range and does not approach the thresholds for listing as Vulnerable for range or population size criteria.

Squatter Pigeons are usually seen in pairs or small groups foraging on the ground for grass seeds, legumes, other herbs and forbs, acacia seeds, insects and ticks (DoE 2015b). Described as locally nomadic at the species level, there is no evidence to show Squatter Pigeons undertake long-distance movements (Griffioen and Clarke 2002). The species typically breeds from late winter to summer, nesting in depressions scraped into the ground and lined with grass (DoE 2015b).

The Squatter Pigeon occurs on the inland slopes of the Great Dividing Range, and is distributed from the dry tropics of central Queensland to the Border Rivers Region of northern New South Wales near Glen Innes. The estimated extent of occurrence is approximately 440,000 km² (DoE 2015b). The estimated total population of the species is considered to be of low reliability as no systematic surveys have been undertaken. However in 2000, there were estimated to be approximately 40,000 breeding birds (Garnett and Crowley 2000). Given the Squatter Pigeon's ubiquitous nature and relative abundance, the population is thought to be stable at present. It is also thought this species occurs as a single, contiguous (i.e. inter-breeding) population (DoE 2015b).

7.2.2 Occurrence within the Project Area

The Squatter Pigeon has been observed regularly in small numbers within the Study Area (Ecoserve 2007, GHD 2009, BAAM 2012). Sightings have occurred in several habitat types, including adjacent to the existing terminal, in coastal areas near Dingo Beach and in woodlands on the south-western margins of the Study Area. There are no recorded sightings within the Project Area (Figure 7).

Given the Squatter Pigeon is listed as Vulnerable under the EPBC Act, it is relevant to understand whether the Study Area supports an 'important population' of the species in undertaking this impact assessment. No populations have been identified as being important to the long-term survival of the Squatter Pigeon, nor have areas of critical habitat been determined (DoE 2015b). The species is thought to interbreed across its entire geographic range, and it is a habitat generalist that uses both remnant and disturbed areas.

Within the Abbot Point region, the Squatter Pigeon has been observed in five of eight fauna surveys between 2007 and 2014. These records have been distributed across the Study Area in a variety of habitats. Overall, it is considered that the Squatter Pigeon population at Abbot Point is small and does not meet the criteria for an important population or habitat critical to the survival of the species (as defined in Significant Impact Guidelines 1.1) for the following reasons:

- The species is ubiquitous in this part of its geographic range
- The species is not restricted by habitat availability in the Study Area or within the region (this is particularly the case because the species is a habitat generalist)
- The numbers recorded at Abbot Point are small and the species is neither rare nor disjunct from the broader population (which occurs across a large range)
- It is not at the edge of the range of the species and is therefore not important in terms of range expansion and recovery
- Given the above, there is no evidence to suggest the individuals found at Abbot Point are important in terms of maintaining genetic diversity.



Figure 7 Map showing the location of Squatter Pigeon sightings across the Study Area

7.2.3 Potential impacts of the Project on the Squatter Pigeon

Section 5 provides detailed descriptions of the direct and indirect impacts relevant to the Project. Of these impacts, those that have been identified as being relevant to the Squatter Pigeon are as follows:

- Habitat loss resulting from clearing of vegetation or smothering during fill placement
- Mortality or injury resulting from fauna strike (vehicles), entrapment (excavation) or collisions with structures
- Reduced breeding success from destruction of ground nests
- Reduction in habitat quality resulting from fragmentation and edge effects due to clearing of vegetation (weeds and pests).

Habitat loss

The Project will require some clearing of vegetation within the development footprint, which may lead to a loss of habitat for the Squatter Pigeon. Approximately 75 ha of habitat suitable for the Squatter Pigeon will be disturbed by the Project within the DMCP and pipeline alignment. This loss is unlikely to be significant in relation to the Squatter Pigeon, as habitat availability does not appear to be a limiting factor for the species.

Displacement from areas that are subject to development within the Project Area is unlikely to lead to decline, as individuals are expected to readily move to other nearby areas both within the Study Area and in the region more broadly. The following factors are relevant to the assessment of potential impacts:

- The species has been recorded within a variety of habitats at Abbot Point and does not appear to be more associated with or restricted to areas that are subject to development
- Habitat at Abbot Point is similar to that available throughout the region
- The species is a habitat generalist, and is known to occur within both disturbed and remnant areas.

Furthermore, the number of individuals recorded at Abbot Point is considered to be relatively small and unlikely to comprise an important population of the species (BAAM 2012).

Despite this, measures to minimise vegetation clearing and the associated loss of habitat for the Squatter Pigeon within the Project Area are recommended, as this will minimise the level of impact on local individuals and is part of good environmental practice.

Fauna mortality, including destruction of nests

The proposed development, particularly during the construction phase, will result in an increase in the number of vehicles and other machinery using the Project Area. The Squatter Pigeon is known to freeze in its position when danger approaches, making it susceptible to mortality during habitat clearing and as a result of vehicle and other machinery strike during construction and operation.

Squatter Pigeons are ground nesting and the chicks are capable of only short flights when they depart the nest (DoE 2015b). Mortality or injury of chicks from entrapment in excavated ground is therefore possible.

Specific measures to manage and mitigate the risk of Squatter Pigeon strike are recommended and are discussed below.

Reduced habitat quality

Clearing of vegetation for development of the Project has the potential to fragment the landscape, which may also reduce the viability of an area by increasing the occurrence and severity of 'edge effects'. Of

these edge effects, an increase in the accessibility for pest animals is most likely to be an issue for the Squatter Pigeon.

Feral animals are a recognised threat to the Squatter Pigeon due to predation (by cats and dogs) and competition for foraging resources (from species such as rabbits; DoE 2015b). Management of pest species has been identified as beneficial to the Squatter Pigeon.

7.2.4 Mitigation and management measures

Based on the above analysis, impacts from the Project on the Squatter Pigeon and its habitat are expected to be minor, reflective of the species generalist nature, tolerance of disturbed areas and the availability of suitable habitat across the region. Despite this, the proposed development is still expected to have some level of impact on the Squatter Pigeon. Therefore, measures to address the following identified impacts will be implemented in order to minimise the level of impact on local individuals.

Habitat loss

The Project will require some clearing of vegetation within the Project Area and this may lead to a loss of habitat for the Squatter Pigeon.

The following general requirements will therefore be adopted:

- Restrict clearing to the minimum required footprint that enables the construction and operation of the DMCP and pipeline infrastructure
- Survey and mark areas to be cleared to ensure no additional habitats are inadvertently disturbed; and undertake progressive rehabilitation of areas that are no longer needed for on-going operations (e.g. construction laydown areas).

Fauna mortality and nest disturbance

Construction activities will involve an increase in vehicles and machinery and this may lead to an increased occurrence of Squatter Pigeon mortality through direct strike or entrapment of chicks in excavated areas. This is particularly relevant for the Squatter Pigeon due to its behavioural trait to freeze in response to danger. Additional vehicle and machinery equipment across the Project Area and placement of fill materials may also destroy active Squatter Pigeon nests on the ground.

The following specific measures will be implemented to address these potential impacts:

- Personnel operating vehicles in and adjacent to the Project Area should be made aware of the presence of the Squatter Pigeon and the potential for it to be encountered on the vehicle tracks, particularly those that are not formed roads in woodlands
- Qualified personnel should conduct thorough pre-clearance surveys of the Project Area prior to vegetation clearance to flush out individuals and determine the location of any nests. Particular attention should be given to areas of short, dry, grass tussocks and under bushes and fallen logs. If nests are located, translocation of the eggs/young should be conducted by qualified personnel to a suitable nearby habitat, if appropriate.

Reduced habitat quality

Pest species management has been an important part of the ongoing management of the wetland environment at Abbot Point. Whilst primarily geared towards enhancing the wetland habitat values and decreasing existing threats to shorebirds and turtle nesting, pest management measures will also benefit the Squatter Pigeon.

7.2.5 Consequential impacts

Three approved projects facilitated by the Abbot Point Growth Gateway Project involve the disturbance of approximately 19,433 ha of potentially suitable Squatter Pigeon Habitat (Table 15). The majority of this disturbance is associated with clearing of vegetation over the life of mining operations at the Carmichael Coal Mine. Most of this habitat was assessed not to be habitat critical to the survival of the species, due to the availability of similar suitable habitat in the adjacent landscapes.

Table 15 Summary of area of Squatter Pigeon habitat to be disturbed by facilitated projects

| Project | Area of Squatter Pigeon habitat to be disturbed (ha) |
|--|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 18,004 (combined mine, rail, subsidence and off-site infrastructure) ⁽¹⁾ |
| North Galilee Basin Rail Project (EPBC 2013/6885) | 1,362 (disturbance limit) ⁽²⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 67 (remnant and high value regrowth habitat) ⁽³⁾ |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 91; (2) EPBC Act Approval 2013/6885 Condition 3; (3) Abbot Point Coal Terminal 0 Final EIS.

EPBC Act approval conditions for the NGBR (Conditions 4 and 5), Abbot Point T0 (Condition 19) and Carmichael Coal and Rail (Conditions 5 and 6) projects require the development of management plans to adaptively manage and mitigate their impacts on Squatter Pigeon.

7.2.6 Cumulative impacts

There is some potential for impacts of the Abbot Point Growth Gateway Project to act cumulatively with those of other projects. However, this is limited by the very small scale of predicted impacts of the Abbot Point Growth Gateway Project on the Squatter Pigeon. A summary of predicted impacts on the habitat of Squatter Pigeon for projects which may have cumulative impacts is provided in Table 16.

Table 16 Summary of habitat for the Squatter Pigeon to be disturbed by other projects

| Project | Area of Squatter Pigeon habitat to be disturbed (ha) |
|---|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 18,004 (combined mine, rail, subsidence and off-site infrastructure) ⁽¹⁾ |
| North Galilee Basin Rail Project (EPBC 2013/6885) | 1,362 (disturbance limit) ⁽²⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 67 (remnant and high value regrowth habitat) ⁽³⁾ |
| GVK Hancock Terminal 3 Project (EPBC 2008/4468) | 174 ⁽⁴⁾ |
| GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648) | 6,348 (high value habitat disturbance limit, rail and mine combined) ⁽⁵⁾ |
| GVK Hancock Kevin's Corner Project (EPBC 2009/5033) | 1,158 (high value habitat disturbance limit from mine and subsidence combined) ⁽⁶⁾ |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 91; (2) EPBC Act Approval 2013/6885 Condition 3; (3) Abbot Point Coal Terminal 0 Final EIS; (4) Abbot Point Coal Terminal 3 MNES Preliminary Documentation and EPBC Act Approval 2008/4468 Condition 2; (5) EPBC Act Approval 2008/4648 Condition 2; (6) EPBC Act Approval 2009/5033 Condition 7.

All of the projects under consideration for the assessment of cumulative impacts (combined with the Abbot Point Growth Gateway Project) involve the disturbance of approximately 27,188 ha of habitat potentially suitable for the Squatter Pigeon. The majority of this disturbance is to occur up to 300 km inland of the coast, within the Galilee Basin and over the decadal time periods of mining operations.

At a local scale within the Abbot Point region, construction stages of the Project will involve the direct disturbance of approximately 75 ha of potentially suitable habitat for the Squatter Pigeon. This impact has the potential to act cumulatively with the clearing of 241 ha of habitat during construction of the T0 and T3 developments. However extensive surveys of these areas have not identified Squatter Pigeon to be present in large numbers (CDM Smith 2013; HCIPL 2012). Additionally, the Abbot Point region is not identified as important habitat for the species (BAAM 2012).

The cumulative impact of the Abbot Point Growth Gateway Project on Squatter Pigeon is therefore considered to be low, for the following reasons:

- The area of potentially suitable habitat to be disturbed by the Project is relatively small when compared with that of other approved projects (0.7% of habitat for all projects evaluated for cumulative impacts)
- The species is ubiquitous in this part of its geographic range
- The species is not restricted by habitat availability as the species is a habitat generalist
- The numbers recorded at Abbot Point are small and the species is neither rare nor disjunct from the broader population (which occurs across a large range)
- Abbot Point is not at the edge of the species range of the species and is therefore not important in terms of range expansion and recovery

7.2.7 Residual impacts and outcome

As discussed above, the overall impacts of the Project on the Squatter Pigeon are unlikely to be significant. However, a range of mitigation measures should nonetheless be implemented to manage any minor impacts and facilitate the on-going use of the Project Area by the species. Offsets are not considered necessary.

8 Assessment of impacts on migratory shorebird species

8.1 Migratory shorebirds overview

8.1.1 Ecology

Thirty-six migratory shorebird species use the East Asian-Australasian flyway. Each year these birds breed in the northern hemisphere and migrate south to Australia and New Zealand where they feed intensively, building up energy reserves to fuel their northern migration and breeding (Clemens *et al.* 2008).

East Asian-Australasian flyway

The East Asian-Australasian (EAA) flyway extends from Siberia and Alaska through east and south-east Asia (most predominately China and Korea) to Australia and New Zealand. The EAA flyway is utilised by at least 5 million migratory shorebirds (Gosbel *et al.* 2004).

Migratory species using the EAA flyway undertake annual migrations of thousands of kilometres between their southern feeding areas and breeding areas in the northern hemisphere. Species have been recorded travelling over 10,000 km non-stop, with total return distances from northern breeding grounds to southern feeding areas exceeding 29,000 km.

Northward migration to the breeding grounds typically takes place from March to early June. The birds arrive for the Arctic breeding season and must breed and fledge offspring within a six to seven week window of favourable summer climatic conditions. The return migration to non-breeding or feeding areas occurs from July to October. Most migratory shorebird species have delayed maturity, and will skip their first northerly migration by staying in Australia. The young of some species will not return to breed until they are two or more years old. These immature birds may undertake partial migration from southern to northern areas of Australia.

During migration, birds move through staging areas. Staging habitat is defined as areas that meet shorebird feeding and roosting requirements during migration. Shorebirds exhibit strong site fidelity to preferred feeding and roosting areas and do not readily use alternative areas (Tudor, 2002).

Habitat in Australia

Australia provides important feeding habitat for migratory shorebirds of the EAA flyway. The migratory shorebirds that regularly visit Australia have a wide variety of habitat requirements, spatial distributions and patterns of habitat use (Marchant and Higgins 1993). Migratory shorebirds start arriving in northern Australia in August, and then disperse throughout the country. Migratory shorebird habitat in Australia provides:

- Feeding areas with abundant food resources. Physical characteristics of feeding areas primarily consist of intertidal mudflats, sandy beaches, salt pans and rocky intertidal areas. The characteristics of high value feeding areas include large populations of invertebrates, low disturbance and un-degraded soils. Several species also readily feed in wet or moist substrates on coastal or inland freshwater wetlands.
- Roosting areas where migratory shorebirds can sleep and preen during non-feeding times. Roosting areas in proximity to feeding areas reduce energetic costs and maintain positive energy flow. Physical characteristics of roosting areas include little or no vegetation on open ground that remains above water during high tides (Tudor, 2002).

Habitat on the North-east Queensland coast

Over the southern summer Queensland supports the second highest population of migratory shorebirds in Australia and a greater number of species than any other state or territory (Gosbell and Clemens 2006).

The north-east Queensland coast provides significant habitat for migratory shorebirds (Driscoll 1993). The wetlands of north-east Queensland provide a diverse range of habitat values even in instances where the abundance of shorebirds recorded in them is low (Clemens *et al.* 2008).

The diversity of Queensland habitat used by migratory shorebirds includes:

- Coastal habitats – coastal wetlands, estuaries, mudflats, rocky inlets, reefs, sandy beaches and mangroves
- Inland habitats – inland wetlands, floodplains and grassland area.

Queensland has significant ephemeral wetland areas both on and near the coast and inland. Ephemeral wetland environments are characterised by short, infrequent, and unpredictable water availability, which determines if and when birds are present.

The importance of ephemeral wetlands as shorebird habitat is due largely to the fact that species that utilise ephemeral wetlands have adapted to annual variation in water conditions, and are known for their

flexible annual distribution patterns. These species exploit a large network of wetlands that extend over hundreds of kilometres. Each year they select from among the subset of sites that are sufficiently wet (Robinson and Oring 1996). Therefore, while one particular ephemeral wetland may not be critical as habitat to any one species, a regional wetland network is critical.

8.1.2 Impact assessment under EPBC Act

Potential impacts on migratory shorebirds have been considered within the context of two key concepts commonly applied under the EPBC Act for migratory species (DEWHA 2009a; DoE 2013):

- Important habitat
- An ecologically significant proportion of the population.

Where neither of these two features of a migratory species is present, impacts are generally not considered an issue under the EPBC Act (DoE 2013).

In addition to this broad guidance, the Commonwealth Government has also issued a set of specific guidelines (DEWHA 2009a) for assessing the importance of habitat for migratory shorebird species in Australia. These guidelines (referred to as EPBC Act policy statement 3.21) outline a set of criteria for identifying 'important habitat'. The associated background paper (DEWHA 2009b) that accompanies the policy statement provides detailed recommendations about survey requirements for migratory shorebirds.

Under the guidelines (DEWHA 2009a), important habitat for migratory shorebirds (excluding Latham's Snipe) includes sites that support:

- At least 0.1 per cent of the flyway population of a single species;
- At least 2,000 migratory shorebirds; or
- At least 15 migratory shorebird species.

Important habitat for Latham's Snipe (DEWHA 2009a) includes sites that:

- Support at least 18 individuals of the species; and
- Are naturally occurring open freshwater wetlands with vegetation cover nearby (for example, tussock grasslands, sedges, lignum or reeds within 100 m of the wetland).

The guidelines also provide a definition of 'a site' as:

the entire (discrete) area of contiguous habitat used by the same group of migratory shorebirds, which may include multiple roosts and feeding areas.

It is therefore relevant to undertake an assessment of whether Abbot Point provides important habitat for migratory shorebirds as a key first step in the impact assessment. For the purposes of this report, 'the site' is defined as the Caley Valley Wetland (as per the DIWA mapping), which is a discrete area of continuous habitat used by the same group of birds at Abbot Point.

8.2 Migratory shorebirds at Abbot Point

Section 4 provides details of several surveys that have been undertaken at Abbot Point to understand the occurrence of migratory shorebirds within the Caley Valley Wetland. The results of the most

comprehensive suite of surveys are presented in BAAM (2012) and are replicated in Table 17 and Table 18.

Table 17: Migratory shorebird occurrences at Abbot Point (from BAAM 2012)

| Migratory shorebird species | Common name | Previous | Birdlife Aust | BAAM Feb 2012 | BAAM Mar 2012 | BAAM Jun 2012 | BAAM Nov 2012 | BAAM Dec 2012 |
|----------------------------------|------------------------|----------|---------------|---------------|---------------|---------------|---------------|---------------|
| <i>Actitis hypoleucos</i> | Common Sandpiper | X | | | | | | |
| <i>Calidris acuminata</i> | Sharp-tailed Sandpiper | X | | X | X | X | X | X |
| <i>Calidris ferruginea</i> | Curlew Sandpiper | | X | | | | | |
| <i>Calidris ruficollis</i> | Red-necked Stint | X | X | X | X | X | X | X |
| <i>Charadrius leschenaultii</i> | Greater Sandplover | | | | X | | | |
| <i>Charadrius veredus</i> | Oriental Plover | X | | | | | | |
| <i>Gallinago hardwickii</i> | Latham's Snipe | X | | X | X | | X | X |
| <i>Limosa limosa</i> | Black-tailed Godwit | | | X | | X | X | |
| <i>Numenius madagascariensis</i> | Eastern Curlew | X | | X | X | | X | X |
| <i>Numenius minitus</i> | Little Curlew | | | | X | | | |
| <i>Numenius phaeopus</i> | Whimbrel | X | | X | X | | X | X |
| <i>Pluvialis fulva</i> | Pacific Golden Plover | X | | X | | | X | X |
| <i>Tringa incana</i> | Wandering Tattler | X | X | X | X | | | |
| <i>Tringa nebularia</i> | Common Greenshank | X | X | X | X | | X | X |
| <i>Tringa stagnatilis</i> | Marsh Sandpiper | | | X | X | X | X | X |

Table 18: Total counts, population estimates and % flyway population for main wetland (from BAAM 2012)

| Scientific name | Common name | Feb count | Feb est | Mar count | Mar est | June count | June est | Nov count | Dec count | 0.1% level | % pop |
|---|---------------------------------|------------|-------------|-------------|-------------|------------|-----------|------------|------------|-------------|-------------|
| <i>Calidris acuminata</i> | Sharp-tailed Sandpiper | 781 | 1199 | 351 | 377 | 1 | 2 | 556 | 129 | 160 | 0.75 |
| <i>Calidris ruficollis</i> | Red-necked Stint | 389 | 389 | 1224 | 1224 | 47 | 47 | 343 | 117 | 325 | 0.38 |
| <i>Charadrius leschenaultii</i> | Greater Sand Plover | 0 | 0 | 1 | 1 | | | | | 110 | <0.01 |
| <i>Gallinago hardwickii</i> | Latham's Snipe | 29 | 54 | 7 | 9 | | | 2 | 2 | 100 | 0.05 |
| <i>Limosa limosa</i> | Black-tailed Godwit | 1 | 1 | | | 1 | 1 | 2 | | 160 | <0.01 |
| <i>Numenius madagascariensis</i> | Eastern Curlew | 1 | 1 | 1 | 1 | | | 1 | 34 | 38 | <0.01 |
| <i>Numenius minutus</i> | Little Curlew | 0 | 0 | 1 | 1 | | | | | 180 | <0.01 |
| <i>Numenius phaeopus</i> | Whimbrel | 3 | 3 | 2 | 2 | | | 2 | 22 | 100 | <0.01 |
| <i>Pluvialis fulva</i> | Pacific Golden Plover | 1 | 1 | | | | | 2 | | 100 | <0.01 |
| <i>Tringa nebularia</i> | Common Greenshank | 37 | 42 | 35 | 35 | | | 14 | 3 | 60 | 0.07 |
| <i>Tringa stagnatilis</i> | Marsh Sandpiper | 11 | 19 | 10 | 10 | | | 26 | 3 | 100-1000 | <0.01 |
| Australian Painted Snipe <i>Rostratula australis</i> is a shorebird that is still listed as Migratory, but is not included in the EPBC Act Draft Guidelines | | | | | | | | | | | |
| <i>Rostratula australis</i> | Australian Painted Snipe | 3 | 8 | | | 24 | 35 | | | 1.88 | 1.87 |

When analysed against the criteria for important habitat, the above results clearly demonstrate that the Caley Valley Wetland is important habitat for migratory shorebirds. This is because the site supports:

- $\geq 0.1\%$ of the flyway population for:
 - Red-necked Stint (the BAAM survey recorded 0.38%); and
 - Sharp-tailed Sandpiper (the BAAM survey recorded 0.75%)
- ≥ 18 individual Latham's Snipe (the BAAM survey estimated 54 individuals present during the February count); and
- ≥ 15 migratory shorebird species (a total of 15 species have been recorded across the various surveys).

When conditions are suitable, the site also supports approximately 1.87% of the total population of Australian Painted Snipe, and can therefore also be considered important habitat for this species (listed as both Endangered and Migratory under the EPBC Act, although not included in the list of 36 migratory shorebirds).

While not present at $\geq 0.1\%$ of the flyway population, the Eastern Curlew and Curlew Sandpiper have been recorded within the Caley Valley Wetland. Both species have been recently (26 May 2015) listed as Critically Endangered under the EPBC Act.

In summary, impacts of the Project on any part of the Caley Valley Wetland need to be considered as impacts on important habitat for migratory shorebirds. For some species, ecologically significant proportions of the flyway population have been recorded on site or they are listed as threatened species, warranting a detailed consideration of potential impacts on those species.

The following sections provide further information on the locations that migratory shorebirds including the key species listed individually above have been recorded within the Caley Valley Wetland. Information has been taken largely from BAAM (2012) and supplemented by other surveys including those of BMT WBM (2012).

8.2.1 Migratory shorebird occurrence throughout the Caley Valley Wetland

Section 8.6 and Appendix A show maps of the survey areas in which migratory shorebird species have been recorded within the Caley Valley Wetland, primarily using data from 2012. Several species have been recorded throughout the Open Marsh, Closed Marsh and Open Pan areas. Shorebirds were not evenly distributed throughout the wetland area, with the highest numbers of individuals being consistently recorded in the in the Open Pan part of the wetland. However, patterns of habitat use were often species specific.

Shorebird numbers were substantially lower during the dry season surveys than during the wet season. This was to be expected during June, when birds had returned to the northern hemisphere on their annual migration. November and December surveys also recorded fewer birds than the wet season surveys. This is likely to be due to the wetland having dried over the course of the winter months and providing less habitat for shorebirds, than when significant amounts of water were available earlier in the year. This result highlights the natural variability of the wetland and the seasonal dynamic of shorebird presence at the site. Notably, three species of bird were recorded in all five survey periods during 2012; the Marsh Sandpiper, Red-necked Stint and Sharp-tailed Sandpiper.

8.2.2 Use of the eastern wetland fringe adjacent to Project Area

Utilisation by shorebirds of the eastern wetland fringes located adjacent to the Project Area is of significant relevance to the impact assessment. Off-site and indirect impacts of the Project from construction noise, stormwater runoff, lighting, dust and general disturbance are most likely to occur in

this area. Variations in the habitat preferences of shorebird species will partly determine the degree to which those species are susceptible to Project-related impacts. Table 19 provides a summary of habitat utilisation of wetland areas adjacent to the Project Area, based on the results of monitoring surveys (maps presenting the results of surveys are in Section 8.6 and Appendix A).

Shorebird species observed adjacent to the Project Area include the Australian Painted Snipe, Red-necked Stint, Sharp-tailed Sandpiper, Latham's Snipe, Wandering Tattler, Common Greenshank and Marsh Sandpiper.

Table 19 Summary of shorebird survey records adjacent to the Project Area.

| Species | Adjacent to Project Area? | Comments on locations observed during surveys within 500 m of Project Area |
|--------------------------|---------------------------|--|
| Curlew Sandpiper | No | Low numbers 2.5 km south west of the Project Area. |
| Eastern Curlew | Yes | Open Pan and estuarine environments of the western section of the Caley Valley Wetland, 3-4 km west of the Project Area. Also recorded roosting on Dingo Beach 500 m from the Project Area. |
| Australian Painted Snipe | Yes | Low numbers along the eastern fringe of the wetland adjacent to the Project Area. Observed in similar habitats at the southern and northern fringe of the wetland and in the central Closed Marsh. |
| Red-necked Stint | Yes | A single individual was observed adjacent to the northern extent of the Project Area. Otherwise observed more than 500 m away from the Project Area. |
| Sharp-Tailed Sandpiper | Yes | Observed along the entire eastern fringe of the wetland, adjacent to the Project Area. Also recorded in large numbers at Lake Caley, throughout the Open Marsh and within the Open Pan Zone. |
| Greater Sand Plover | No | Observed several kilometres from the Project Area. |
| Latham's Snipe | Yes | Observed in low numbers along eastern fringe of the wetland. Observed in higher numbers in the central Closed Marsh 500 m from the Project Area. |
| Bar-tailed Godwit | No | Observed several kilometres from the Project Area. |
| Black-tailed Godwit | No | Low numbers, and not immediately adjacent to the Project Area. |
| Little Curlew | No | A single record from the Closed Marsh, not adjacent to the Project Area. |
| Whimbrel | No | Observed 500 m from the Project Area, mostly in the Open Pan and beach environments. |
| Golden Plover | No | Observed in low numbers further than 500 m west and south of the Project Area. |
| Grey-tailed Tattler | No | Observed several km west of the Project Area. |
| Wandering Tattler | No | Observed in very low numbers on the rocky shoreline to the north of the existing coal terminal and at the entrance of the Caley Valley Wetland to the Coral Sea. |
| Common Greenshank | Yes | Observed in low numbers adjacent to the Project Area. Much more abundant in the Open Pan and Lake Caley. |
| Marsh Sandpiper | Yes | Observed in low numbers adjacent to the Project Area. More abundant in the central and southern fringes of the wetland. |

8.3 Key Shorebird Species relevant to the impact assessment

This section provides further information on key shorebird species most relevant to the impact assessment, based on their conservation status and habitat preferences for areas located adjacent to the Project Area. The information has also informed the development of mitigation and management strategies.

There are a number of migratory shorebird species in addition to those discussed below that have been recorded within the Caley Valley wetland (see Table 19 and Appendix A). However, a detailed analysis of their ecological preferences and sighting records suggests they occur well away from the Project Area. Impacts on these species are considered unlikely and they have not been discussed individually in the remainder of this assessment, but rather addressed in Section 8.4 and 8.5 as a group.

8.3.1 Eastern Curlew

The Eastern Curlew was listed as Critically Endangered under the EPBC Act on 26 May 2015, but was not listed at the time of referral determination on 14 May 2015. In Australia, habitat includes intertidal mud and sand flats for feeding, and sand bars and spits for roosting at high tide. In Australia, threats to the species include human disturbance, habitat degradation, hydrological changes and invasive plants (TSSC 2015a). Disturbance to pre-migratory Eastern Curlews can affect their ability to migrate to the northern hemisphere to breed during the Australian winter.

Surveys during 2012 recorded low numbers, except during December 2012 when 34 individuals were counted at high tide within the Open Pan Zone of the wetland 4 km west of the Project Area. The species prefers estuarine environments within the wetland and has not been observed immediately adjacent to the Project Area. BMT WBM (2012) noted individuals from a 2006 survey roosting on Dingo Beach 500 m from the Project Area.

Habitat preferences of the Eastern Curlew for areas located away from the Project Area make the species of low susceptibility to off-site Project impacts. Oldland *et al.* (2009) suggest the Eastern Curlew is more sensitive to human-related disturbance than other shorebird species, with a minimum buffer distance of 126 m from people recommended. All sightings of Eastern Curlew at the wetland have been recorded at distances of 500 m from the Project Area. However, given this species is listed as Critically Endangered and has been recorded within the broader Study Area it is included in the assessment of off-site and indirect impacts from the Project.

8.3.2 Curlew Sandpiper

The Curlew Sandpiper was listed as Critically Endangered under the EPBC Act in 2015, but was not listed at the time of referral determination on 14 May 2015. In Australia, foraging habitat includes intertidal mudflats and non-tidal wetlands. Roosting occurs on sand spits, wetlands, lagoons and sometimes on mangroves (TSSC 2015b). In Australia, threats to the species include human disturbance, habitat degradation, hydrological changes and invasive plants (TSSC 2015b). The species is also threatened by wetland degradation in East Asia along its migratory route.

There are two Wildlife Online records of the Curlew Sandpiper from the Caley Valley Wetland. Eight to ten individuals were also observed by BMT WBM (2012) in the Closed Marsh of the wetland, approximately 2.5 km south west of the Project Area. There were no sightings of the species during the BAAM (2012) surveys. The species appears to be an infrequent visitor to the Caley Valley Wetland, and there is no evidence to suggest that areas adjacent to the Project Area are preferred habitat. However, given this species is listed as Critically Endangered and has been recorded within the broader Study Area it is included in the assessment of off-site and indirect impacts from the Project.

8.3.3 Red-necked Stint

The Red-necked Stint is the smallest shorebird in Australia and is listed as Migratory under the EPBC Act. The species was found in significant numbers at Abbot Point during 2012. The BAAM (2012) wet season survey found the species restricted to the Open Pan Zone and western edge of the freshwater areas. This survey found a total of 134 birds on the western edge of the palustrine area in the north western section of the Closed Marsh and 1,088 individuals foraging in the Open Pan Zone. During this survey period, Red-necked Stints were observed to be foraging in large flocks with other shorebird species, mainly sandpipers. The diversity of habitats at the wetland allows the Red-necked Stint to use the muddy shallows of the Open Pan Zone as well as the edges of the main wetland basin.

The BAAM (2012) dry season survey found 47 Red-necked Stints on the south western edge of the Open Marsh Zone. This finding potentially adds to the relevance of Caley Valley Wetland as an important habitat for migratory shorebirds. Red-necked Stints arrive in Australia from August (possibly July) with most from early September. Almost all have arrived in Australia by November. They begin the return to breeding grounds from late February through to April although a few remain until May (DoE 2015b). The 47 Red-necked Stints counted on the site in late June 2012 were most likely young birds, which had not migrated to breed and were spending the northern hemisphere summer in Australia.

While most Red-necked Stints observed at the Caley Valley Wetland have been located more than 500 m from the Project Area, the species is likely to occasionally utilise habitats in closer proximity to the Project. Given that a significant proportion of the flyway population utilise the wetland, the species is included in the assessment of off-site and indirect impacts.

8.3.4 Sharp-tailed Sandpiper

The Sharp-tailed Sandpiper is a small to medium sized shorebird listed as Migratory under the EPBC Act. The species has been found in significant numbers at Abbot Point. The BAAM (2012) survey found the Sharp-tailed Sandpiper in large numbers adjacent to the Project Area, although the population halved between the February and March survey periods (Table 18). This was possibly related to the large amount of rain that fell between surveys (151 mm). The Sharp-tailed Sandpiper forages in shallow water across wetland fringes and much of this foraging habitat disappeared as a result of the substantial post-rain rise in water level. Notably the species was found in almost equal numbers in the Open and Closed Marsh zones. Conversely the numbers of Sharp-tailed Sandpiper recorded in March in the Open Pan Zone increased as the raised water level improved.

The habitat mosaic that makes up Caley Valley Wetland is conducive to the foraging and roosting behaviours of the Sharp-tailed Sandpiper. The species feeds opportunistically on the mosaic of different habitat types, such as intertidal mudflats on bare wet mud or sand, and in shallow water (all provided by the wetland).

The June 2012 BAAM survey found one Sharp-tailed Sandpiper on the western edge of the Open Marsh. That is, there was little evidence of a local population of young birds that had not migrated to breed in the northern hemisphere. Typically in Queensland, Sharp-tailed Sandpiper numbers are very low at this time of year (Queensland Wader Study Group records). The species was also found in large numbers in both November and December in the Lake and Open Pan sections of the wetland. The species is included in the assessment of off-site and indirect impacts from the Project, due to its demonstrated use of habitat adjacent to the Project Area.

8.3.5 Latham's Snipe

Latham's Snipe is a medium sized shorebird and the largest species of snipe found in Australia. The species is listed as Migratory under the EPBC Act. Abbot Point is considered important habitat for

Latham's Snipe. The threshold for a site to be considered an 'important habitat' for Latham's Snipe is records of greater than 18 individuals. There were 36 records of Latham's Snipe from the BAAM (2012) wet season surveys. Twenty seven birds were sighted in a single field survey, with the estimated number of individuals (accounting for those that were present but not observed) being more than double this at 63 birds. The higher estimate is commensurate with standard surveying practice for Latham's Snipe, and is necessary to account for the difficulties involved with surveying this species given their cryptic appearance and behaviour. This species was also recorded in the November and December 2012 dry season surveys (two birds in each survey).

The mosaic of habitat types within the Caley Valley Wetland is conducive to Latham's Snipe, in terms of its foraging and roosting preferences and its cryptic nature. The sensitivity of the species makes the Closed Marsh Area of the wetland important because the fringing sedges allow the birds to move and forage under cover. The species utilises salt couch on the margins of wet areas, unlike most migratory shorebirds.

Within the Study Area Latham's Snipe moves between the Open and Closed Marsh zones (foraging areas of mud in each zone). The common element in both zones is the presence of low dense vegetation. The species is therefore included in the assessment of off-site and indirect impacts from the Project.

8.3.6 Australian Painted Snipe

The Australian Painted Snipe is listed as Endangered under the EPBC Act. The species occurs in shallow freshwater and brackish wetlands, and is most common in eastern Australia. The species has undergone a severe decline since the 1950s and in particular during the past 26 years, due to loss and degradation of wetland habitats. Specific threats to habitats include changes to hydrology affecting water depth and agricultural modifications associated with cattle trampling, nutrient enrichment and increased cropping (TSSC 2013).

Abbot Point is considered important habitat for the Australian Painted Snipe. The species has been found in unusually high numbers in 2012, representing 1.8% of the total population of the species. The three Australian Painted Snipe recorded in the BAAM (2012) wet season survey were flushed in short and relatively sparsely vegetated edge habitat flooded with shallow fresh water on the southern fringe of the Closed Marsh Zone. In the BAAM (2012) dry season surveys, 24 individuals were observed equally in the Open and Closed Marsh zones of the wetland. It is notable that within the Open and Closed Marsh zones the Australian Painted Snipe was located very broadly across all areas, from the northern most section of the Open Marsh to the southern edge of the Closed Marsh.

BAAM (2012) recorded that the species was present in family groups during the June survey. The only group observed well prior to flushing included two juvenile birds that were noticeably smaller than the attendant adult, suggesting recent breeding activity, most likely on the wetland itself (although breeding elsewhere and subsequent movement to the wetland cannot be discounted). Australian Painted Snipe are known to breed in the Caley Valley Wetland; a clutch of eggs collected on 9th April 1978 in the Caley Valley Wetland is catalogued in the Australian National Wildlife Collection (Atlas of Living Australia 2012). The breeding season at Abbot Point is likely to extend from February to September, with nesting most likely over the period from March to May.

The location and numbers of the Australian Painted Snipe found in the Study Area are presented in Section 8.6.2. Unlike other species, some precise record locations are available (rather than transect locations). These data indicate there is habitat utilised by the Australian Painted Snipe located adjacent to the Project Area. The species is therefore included in the assessment of off-site and indirect impacts

from the Project. As with Latham's Snipe, the species utilises salt couch (on the margins of wet areas), unlike most migratory shorebirds.

8.3.7 Common Greenshank

The Common Greenshank is a heavily built shorebird listed as Migratory under the EPBC Act. The species has been found in significant numbers at Abbot Point. BAAM (2012) found the Common Greenshank in all surveys except June, with numbers commonly ranging from 30 to 40 individuals. The species was also observed in low numbers by BMT WBM (2012). While a solitary individual was observed along a transect of the eastern wetland adjacent to the Project Area, the species was much more abundant along the western edge of the Northern Marsh, the central Closed Marsh and the Open Pan habitats. While not common in sections of the wetland adjacent to the Project Area, the species is included in the assessment of off-site and indirect impacts.

8.3.8 Marsh Sandpiper

The Marsh Sandpiper is a medium sized shorebird listed as Migratory under the EPBC Act. The species has been found in significant numbers at Abbot Point. BAAM (2012) recorded the Marsh Sandpiper during each of its surveys, with highest numbers of 26 individuals during November 2012. The species was also observed by BMT WBM (2012) in the Closed Marsh. While a transect by BAAM (2012) identified two individuals adjacent to the Project Area, the species was more abundant in the central and southern sections of the Closed Marsh, and the Open Pan of the wetland. While not common in sections of the wetland adjacent to the Project Area, the species is included in the assessment of off-site and indirect impacts.

8.4 Potential impacts of the Project on migratory shorebird species

Section 5 provides detailed descriptions of the direct and indirect impacts relevant to the Project. Of these impacts, those that have been identified as being relevant to the migratory shorebird species (including the key species where a significant population is present: Australian Painted Snipe, Latham's Snipe, Sharp-tailed Sandpiper; and Red-necked Stint) are as follows:

- Mortality or injury resulting from fauna strike (vehicles), entrapment (excavation) or collisions with structures
- Off-site and indirect disturbance associated with:
 - Construction noise
 - Dust
 - Increased human activity
 - Lighting
 - Changes stormwater runoff regime
 - Changes to the groundwater regime

8.4.1 Mortality or injury

The proposed development, particularly during the construction phase, will result in an increase in the number of vehicles and other machinery using the project area. Vehicles and large structures have the potential to increase bird mortality through direct strikes.

The risk of raised mortality through migratory shorebirds striking structures is considered to be minor given that Abbot Point is used by migratory shorebirds for feeding and roosting rather than as an EAA flyway staging or flyover area.

While the risk of vehicle strike is also considered low, there is increased potential for this to occur during construction when vehicles and machinery may be operating within and around habitat areas. Management of this potential impact is therefore recommended.

The current project design identifies the use of excavation to establish the dredged material ponds. Entrapment in open excavations may pose a risk to injured birds and other fauna.

Specific measures to manage and mitigate the risk of migratory shorebird strike are recommended and are discussed below.

8.4.2 Construction noise

Increased noise associated with construction within the Project Area has the potential to cause localised shifting of noise-sensitive species and individuals away from the sources of noise, thereby disrupting feeding and roosting. Studies of waterbird responses to various types of noise disturbance indicate that the following key thresholds for potential impacts on shorebirds would apply at Abbot Point (SLR 2012; SLR 2015):

- 60 dBA for single noise events
- 65 dBA for steady continuous noise.

These criteria are general in nature, and site specific factors may contribute to higher or lower criteria under certain circumstances. For example, Hicks *et al.* (1987) found that Sooty Terns and Common Noddies on Michaelmas Cay in the GBR were far more likely to take flight from seaplanes that were taking off than those that were landing. Generally foraging birds show a greater tolerance to noise than roosting or nesting birds. For an ongoing construction project, avoidance of otherwise suitable foraging and roosting habitat is a potential mode of disturbance, which could lead to overcrowding in alternative habitats or reduced foraging efficiency.

In order to minimise off-site and indirect impacts of the Project (including noise) on wetland values, the DMCPs were set back 50 m from the wetland fringe as part of the Project design. SLR (2015) modelled the predicted distribution of cumulative noise (which includes that produced by existing operations at T1) across the Study Area for seven stages of the Project under three different weather conditions. These conditions were:

- Neutral - 10°C, 70% humidity, D Pasqual Stability Class and 0 m/s wind speed
- Inversion - 10°C, 90% humidity, F Pasqual Stability Class and 0 m/s wind speed
- Wind-enhanced - 10°C, 90% humidity, F Pasqual Stability Class and 3 m/s wind speed from a south-east direction

These stages and their relevant noise criterion for shorebird disturbance are summarised below:

- Topsoil stripping and stockpiling (60 dBA LAmax)
- Embankment subgrade preparation (60 dBA LAmax)
- Embankment construction (60 dBA LAmax)
- Pond liner installation (65 dBA LAeq)
- Dredging of the seabed (65 dBA LAeq)
- Management of dredged material in the DMCP (60 dBA LAmax)
- Post-dredging management of the DMCP (60 dBA LAmax)

The results of noise modelling indicate that:

- noise exceeding the criteria for shorebird disturbance will extend into shorebird habitats of the Caley Valley Wetland for some Project stages as summarised in Table 20 and presented in Figure 8 to Figure 14.
- there was little variability predicted in the distribution of noise contours in response to different weather conditions.

For each modelled Project stage, a single contour was adapted from the three weather conditions modelled, with the selected contour being that which had the maximum overlap with the wetland. This approach provided an estimate of the maximum extent of noise where disturbance is anticipated under a variety of weather conditions. While this method will overestimate the area affected by noise at any given point in time, changes in weather conditions can occur rapidly (in less than an hour) and the response of shorebirds to changes in the noise regime from varying weather conditions may take longer (days or weeks). Such a conservative approach is also most appropriate for the purpose impact assessment.

Predicted cumulative noise contours (incorporating noise from the existing T1 operations) are based on either single noise events (dBA L_{Amax}; Figure 8 to Figure 10, Figure 13 and Figure 14) or steady continuous noise (dBA L_{Aeq}; Figure 11 and Figure 12). The results indicate that construction activities are predicted to produce single noise events above the disturbance criterion for some areas overlapping with and adjacent to the Project's development footprint. Steady continuous noise is not predicted to be generated above the disturbance criterion across most of the Project's development footprint. Modelling of pond liner installation and dredging stages of the Project indicates that continuous noise will mostly be generated by the existing operations of the T1 facility, and largely contained within the T1 site boundary. Further details of the noise modelling results are provided in SLR (2015).

Table 20 Summary of the area of wetland habitat for shorebirds enclosed by the modelled 60/65 dBA contour for various stages of the Project's construction and operations

| Project Stage | Latham's Snipe and Australian Painted Snipe Predicted area of wetland habitat enclosed by 60 dBA L _{Amax} or 65 dBA L _{Aeq} contour (ha) ¹ | Other migratory shorebirds Predicted area of wetland habitat (excluding salt couch) enclosed by 60 dBA L _{Amax} or 65 dBA L _{Aeq} contour (ha) ² |
|--|--|--|
| Topsoil stripping and stockpiling | 21.2 | 14.9 |
| Embankment subgrade preparation | 21.9 | 15.0 |
| Embankment construction | 16.0 | 10.0 |
| Pond liner installation | 0.0 | 0.0 |
| Dredging of the sea bed | 0.0 | 0.0 |
| Management of dredged material in the DMCP | 12.2 | 6.4 |
| Post dredging management of the DMCP | 1.7 | 0.5 |

¹ Relevant to assessment of impacts on Latham's Snipe and Australian Painted Snipe. These species may utilise salt couch on the margins of wet areas.

² Relevant to assessment of impacts on other migratory shorebirds, for which salt couch does not represent important habitat. The mixed salt couch and samphire community has been included as habitat.

Construction noise above the criteria at which disturbance of shorebirds may be expected was predicted to extend into the wetland for construction phases of the Project and for the management of dredged material during and after dredging. Noise levels above the criteria were not predicted to extend into the wetland during pond liner installation and dredging stages of the Project.

Construction and management stages of the Project have the potential to impact on shorebird, behaviour in a small part of the wetland (up to 0.4% of wetland area) through localised shifting of noise-sensitive species and individuals away from the sources of noise. Further assessment of the potential for such impacts is discussed for key shorebird species in Section 8.6, taking into account species-specific ecological requirements and habitat utilisation in the affected parts of the wetland.

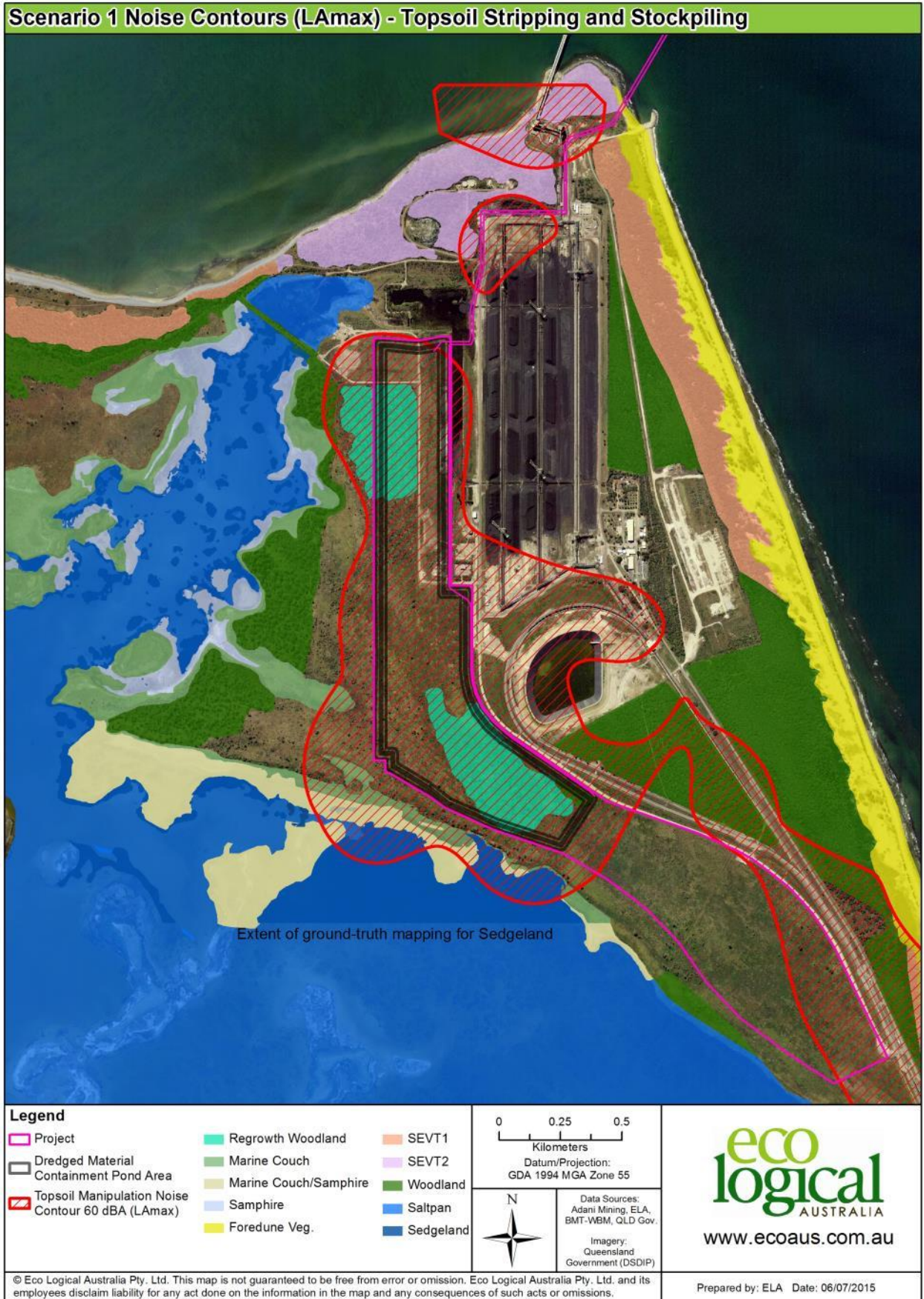


Figure 8 Map showing location of wetland habitat enclosed by the cumulative 60 dBA L_{Amax} contour for topsoil stripping and stockpiling

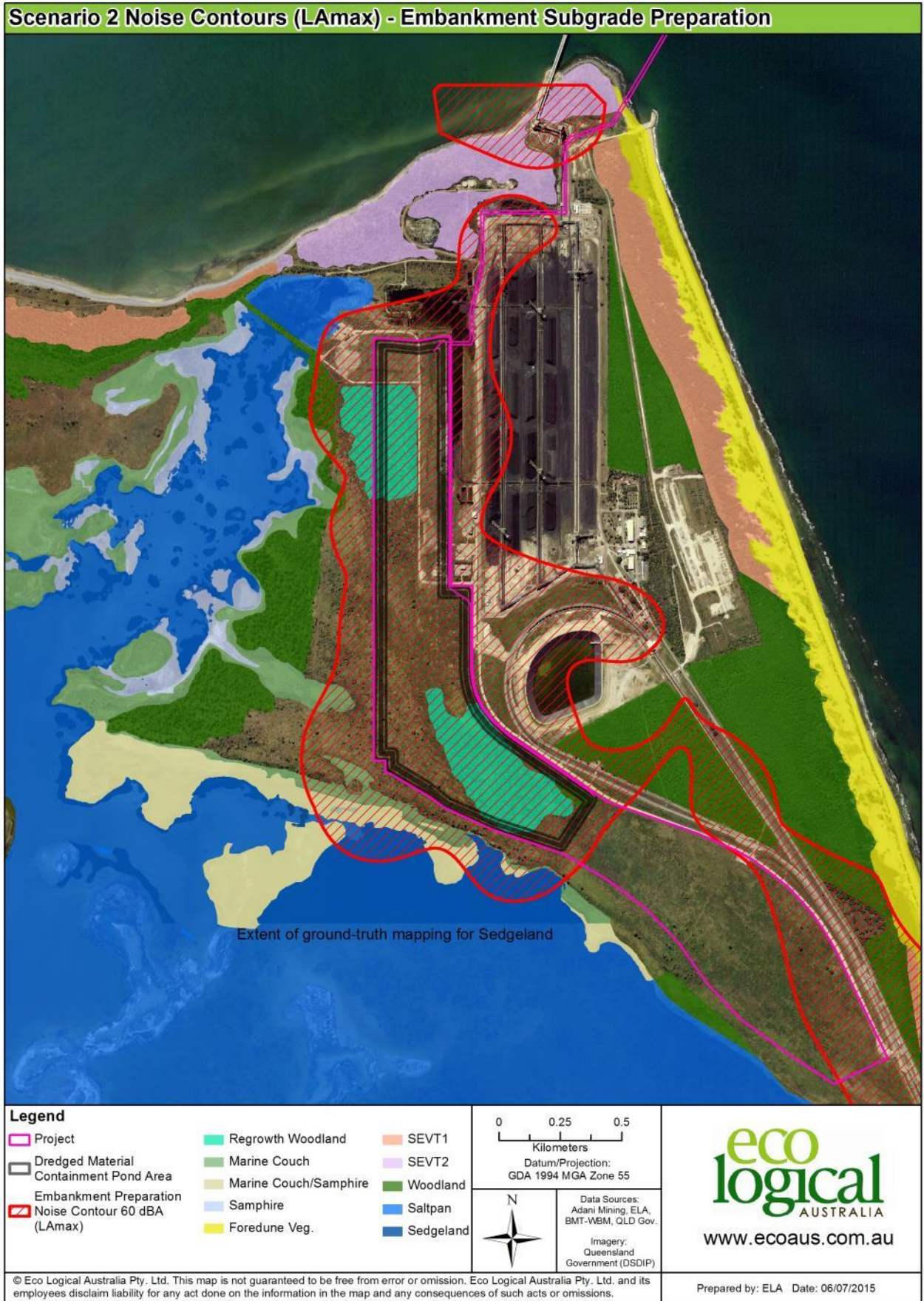


Figure 9 Map showing location of wetland habitat enclosed by the cumulative 60 dBA L_{Amax} contour for embankment subgrade preparation

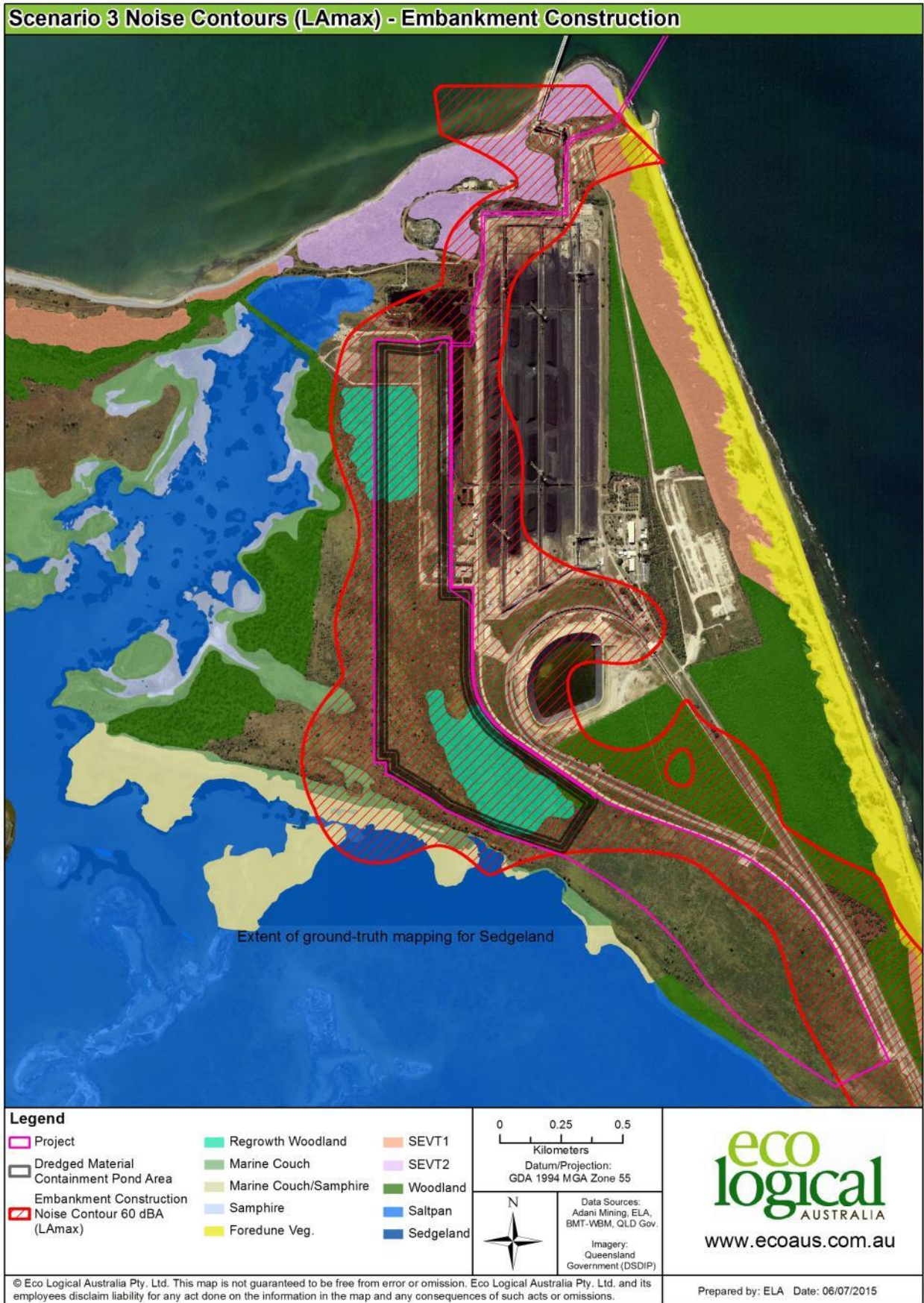


Figure 10 Map showing location of wetland habitat enclosed by the cumulative 60 dBA LAm_{ax} contour for embankment construction

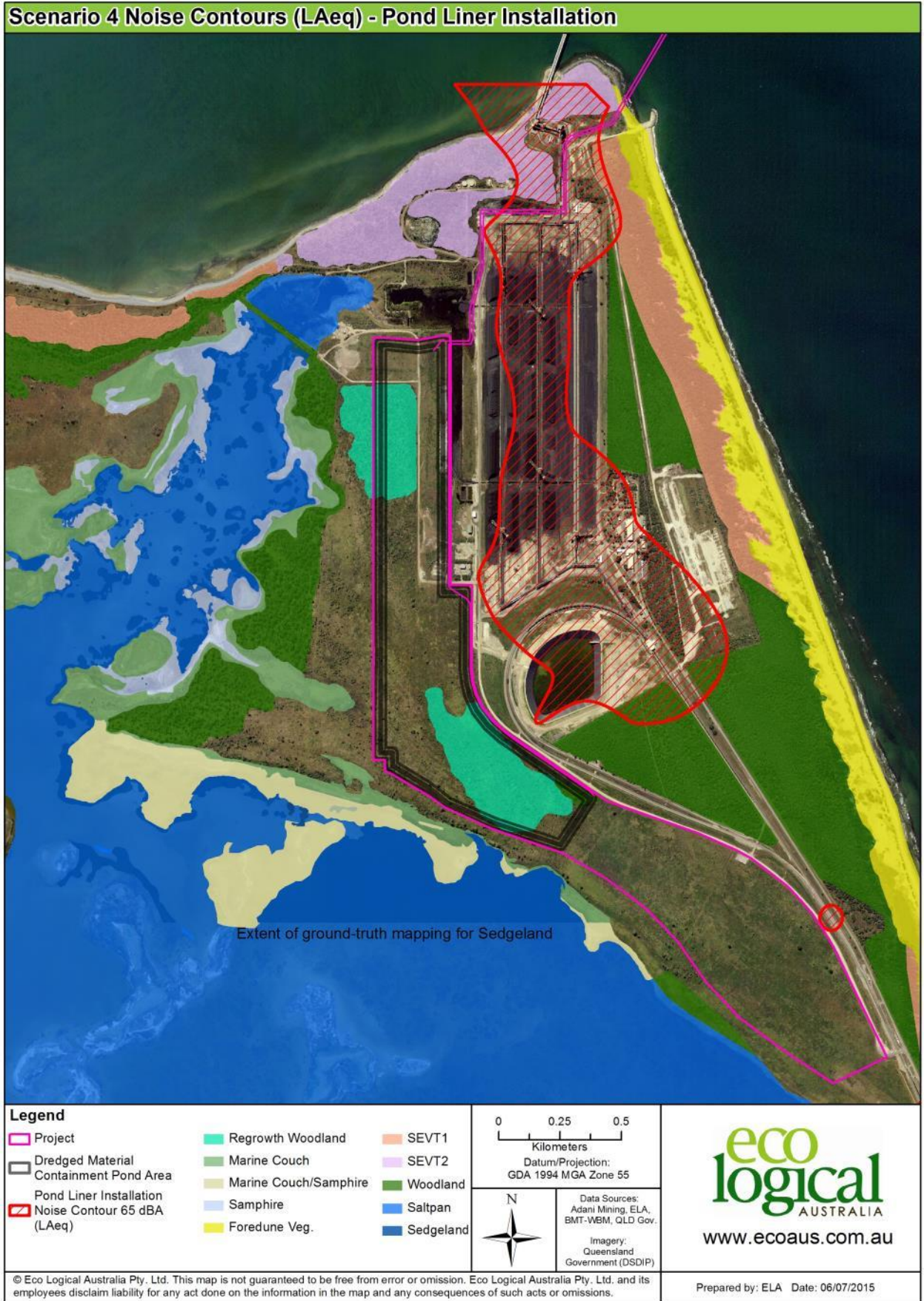


Figure 11 Map showing location of wetland habitat enclosed by the cumulative 65 dBA LAeq contour for pond liner installation

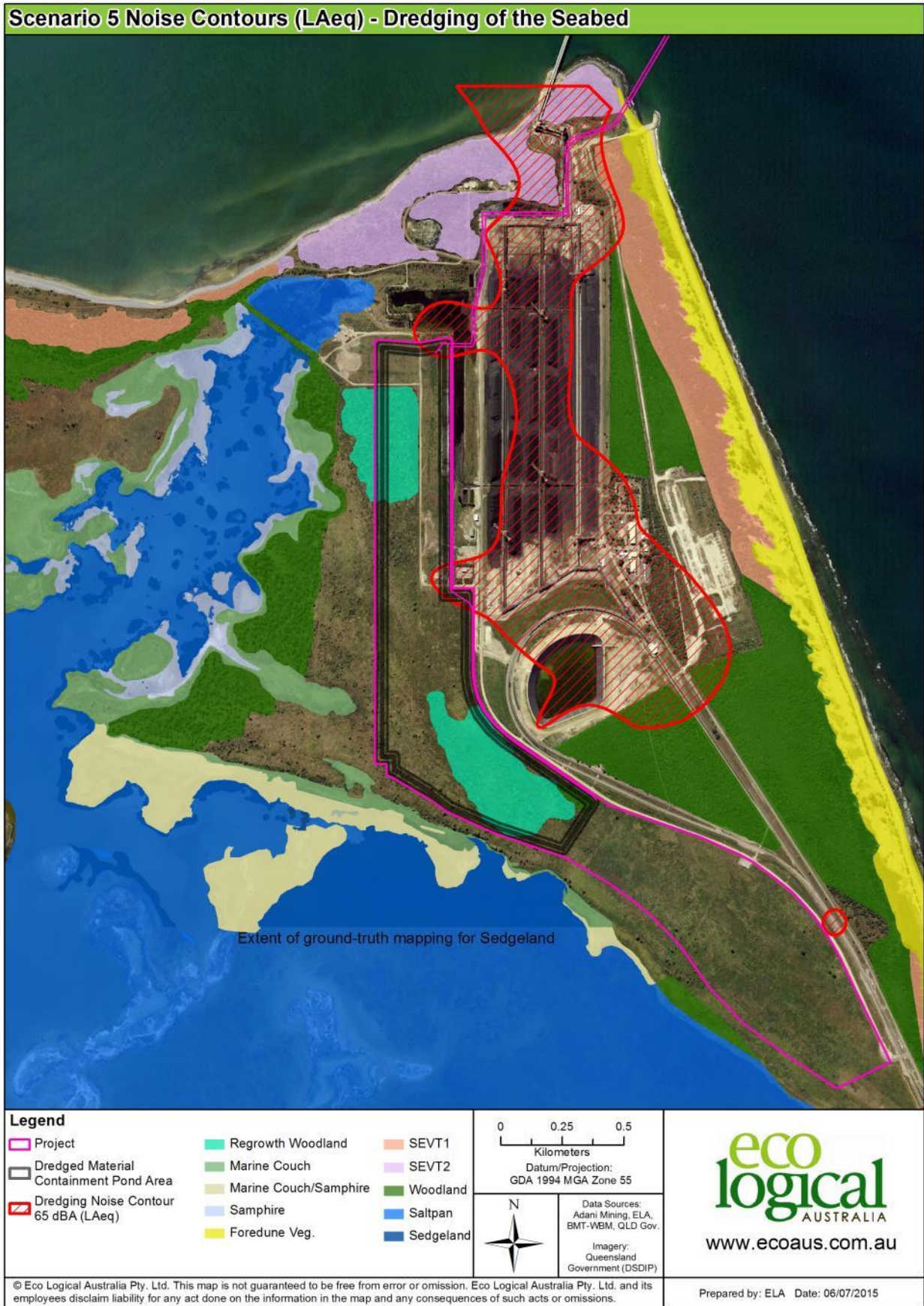


Figure 12 Map showing location of wetland habitat enclosed by the cumulative 65 dBA LAeq contour for dredging of the seabed

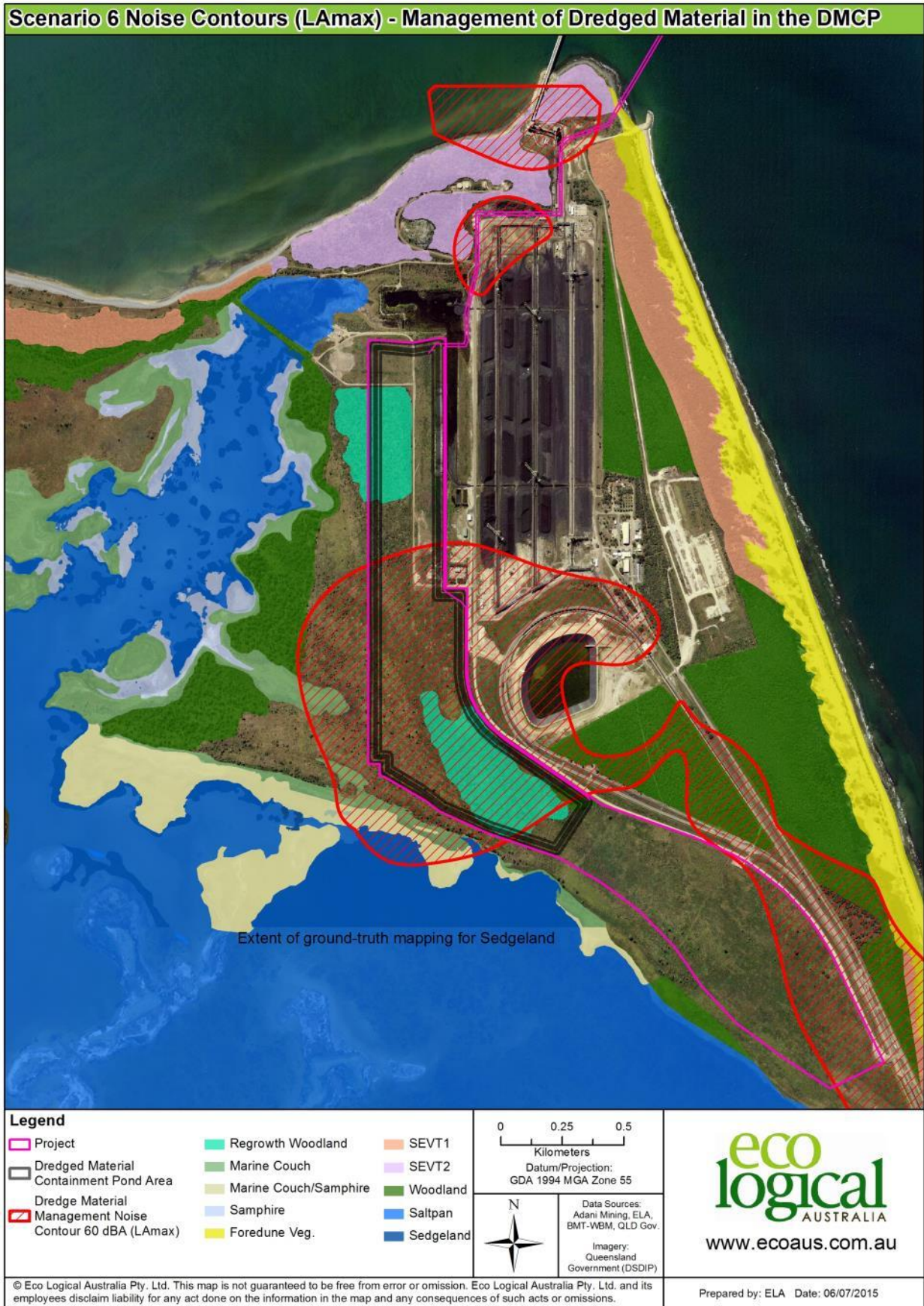


Figure 13 Map showing location of wetland habitat enclosed by the cumulative 60 dBA L_{Amax} contour for management of dredged material within the DMCP

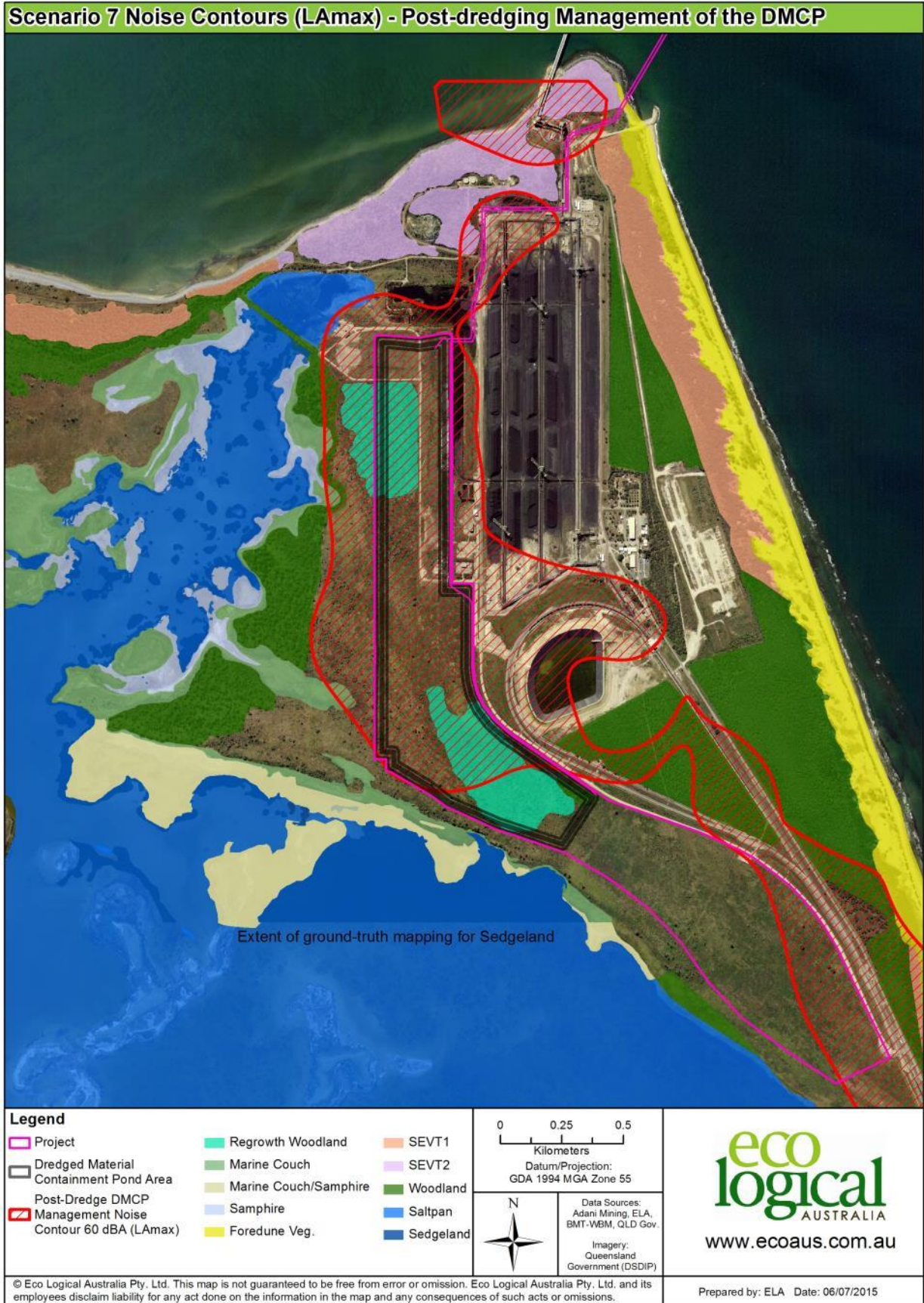


Figure 14 Map showing location of wetland habitat enclosed by the cumulative 60 dBA LAmax contour for post dredging management of the DMCP

8.4.3 Dust

Katestone (2015) undertook dispersion modelling to predict dust concentrations and deposition rates generated by Project construction activities (with and without existing background conditions) in the within the Caley Valley Wetland. The modelling assumed the application of standard dust management practices such as the wetting of soil stockpiles and haul roads.

Maximum dust deposition levels were predicted to be below the vegetation criterion of 200 mg/m²/day (Katestone 2015). Impacts of dust deposition on wetland flora habitats for shorebirds are therefore not anticipated as a result of construction works.

Results of the dispersion modelling in relation to dust concentrations and human health criteria were varied. The PM_{2.5} criteria were not exceeded for 24 hour or annual exposure. This is a positive result, as PM_{2.5} is known to cause greater respiratory problems than the other criteria modelled. Likewise, the TSP result was below the relevant human health criterion of 90 µg/m. However, the modelled PM₁₀ result was predicted to exceed the human health criterion of 50 µg/m for a distance of approximately 600 m into the wetland, covering an area of approximately 111.5 ha (Figure 15).

The human health criteria for sensitive receptors (e.g. residential development) are assessed against ambient air quality objectives such as those contained within the *Environmental Protection (Air) Policy 2008* or the National Environment Protection Measure for Air. However, the potential impacts of dust on construction workers on-site are typically assessed against Workplace Exposure Standards for Airborne Contaminants published by Safe Work Australia. These are less stringent than the ambient air standards, with the Workplace Exposure Standard for rouge dust being 10,000 µg/m³ (at ambient conditions) over an eight hour average (compared with the ambient air objective of 50 µg/m³ for a 24 hour average).

Neither of the above-mentioned approaches to assessing risks to human health from dust were developed with migratory shorebirds in mind. The criteria used in the modelling are considered to be conservative when applied to human health and can be assumed to be conservative for the purposes of assessing impacts on the environment (ELA and Open Lines 2012). However, there is a moderate to high degree of uncertainty in assessing the significance of the predicted exceedance of PM₁₀ dust emissions from the Project, and compliance with criteria for PM_{2.5} and TSP.

The impact of dust particle inspiration on the health of wild birds is not well-understood (Brown *et al.* 1997, Kiama *et al.* 2008). It has been suggested that birds, moving about their environment and taking up the large amounts of oxygen required for flight, could be utilised as sensitive monitors of air quality (Brown *et al.* 1997). However, there are many distinct differences (morphologic, physiologic, and mechanical) between the bird's lung-air-sac respiratory system and the mammalian broncho-alveolar lung (Brown *et al.* 1997), which hinder the transferability of dust exposure impacts on humans, to birds.

The sites of inhaled nanoparticle deposition within the respiratory systems of wild birds are not well-known. However, in domestic chickens particles with a diameter of approximately 1.1 µm are most frequently deposited in the lungs, abdominal and post-thoracic air sacs, with larger (3.7 - 7 µm) and smaller (0.3 µm) diameter particles deposited in greater numbers in the anterior (forward) portion of the respiratory system (Hayter and Besch 1974).

Birds living in environments contaminated with aerosolized particulates show significant effects of particle inhalation after only a short duration of exposure. Examples include Kiwis foraging in loose dust and sand, birds living in or near desert-like conditions and birds exposed to volcanic ash (Brown *et al.* 1997). Birds in chronic dusty conditions such as lay-houses have significantly decreased production and other observable effects (Brown *et al.* 1997). A study monitoring the inhalation of sterile dust (mean

concentration of 101 - 103 mg/cm³) by four-weeks-old chickens for four weeks found this caused a significant loss of hairs in the lining of the upper part of the trachea, increased mucous secretion, and inflammation of the alveoli – the areas of gas exchange (Collins 1986).

Some of the major adverse health effects of particle exposure in humans are decreased lung function, altered muco-ciliary clearance, chronic obstructive pulmonary disease, asthma, and increased mortality. Although they have different respiratory systems, the physiological impacts of short-term and chronic dust exposure for birds and humans are similar. As such, the exposure of migratory birds to dust and associated small-particles, even for short periods of time, may have adverse impacts on lung function and the capacity for long-distance movements.

An assessment of the available information indicates that dust produced by construction phases of the Project is likely to have a minor impact on migratory shorebirds, for the following reasons:

- Modelled dust concentrations meet human health criteria for two of the three parameters assessed
- Dust concentrations are likely to comply with Workplace Exposure Standards of Work Safe Australia for construction workers on-site (not modelled in this assessment),
- The human health criteria modelled are conservative and are generally applied to activities involving long-term exposure (e.g. residential development)
- The 111.5 ha of wetland habitats where the PM₁₀ criterion is predicted is equivalent to 2.2% of the Caley Valley Wetland
- Dust management strategies exceeding those assumed in the air quality model will be implemented, reducing actual dust concentrations below those of the modelled results
- Shorebirds are mobile and are unlikely to stay continuously within any areas of the wetland. Any exposure to dust is therefore highly unlikely to be continuous.
- Construction stages of the Project may be conducted during periods when the wetland is dry or migratory shorebirds are not present
- Construction activities and therefore the generation of dust may not be conducted continuously
- Dust deposition rates are below the thresholds at which impacts on wetland vegetation would occur
- Water quality (and consequently shorebird prey) is unlikely to be affected by dust deposition

However, there is a moderate to low degree of certainty relating to the assessment of impacts of dust on shorebirds. Therefore, a further analysis of potential impacts of dust (and other modes of disturbance) is provided for key shorebird species in Section 8.6, utilising species-specific data on habitat utilisation.

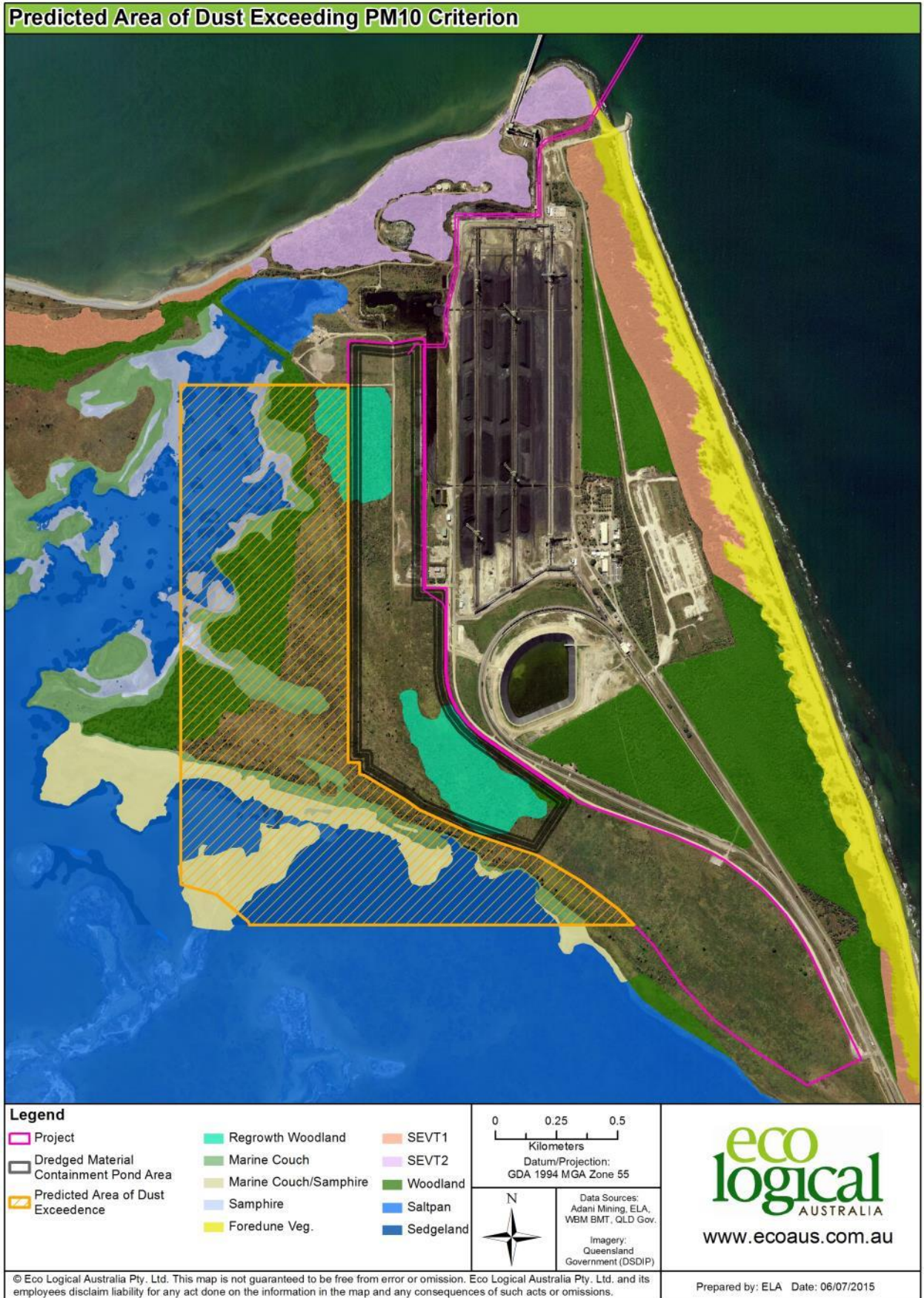


Figure 15 Predicted Area of dust exceeding PM₁₀ criterion

8.4.4 Increased human activity

Increased activity by people within the Project Area and surrounds has the potential to disturb migratory shorebirds and the Australian Painted Snipe.

The major consequence of irregular disturbance is a potential shift to alternative feeding or roosting sites. The time and energy costs as a result of disturbance can be more damaging than permanent habitat loss (West and Caldwor 2006).

In the case of sustained disturbance, migratory shorebirds and Australian Painted Snipe may be deterred from using certain areas through avoidance thereby marginalising some areas of habitat. The result of this avoidance and corresponding displacement may mean that additional pressure is placed on other areas of the wetland. This effect would be more pronounced when water levels and therefore available feeding resources in the wetland are low.

The response of shorebirds to disturbance varies among species. Glover *et al.* (2011) determined the distance at which shorebirds would take flight after being disturbed. Of those species relevant to this assessment, these distances are:

- Red-necked Stint – 18.75 m
- Sharp-tailed Sandpiper - 20.20 m
- Latham's Snipe - 18.63 m.

Oldland *et al.* (2009) also described the distance at which shorebirds flee from people, with the following distances for those species present at Abbot Point:

- Latham's Snipe – 19 m
- Eastern Curlew – 126 m

These data suggest that there is variability in the response of shorebird species to disturbance, and that the area of terrestrial land between the Project Area and wetland habitats (minimum of 50 m) is likely to mitigate the risk of disturbance for all but the most sensitive of shorebird species. Indeed, in most sections of the wetland fringe, this area exceeds 150 m in width. Management of this area during construction and operations will focus on minimising human activity, so that the area can act as a buffer for disturbance to shorebirds.

It should also be noted that alert responses to disturbance (e.g. freezing or cessation of foraging) occur at distances greater than those at which a flight response is initiated (Paton *et al.* 2000). This would particularly be the case for Latham's Snipe and the Australian Painted Snipe which are known to be sensitive to disturbance. Such impacts on key shorebird species are examined in more detail in Section 8.6.

Increased activity within the buffer area between the wetland and Project Area could lead to disturbance and reduce the habitat availability for migratory shorebirds and the Australian Painted Snipe. Managing access to the wetland is recommended for reducing the potential impacts of disturbance, particularly at the southern end of the DMCPs, where the buffer is at its narrowest (approximately 50 m).

8.4.5 Lighting

The Project Area will be lit at night during construction phases and work may continue 24 hours a day if required to meet Project construction schedules. Lighting is required for operational and safety reasons

to facilitate works such as the construction of pond embankments and placement of dredged material within the DMCPs.

Birds within the Caley Valley Wetland are likely to be the most sensitive MNES for increases in Project-related lighting. Like noise and other forms of human disturbance, increased light levels at night can be expected to affect different shorebird species in different ways. Potential impacts include disruption of natural feeding and resting behaviours, increased visibility of shorebirds to predators and increased levels of general disturbance. At least some species may benefit from increased light conditions, as they are visual feeders and are more active foragers on well light nights or in areas adjacent to industrial development (e.g. Dwyer *et al.* 2013).

The Project Area is located within a port industrial precinct and immediately adjacent to the existing T1 operating coal terminal. In this context, lighting from the Project will add to that which is already present within an existing industrial landscape. There have been extensive previous studies of the predicted impacts of industrial light produced by proposed port developments at Abbot Point. These include the Abbot Point CIA (ELA and Open Lines 2012) for a multi-user port facility, and the T0 EIS (CDM Smith 2013).

The Abbot Point CIA predicted that direct light spill into the Caley Valley Wetland from development of the T0, T2 and T3 coal terminal facilities would be approximately 0.5 ha. The T0 EIS identified direct light spill of 0.2 ha onto a turtle nesting beach during construction of a marine offloading area, and an increase in the night time sky glow of the Abbot Point region. Collectively, these studies indicate that the magnitude of light impacts from extensive development activities at the port can be expected to be relatively small, in comparison with the scale of the Caley Valley Wetland (5,154 ha).

As described in Section 5.4.7, night time construction activities will be supported by mobile and directional light towers which have an illumination footprint of approximately 60 m from the source (when facing directly down towards the ground). Lights will only be used to produce sufficient light required for safety and operational purposes, and will be directed away from the wetland, towards the work area. In this context, direct light spill from the Project is anticipated to be contained within the area of terrestrial land between the wetland and Project Area. This area of off-site impacts is a minimum of 50 m and greater than 150 m along the majority of the wetland fringe and will act as a buffer from direct impacts within the Project Area.

Impacts from light on migratory shorebirds are therefore assessed to be low. There is a high degree of certainty associated with this assessment.

8.4.6 Changes to stormwater and groundwater regime

Hydrological and groundwater modelling has predicted that there will be no impact of the Project on elements of the wetland environment important to migratory shorebirds (AGE 2015; BMT WBM 2015). Existing groundwater levels are approximately 2.2 m to 5.4 m below existing ground level (AGE 2015), with mixed fresh and saline waters from dredged material unlikely to affect existing groundwater quality or function.

Changes in water quality within the wetland are expected to be minimal (less than 2 ppt of salinity in the eastern bund area). Changes to the hydrology of the wetland margins utilised by shorebirds are also not expected. In the event of the fuse plug being utilised for an emergency stormwater discharge, impacts will be localised and mitigated by the large amount of water flowing naturally through the wetland, given the magnitude of a rainfall event that would trigger a stormwater discharge requirement.

8.5 Mitigation and management measures

8.5.1 Mortality or injury

While mortality of migratory shorebirds and the Australian Painted Snipe through structural or vehicular strike is not considered likely, it is recognised that construction and operational activities may lead to some level of impact.

The following specific measures will be implemented to address this potential impact:

- Personnel operating vehicles in and adjacent to the project area should be made aware of the presence of migratory shorebirds and Australian Painted Snipe and the potential for individuals to be encountered
- Appropriate speed limits should be sign-posted, included in staff inductions and enforced.
- Vehicles to be limited to traversing approved roads and tracks
- No unauthorised access by vehicles unless required for construction, operation, maintenance or inspections.

8.5.2 Construction noise

The following specific measures should be implemented to address the potential impact of construction noise during construction of the DMCP:

- Use of plant with efficient muffler design.
- Vehicles, plant and equipment will be maintained in accordance with manufacturer's specifications.
- Adjustment of reversing alarms on plant to limit the acoustic range to the immediate danger area.
- Plant and equipment of appropriate size / capacity for the task will be used.
- Use of quieter engines and newer, quieter equipment where practicable.

However, even with the application of these requirements some spill of noise above criteria which can be expected to result in disturbance is likely to occur.

8.5.3 Increased human activity

The extent of migratory shorebird alert and alarm responses to anthropogenic disturbance should be minimised through restricted access to designated areas of the wetland and the buffer between the DMCPs and wetland. However, in the event that access is essential, it is likely that any area subject to disturbance would remain in close proximity to the Project Area (for most species, less than 50 m from the edge of the development). On-site personnel should be made aware of the presence of migratory shorebirds and Australian Painted Snipe and avoid wandering into the wetland areas or adjacent beach habitats.

8.5.4 Lighting

The following mitigation measures will be applied to reduce the impact of Project lighting on shorebirds:

- Use directional lighting and shrouds to protect the Caley Valley Wetland from direct light
- Use mobile light towers which can be moved and adjusted to provide lighting for construction purposes, while minimising lighting of unused areas
- Maintain a buffer area between construction lighting and the Caley Valley Wetland

8.5.5 Changes to stormwater and groundwater regime

Hydrological and groundwater modelling has predicted that there will be no impact of the Project on elements of the wetland environment important to migratory shorebirds (AGE 2015; BMT WBM 2015). Changes in water quality within the wetland are expected to be minimal (less than 2 ppt of salinity in the

eastern bund area). Changes to the hydrology of the wetland margins utilised by shorebirds are also not expected. In the event of the fuse plug is utilised for an emergency stormwater discharge, impacts will be localised and mitigated by the large amount of water flowing naturally through the wetland, given the magnitude of the rainfall event.

8.6 Assessment of Project impacts on key migratory shorebird species

This section extends the assessment of Project impacts on migratory shorebirds as a group to consider impacts on key shorebird species identified as important to the impact assessment in Section 8.3. Sighting records and ecological characteristics are examined for each species to assess susceptibility to potential off-site and indirect impacts discussed above. Species with similar sighting records and/or ecology have been discussed together to avoid repetition. The objective of the analysis is to reduce uncertainty in the assessment of potential impacts by examining:

- Evidence of habitat utilisation by key species within the wetland areas susceptible to off-site and indirect impacts
- Behavioural traits that may reduce or increase the susceptibility of key species to off-site impacts.

8.6.1 Eastern Curlew and Curlew Sandpiper

The Eastern Curlew utilises estuarine sections of the Caley Valley Wetland, including the Open Pan and Intertidal zones. These habitats are located at least 3 km west of the Project Area and are highly unlikely to be influenced by Project activities. The species has also been recorded roosting on Dingo Beach approximately 500 m from the Project Area (BMT WBM 2012). However, the roosting habitat is located well beyond (400 m) the predicted location of noise and dust criteria contours, and is screened by remnant SEVT and woodland vegetation (Figure 16). Accordingly, no disturbance of the roost sites utilised by the Eastern Curlew is anticipated.

While estuarine and coastal sections of the Caley Valley Wetland are utilised by the Eastern Curlew, the Project is not located in close proximity to feeding or roosting habitats of the species and several management and mitigation measures will be implemented to avoid off-site impacts in these areas. In this regard, there is a high degree of certainty that impacts of the Project (either directly or indirectly) on the species are unlikely.

The Curlew Sandpiper was been sighted by BMT WBM (2012) in the central section of the Closed Marsh approximately 2 km south west of the Project Area. The species was not recorded by BAAM (2012) during their extensive surveys of the wetland in 2012. The species has not been recorded within the predicted location of noise and dust criteria contours adjacent to the Project Area (Figure 17).

The Curlew Sandpiper appears to be an infrequent visitor to the Caley Valley Wetland. There is no evidence to suggest that wetland habitats adjacent to the Project Area are preferred by the species, although they may be suitable at certain times of the wetland's seasonal and ephemeral wetting and drying cycle. Several management and mitigation measures will be implemented to avoid off-site and indirect impacts in these areas. There is a moderate to high degree of certainty that impacts of the Project (either directly or indirectly) on this species are unlikely.

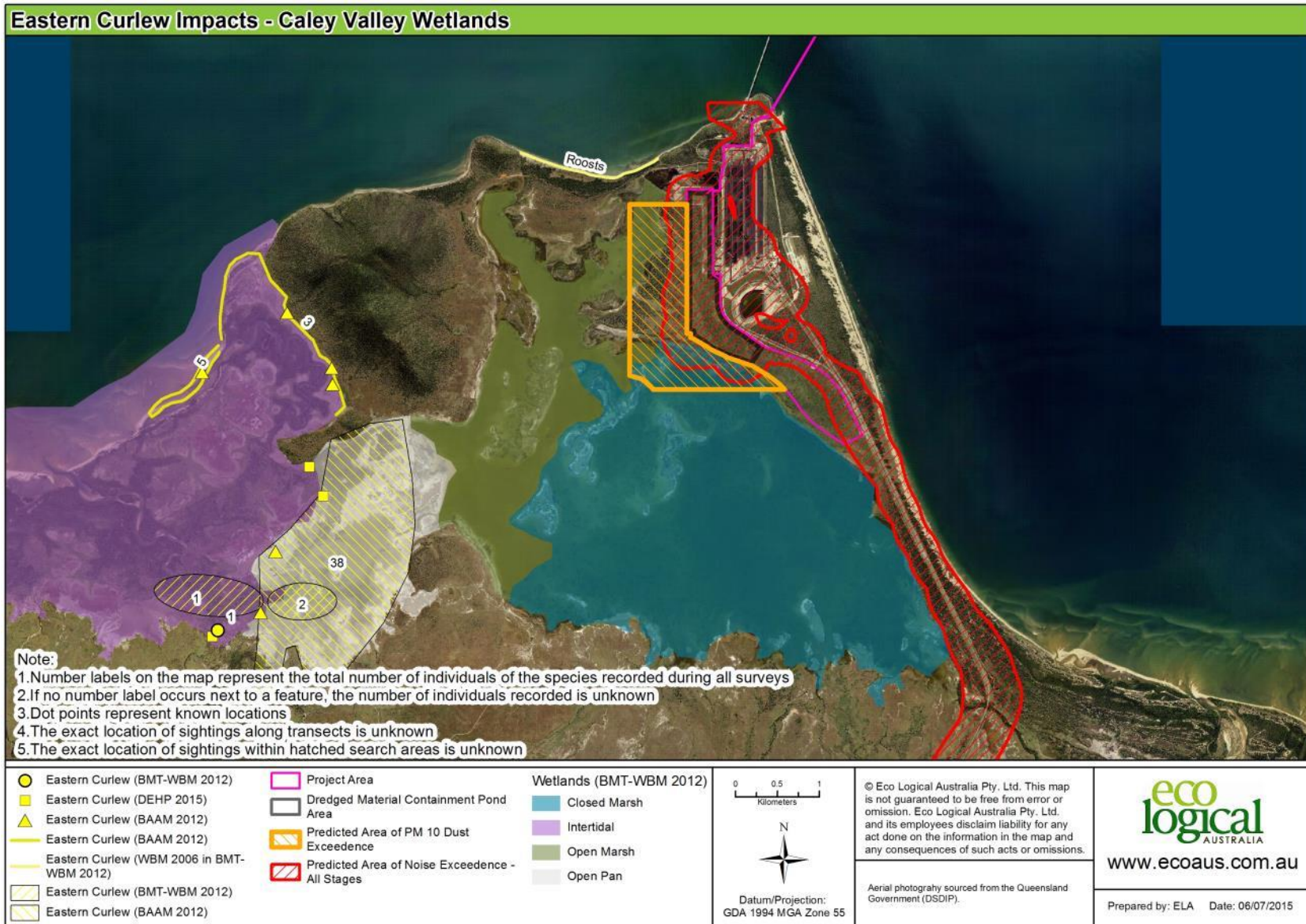


Figure 16 Map showing the location of Eastern Curlew sightings and areas of wetland predicted to be influenced by Project activities

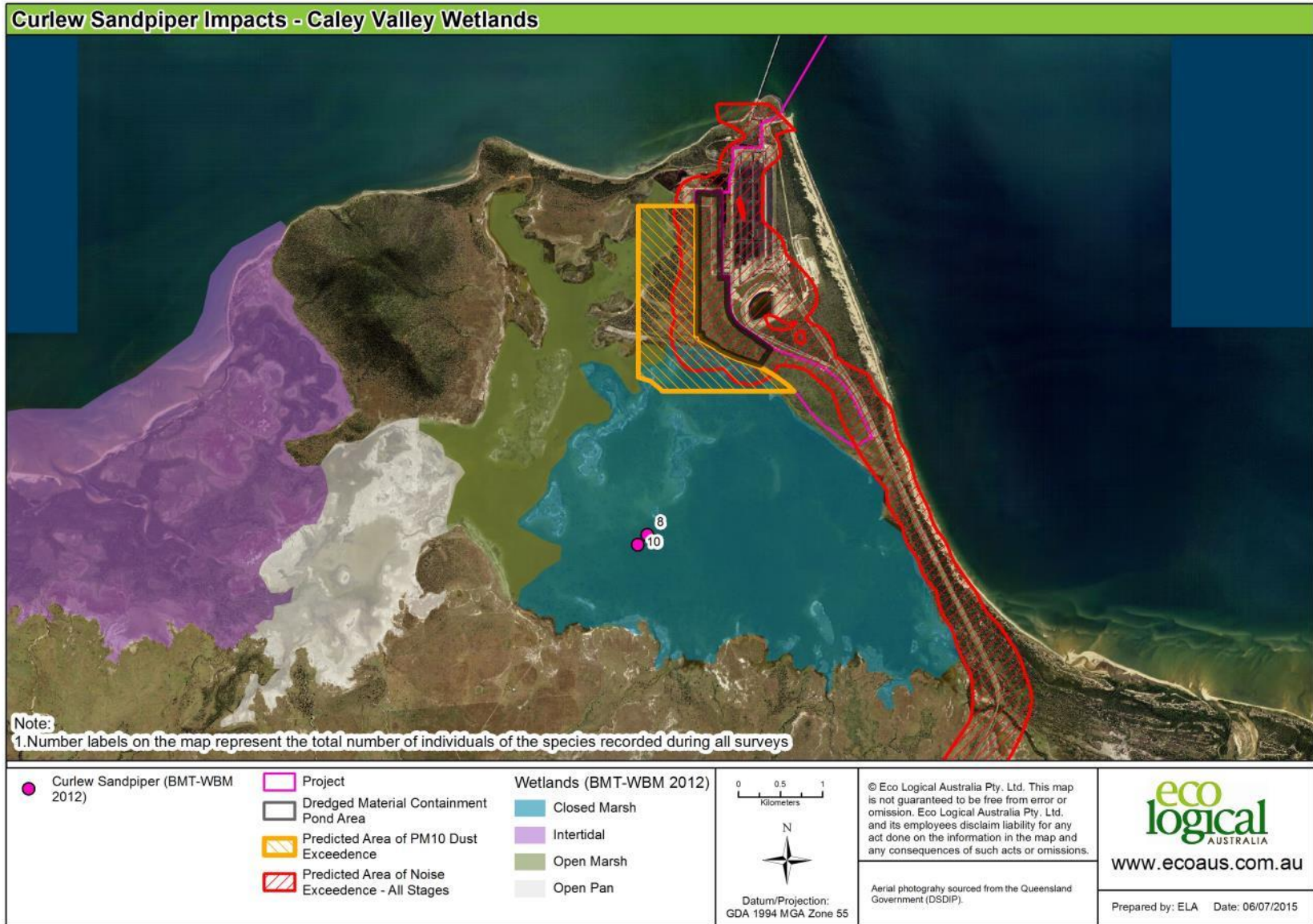


Figure 17 Map showing the location of Curlew Sandpiper sightings and areas of wetland predicted to be influenced by Project activities

8.6.2 Latham's Snipe and Australian Painted Snipe

Latham's Snipe has been sighted throughout eastern sections of the Caley Valley Wetland, utilising a range of habitats within the Open and Closed Marsh zones. Latham's Snipe is likely to have been recorded in the area where off-site impacts from noise and dust are possible (Figure 18). There is some uncertainty about this, as the sightings data are from transects rather than points of observation.

The Australian Painted Snipe has been sighted throughout eastern sections of the Caley Valley Wetland, utilising a range of habitats within the Open and Closed Marsh zones. The species has been sighted on nine occasions adjacent to the Project Area (Figure 20), and to the north, south and west of the Project Area. Sightings data for the Australian Painted Snipe include point locations, with a small number of confirmed sightings occurring within the area where predicted noise and PM₁₀ dust contours extend (potential for off-site impacts).

Unlike the other key shorebird species considered in this assessment, the preferred habitat of the Latham's Snipe and Australian Painted Snipe include grasslands (including marine couch) where they occur at the water's edge and are not dense. Such habitats occur closest to the Project Area, and would be suitable for both snipe species at times when the wetland is full of water. The snipe species therefore have the greatest area of suitable habitat that may be influenced by off-site and indirect impacts from the Project. Both species have been demonstrated to utilise a variety of habitats throughout the eastern Caley Valley Wetland, most likely in response to the location of suitable habitat during various stages of the wetland's wetting and drying cycle.

The sighting records and habitat use for the Latham's Snipe and Australian Painted Snipe indicate that the species utilise wetland habitats adjacent to the Project Area, and therefore have the potential to be impacted by the Project. However, these impacts are considered unlikely to be significant for the following reasons:

- the Project Area does not contain habitat for the species, so the potential impacts are from disturbance (i.e. off-site and indirect impacts).
- the strip of terrestrial land between the Project Area and the wetland (where off-site impacts on fauna could generally be expected) is not preferred habitat for the species, beyond the height of wetland inundation (Figure 19; Figure 21)
- the area of habitat that may potentially be disturbed by noise/dust/light is small (21.9 ha or 0.4% of the wetland for noise; 111.5 ha or 2.2% of the wetland for PM₁₀ dust) relative to the total area of habitat available and demonstrated to be used by the species
- construction activities that will generate the disturbances will be in place for a short period of time (~3 months). In the case of the Latham's Snipe, this is less than an entire migratory bird season) and may occur outside of the season entirely
- ecological values supporting foraging behaviour (e.g. macroinvertebrates) and roosting (e.g. vegetation complexes and wetland areas) are very unlikely to be degraded by construction activities and will still be available to the species following the period of temporary disturbance
- numerous management and mitigation measures will be implemented to keep disturbance to a minimum
- this species are highly mobile and can move to other areas for foraging and roosting if disturbed
- shorebirds have been shown to become habituated to noise within other port settings (e.g. at the Port of Brisbane)

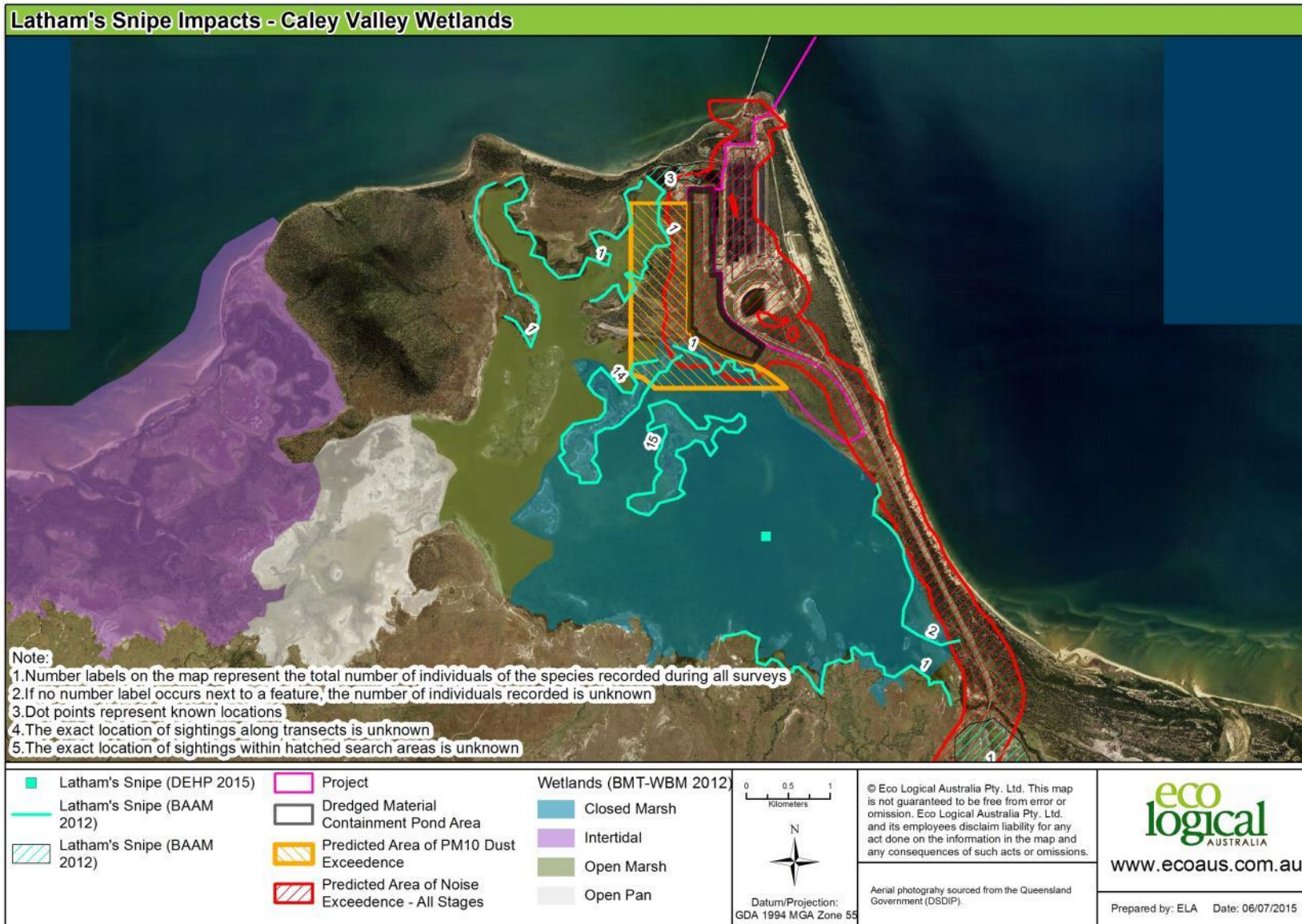


Figure 18 Map showing the location of Latham's Snipe sightings and areas of wetland predicted to be influenced by Project activities

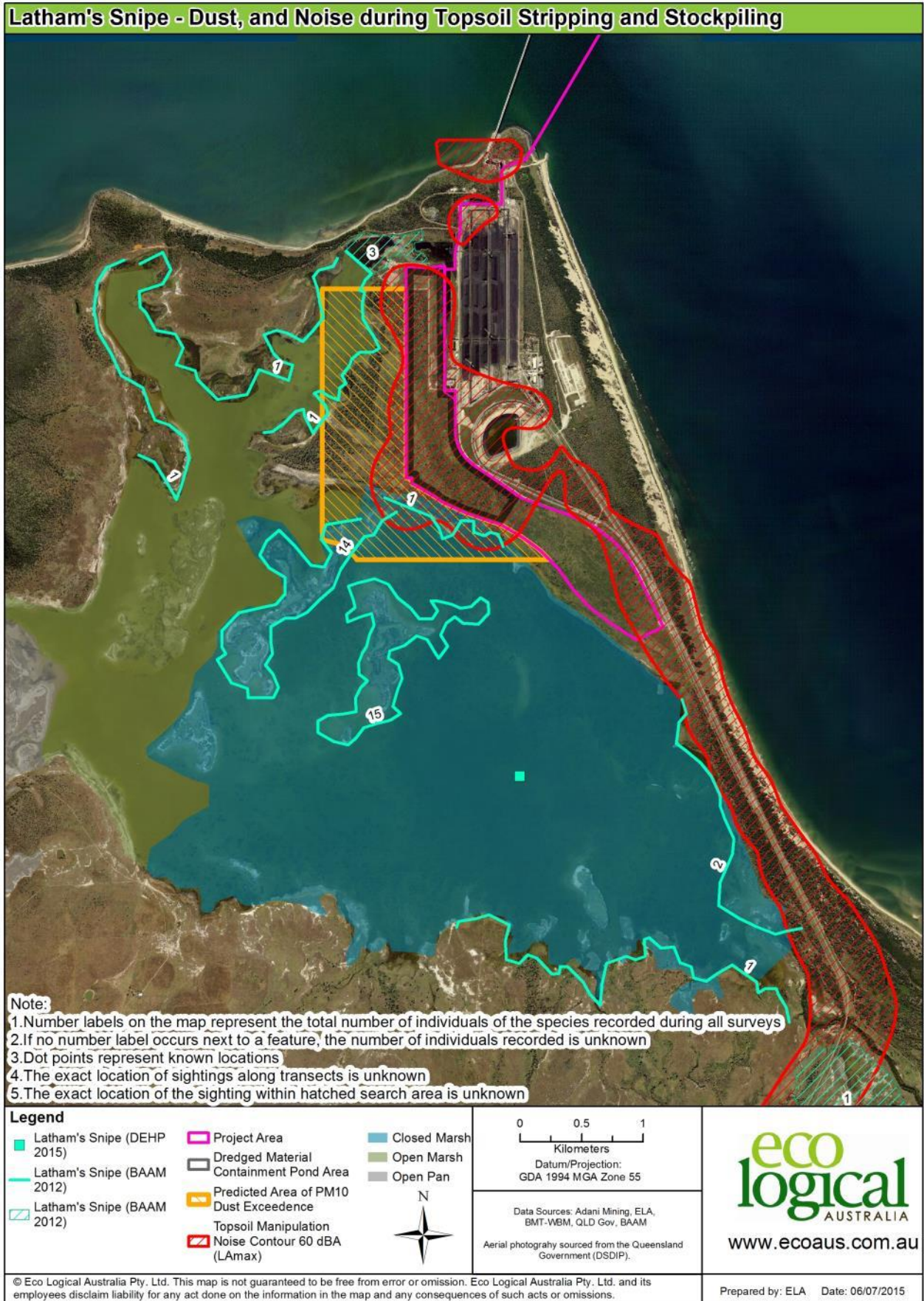


Figure 19 Enlarged map showing Latham's Snipe sightings and areas of wetland predicted to be influenced by topsoil stripping and stockpiling

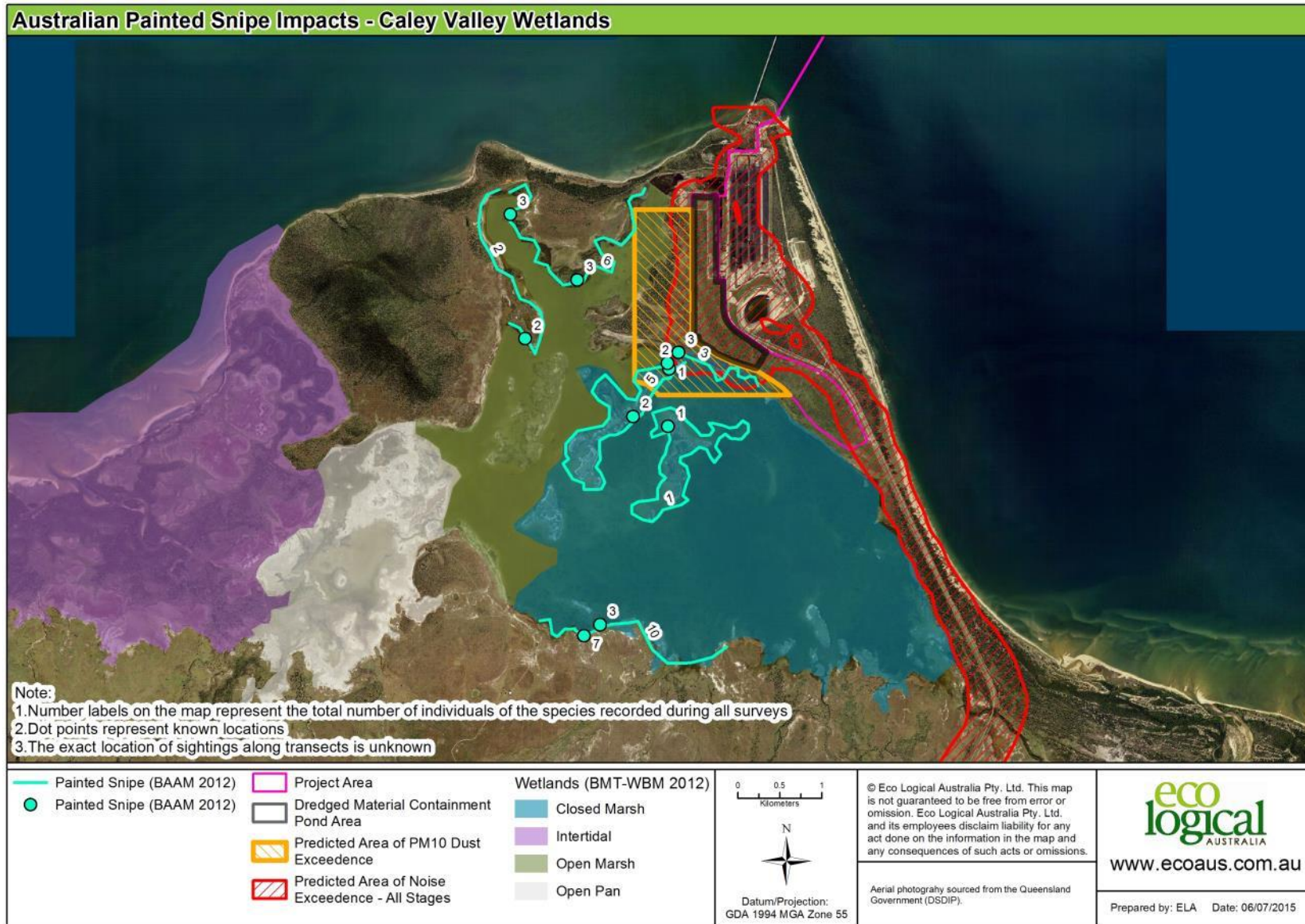


Figure 20 Map showing the location of Australian Painted Snipe sightings and areas of wetland predicted to be influenced by Project activities

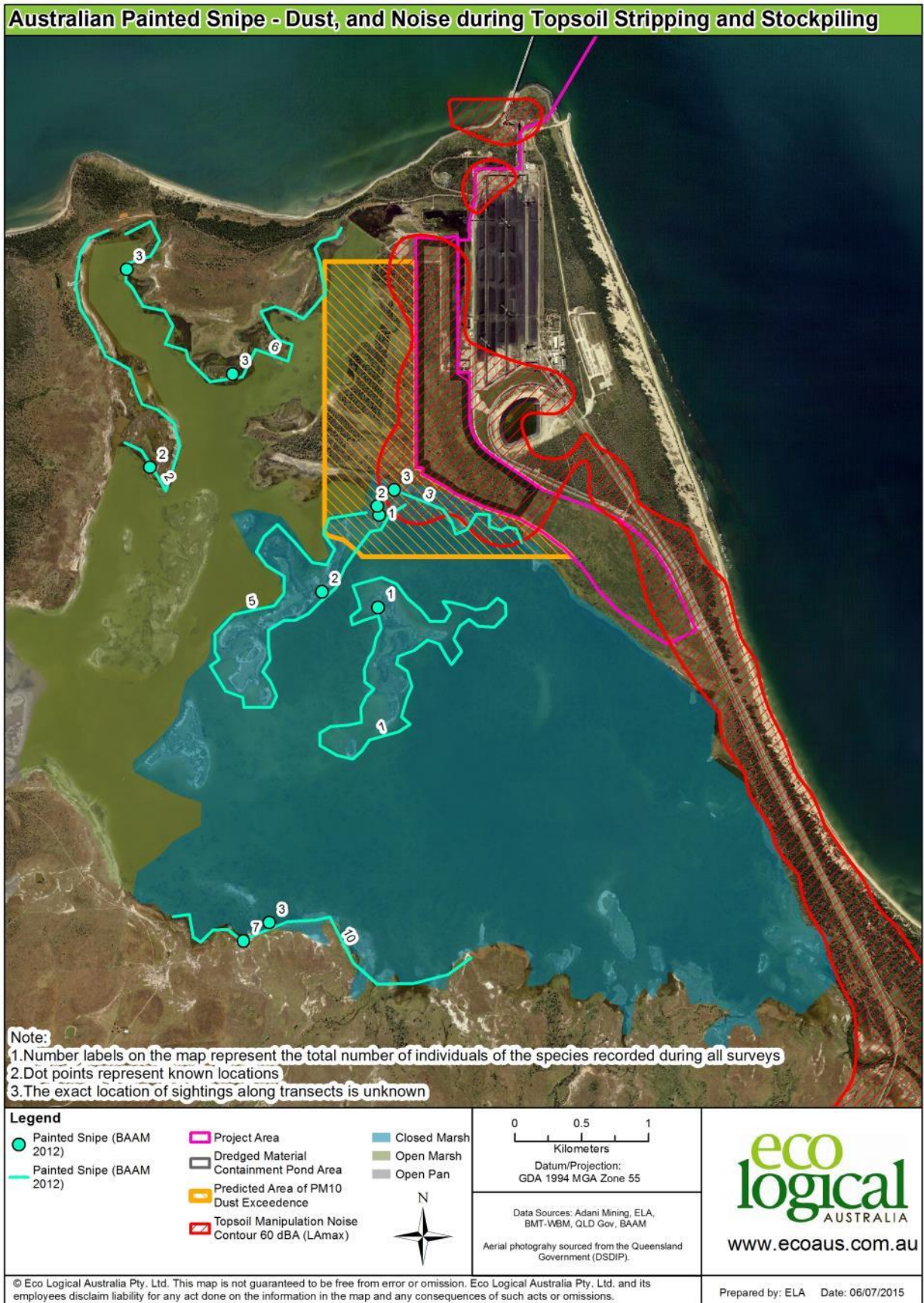


Figure 21 Enlarged map showing Australian Painted Snipe sightings and areas of wetland predicted to be influenced by topsoil stripping and stockpiling

8.6.3 Red-necked Stint, Common Greenshank and Marsh Sandpiper

The Red-necked Stint has been sighted in large numbers within the Caley Valley Wetland, and utilising a range of habitats including the estuarine Open Pan Zone, coastal beaches, Lake Caley and the southern wetland fringe. There are two records of the species relevant to the assessment of off-site and indirect impacts of the Project (Figure 22). The first is a single individual observed near the noise contour at the northern extent of the Open Marsh Zone. The exact location of the sighting is unknown, and 90% of the sighting area extends beyond the noise contour, where noise less than that likely to cause disturbance is predicted to occur. A second record of 10 individuals along the eastern beach is also relevant to the assessment of Project impacts, due to the intersection of this area by the temporary pipeline alignment.

The Common Greenshank has been sighted within the Caley Valley Wetland, utilising a range of habitats including the Open Pan, Open Marsh and Closed Marsh Zones. The species has been recorded along the south eastern fringe of the wetland, including areas where existing rail noise extends to the wetland fringe (Figure 23). There is one confirmed sighting of the Common Greenshank adjacent to the Project Area, within the modelled contours for PM₁₀ dust and noise.

The Marsh Sandpiper has been sighted within the Caley Valley Wetland, and utilising a range of habitats including the Open Pan, Open Marsh and Closed Marsh Zones. The species appears to have a preference for the Closed Marsh Zone, with extensive sightings around Lake Caley and the southern wetland fringe 1.5 km south of the Project Area (Figure 25). There are two confirmed sightings adjacent to the Project Area, within the modelled contours for PM₁₀ dust and noise (Figure 26).

The sighting records and habitat use of the Red-necked Stint, Common Greenshank and Marsh Sandpiper indicate that these species may use an area in the vicinity of the Project Area and therefore have the potential to be impacted by the Project. However, these impacts are considered unlikely to be significant for the following reasons:

- the Project Area does not contain habitat for the species, so the only potential impacts are from disturbance (i.e. off-site impacts).
- the area of terrestrial land between the Project Area and wetland is not preferred habitat for the species, given the observed patterns of wetland use (Figure 24; Figure 26).
- the area of habitat that may potentially be disturbed by noise/dust/light is small (15 ha 0.3% of wetland for noise; 111.5 ha 2.2% of wetland for PM₁₀ dust) relative to the total area of habitat available and shown to be used by the birds
- construction activities that will generate the disturbances will be in place for a short period of time (~3 months, which is less than an entire migratory bird season) and may occur outside the season entirely
- ecological values supporting foraging behaviour (e.g. macroinvertebrates) and roosting (e.g. vegetation complexes and wetland areas) are very unlikely to be degraded by construction activities and will still be available to the species following the temporary disturbance period
- numerous management and mitigation measures will be implemented to keep disturbance to a minimum
- the species are highly mobile and can move to other areas for foraging and roosting if disturbed
- shorebirds have been shown to become habituated to noise in other port settings (e.g. at the Port of Brisbane)

Red-necked Stint Impacts - Caley Valley Wetlands

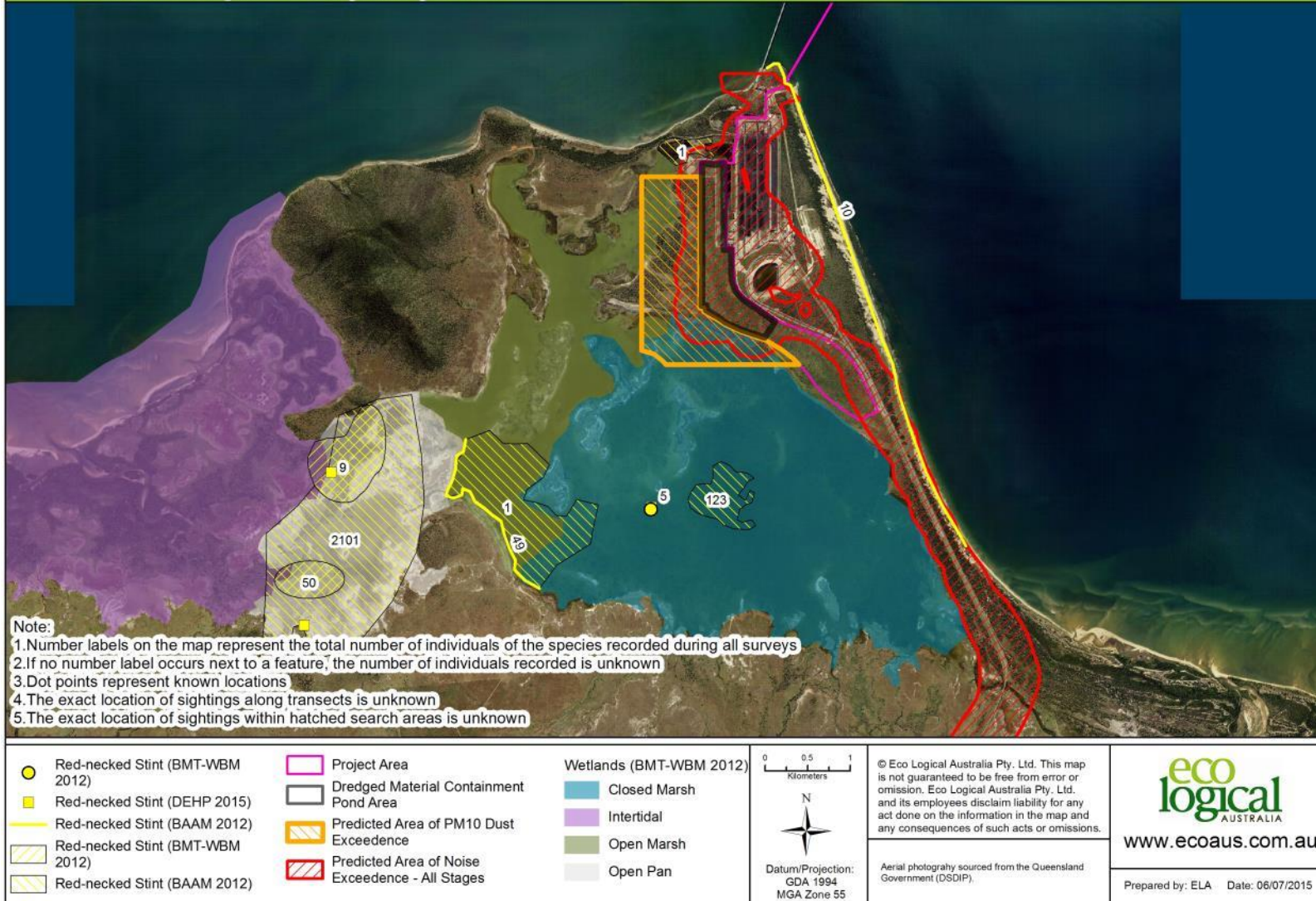


Figure 22 Map showing the location of Red-necked Stint sightings and areas of wetland predicted to be influenced by Project activities

Common Greenshank Impacts - Caley Valley Wetlands

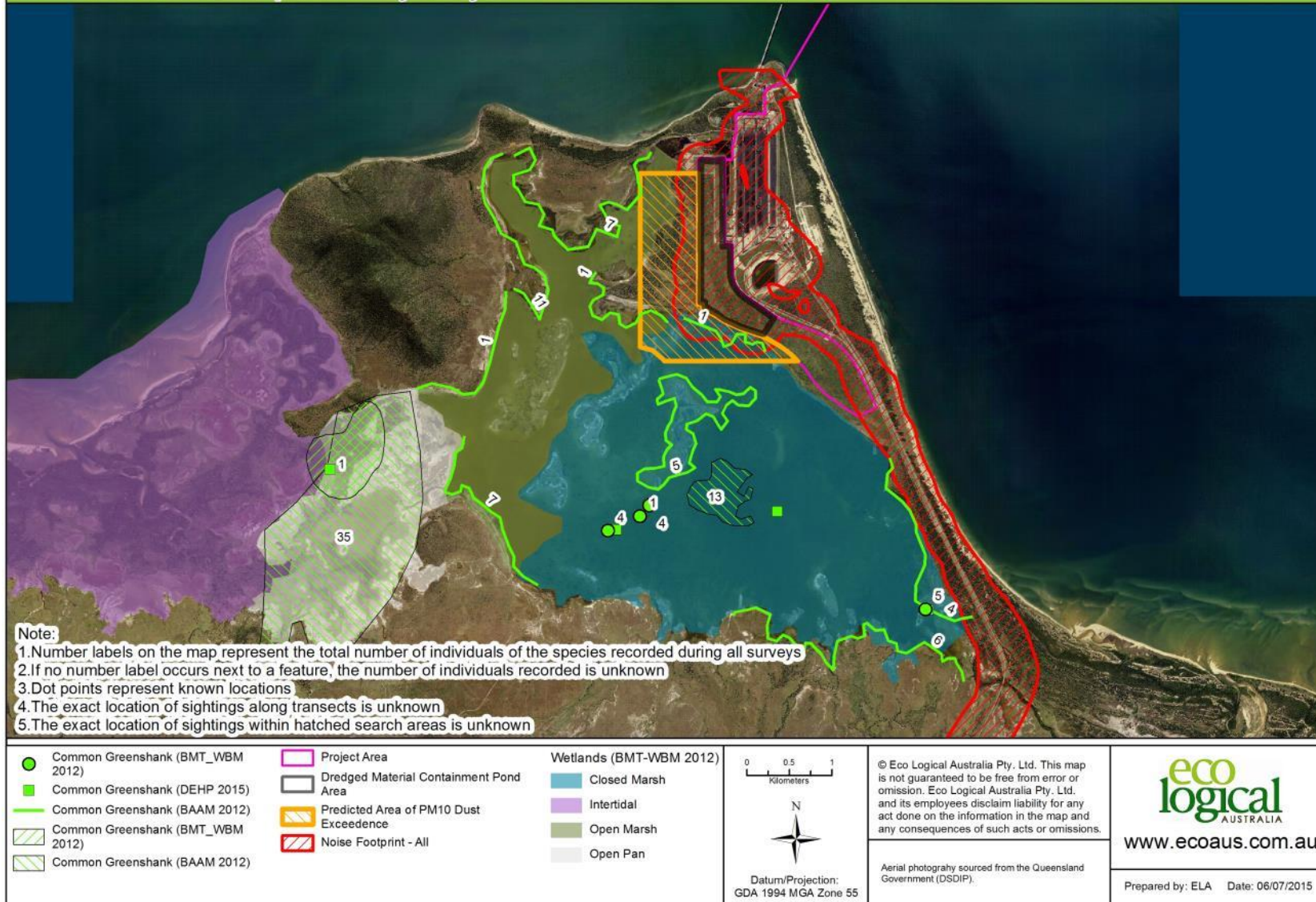


Figure 23 Map showing the location of Common Greenshank sightings and areas of wetland predicted to be influenced by Project activities

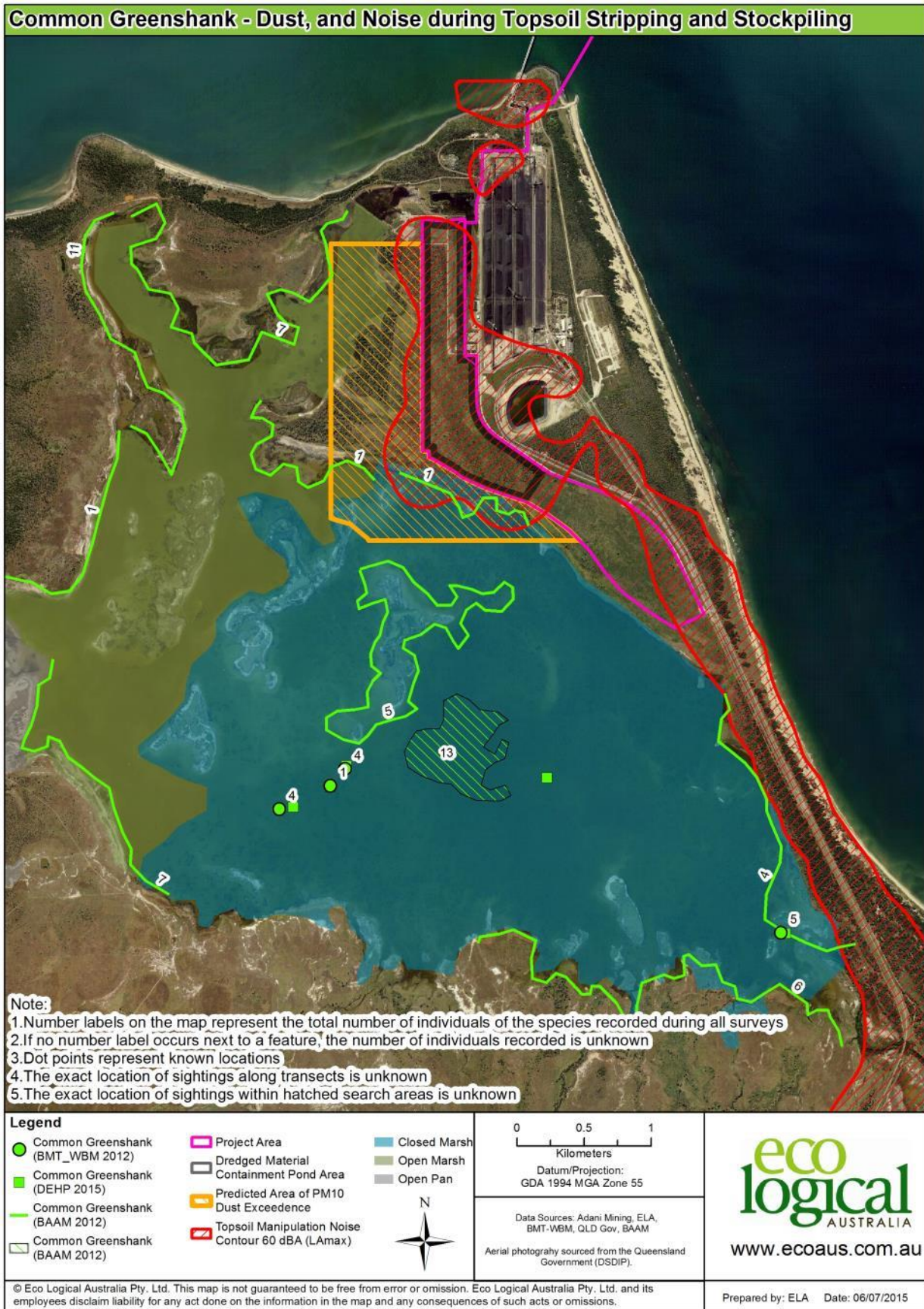


Figure 24 Enlarged map showing Common Greenshank sightings and areas of wetland predicted to be influenced by topsoil stripping and stockpiling

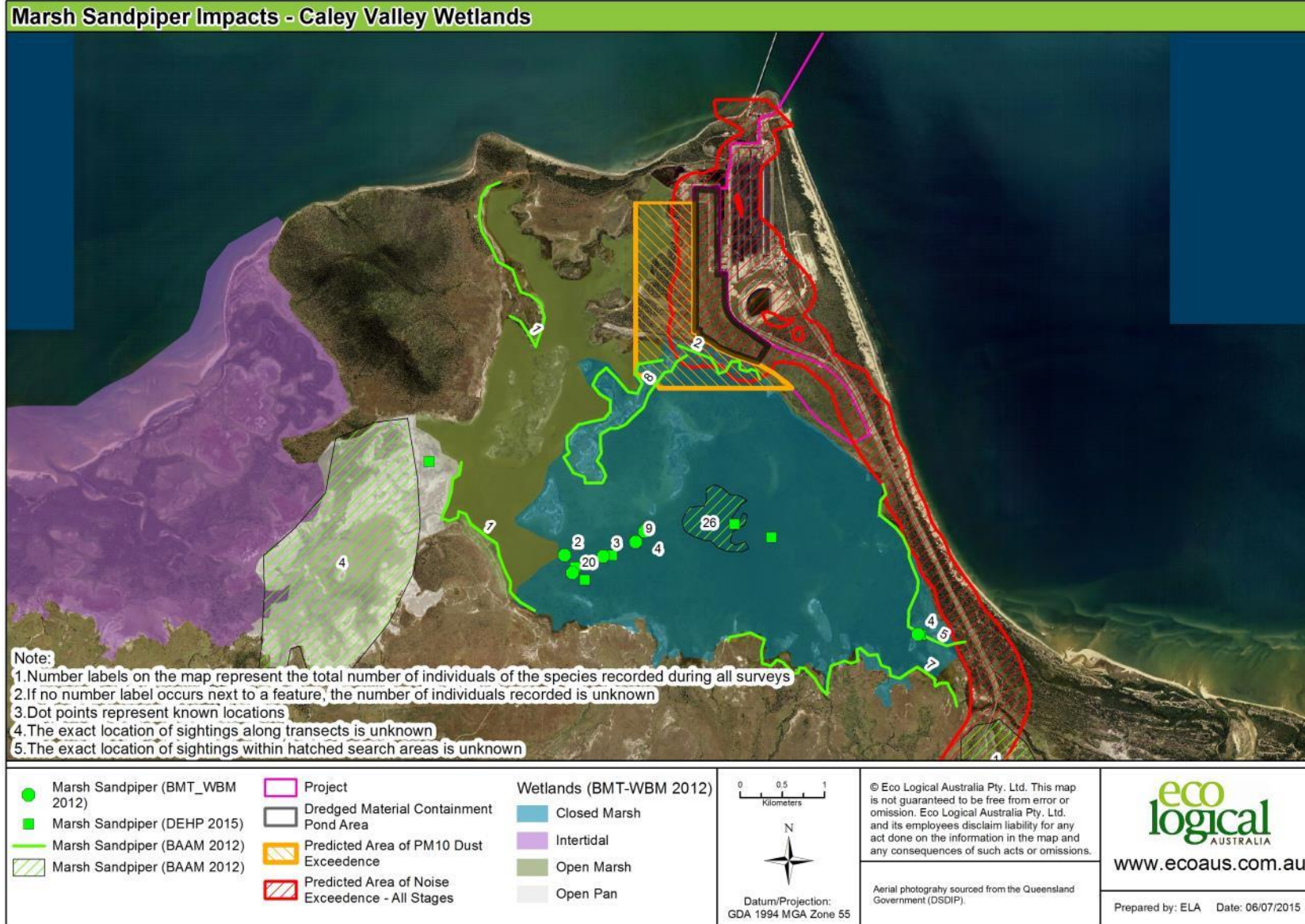


Figure 25 Map showing the location of Marsh Sandpiper sightings and areas of wetland predicted to be influenced by Project activities

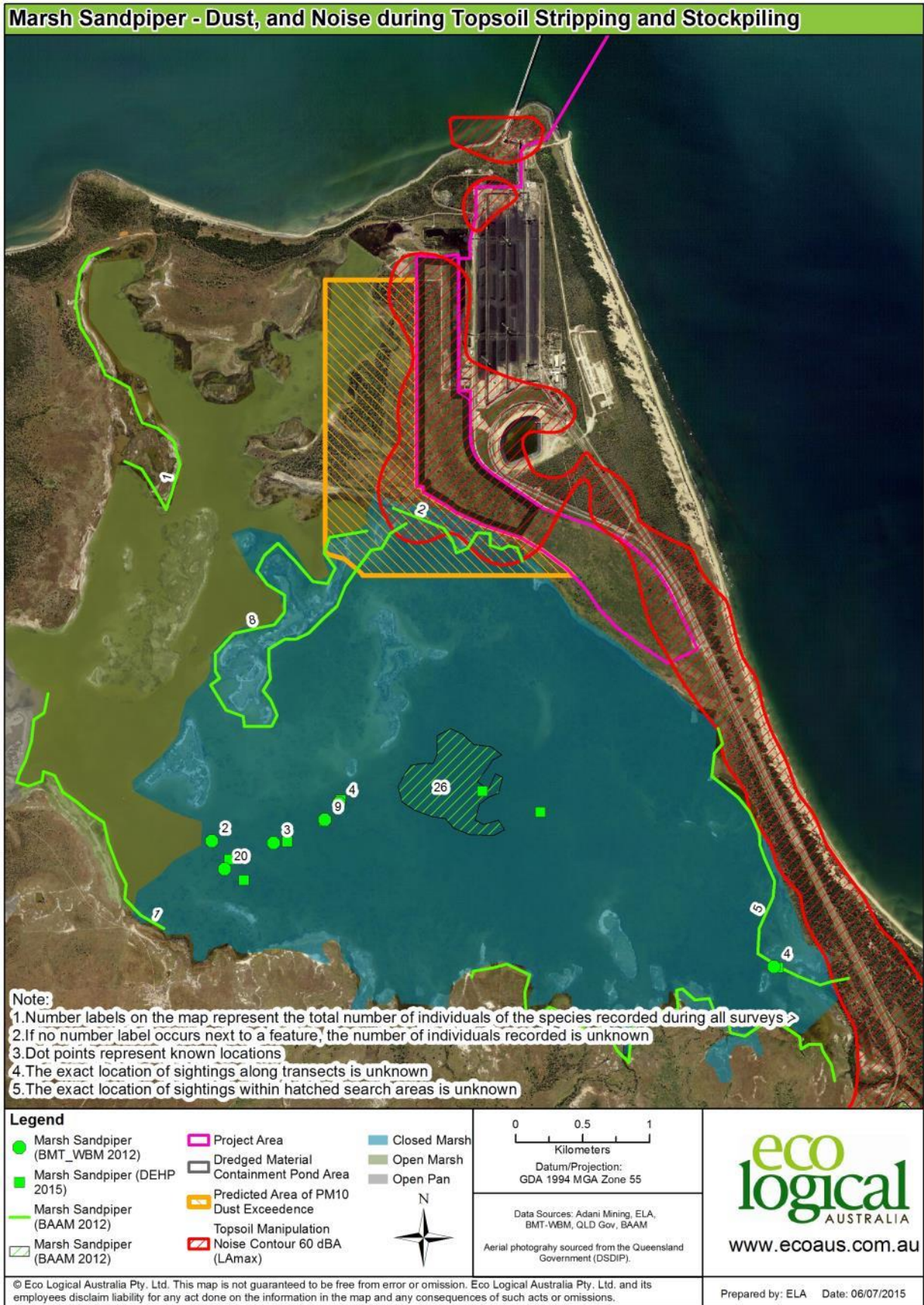


Figure 26 Enlarged map showing Marsh Sandpiper sightings and areas of wetland predicted to be influenced by topsoil stripping and stockpiling

8.6.4 Sharp-tailed Sandpiper

The Sharp-tailed Sandpiper has been sighted in large numbers within the Caley Valley Wetland, and utilising a range of habitats including the Open Pan, Open Marsh and Closed Marsh zones. The species has been recorded along the entire eastern fringe of the wetland, including habitats adjacent to the Project Area (Figure 27).

There are some sightings of large numbers of the Sharp-tailed Sandpiper along transects adjacent to the Project Area. While there is some uncertainty about the location of sightings due to data being from transects rather than points, it is likely that the species has been recorded within the area enclosed by modelled PM₁₀ dust and noise contours, where off-site impacts may occur. However, off-site and indirect impacts of the Project on the Sharp-tailed Sandpiper are considered unlikely to be significant for the following reasons:

- the Project Area does not contain habitat for the species, so the only potential impacts are from disturbance (i.e. off-site impacts).
- the area of terrestrial land between the Project Area and wetland is not preferred habitat for the species, given the observed patterns of wetland use (Figure 28).
- the area of habitat that may potentially be disturbed by noise/dust/light is small (15 ha 0.3% of wetland for noise; 111.5 ha 2.2% of wetland for PM₁₀ dust) relative to the total area of habitat available and shown to be used by the birds
- construction activities that will generate the disturbances will be in place for a short period of time (~3 months, which is less than an entire migratory bird season) and may occur outside the season entirely
- ecological values supporting foraging behaviour (e.g. macroinvertebrates) and roosting (e.g. vegetation complexes and wetland areas) are very unlikely to be degraded by construction activities will still be available to the species following the temporary disturbance period
- numerous management and mitigation measures will be implemented to keep disturbance to a minimum
- this species is highly mobile and can move to other areas for foraging and roosting if disturbed
- shorebirds have been shown to become habituated to noise in other port settings (e.g. at the Port of Brisbane)

Sharp-tailed Sandpiper Impacts - Caley Valley Wetlands

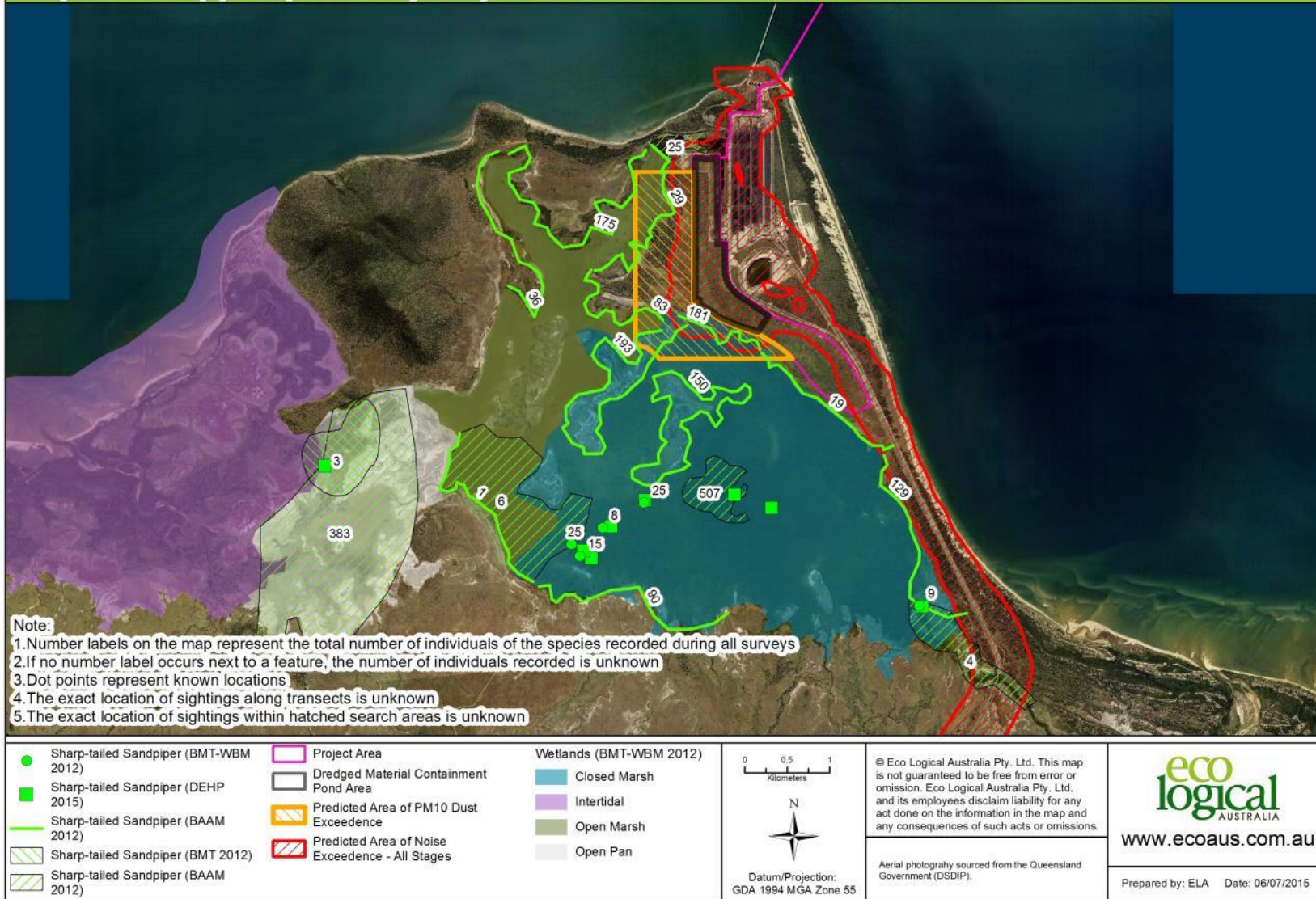


Figure 27 Map showing the location of Sharp-tailed Sandpiper sightings and areas of wetland predicted to be influenced by Project activities

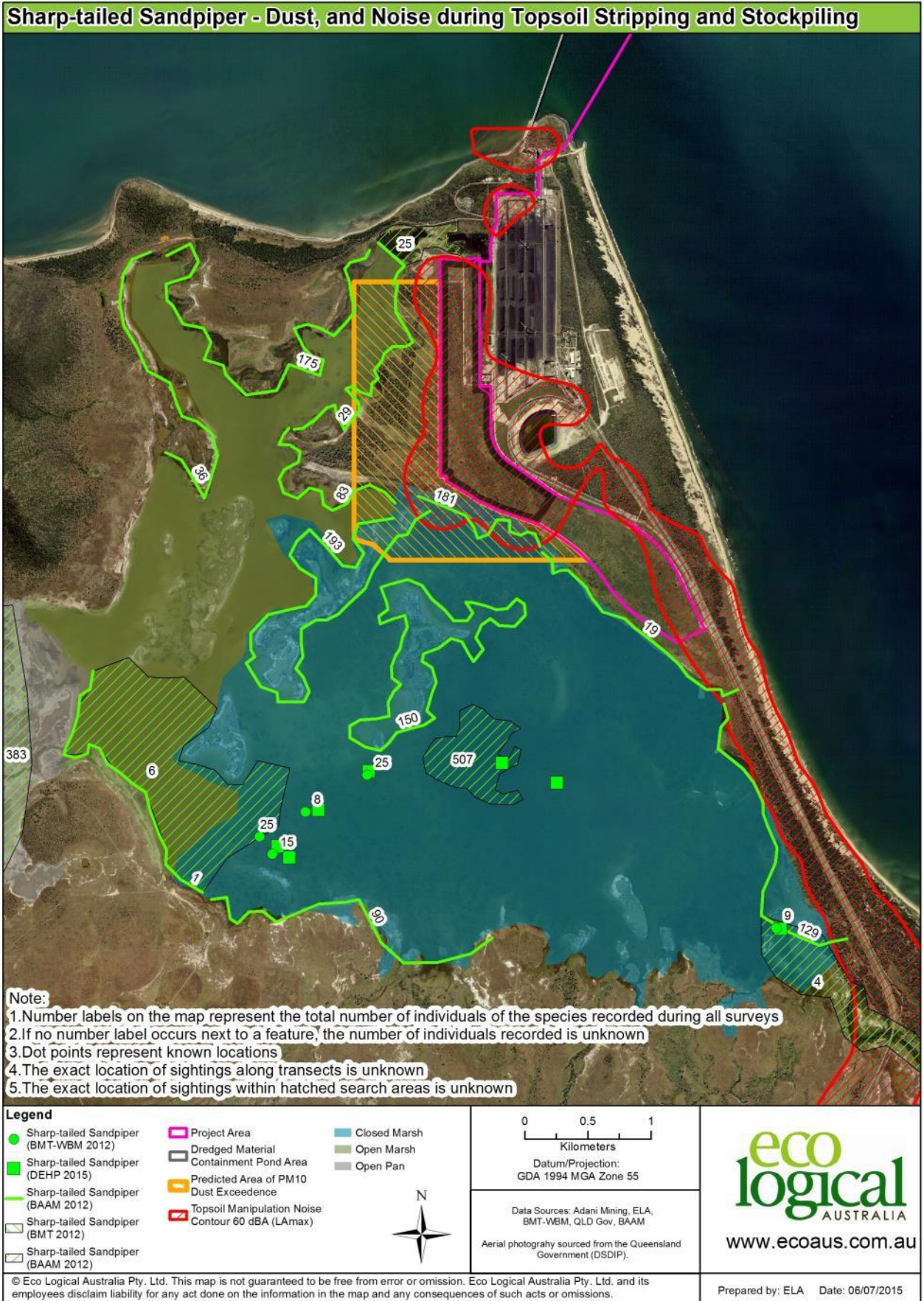


Figure 28 Enlarged map showing Sharp-tailed Sandpiper sightings and areas of wetland predicted to be influenced by topsoil stripping and stockpiling

8.7 Consequential impacts

There is minimal disturbance of migratory shorebirds and their habitat arising from approved projects facilitated by the Abbot Point Growth Gateway Project.

The Carmichael Coal and Rail Project is located up to 300 km inland from the coast. The project will have some impact on inland shorebird habitats, up to 175 ha for Latham's Snipe.

The NGBR Project terminates at Abbot Point, and involves disturbance of up to 45.6 ha of habitat for the Australian Painted Snipe (and migratory shorebirds more generally) within the south eastern sections of the wetland. This disturbance is associated with clearing of vegetation, increased anthropogenic activity, and general degradation of wetland habitats.

The Adani T0 project is located well east of the wetland, and was assessed not to involve any direct disturbance to shorebird habitats within the wetland. Potential off-site and indirect impacts on the wetland from runoff, dust, noise and light were assessed to be low.

EPBC Act approval conditions for the NGBR (Conditions 4 and 5) require the development of management plans to adaptively manage and mitigate the impacts on the Australian Painted Snipe. This plan is also likely to have benefits for migratory shorebirds more generally.

8.8 Cumulative impacts

There is potential for impacts of the Abbot Point Growth Gateway Project to act cumulatively with those of other projects located in close proximity to the Caley Valley Wetland. A summary of potential impacts of other projects on the habitat of migratory shorebirds and the Australian Painted Snipe is provided in Table 21.

Table 21 Potential impacts of approved projects on migratory shorebird and Australian Painted snipe habitat.

| Project | Summary of impacts on shorebirds and their habitat | Location of impact in relation to Project |
|---|---|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 20.45 ha for several shorebird species associated with mining. 175 ha for Latham's Snipe. ⁽¹⁾ | Up to 300km inland. |
| North Galilee Basin Rail Project (EPBC 2013/6885) | Disturbance to 45.6 ha of wetland habitats during construction (disturbance limit for Australian Painted Snipe). ⁽²⁾ Ongoing disturbance during train operations. | Located approximately 4 km south east of the Project Area near the entrance of Saltwater Creek. |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | No direct disturbance of wetland habitats. Minimal off-site and indirect impacts from noise, dust, light and stormwater runoff. | Located 500 to 1,000 m east of the Project Area. |
| GVK Hancock Terminal 3 Project (EPBC 2008/4468) | Direct disturbance to 28 ha of the Caley Valley Wetland. ⁽³⁾ Off-site and indirect impacts from noise, lighting, dust and stormwater runoff. | Located immediately adjacent to (west of) the Project Area. |
| GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648) | Construction of a rail loop involving direct disturbance to 14.5 ha of the Caley Valley Wetland and 99 ha of wetland enclosed by rail | Located immediately adjacent to (south of) the Project Area. |

| Project | Summary of impacts on shorebirds and their habitat | Location of impact in relation to Project |
|---|---|---|
| | loop. ⁽⁴⁾ Ongoing disturbance during train operations. 536 ha Australian Painted Snipe disturbance limit for habitat across rail and mine combined. ⁽⁴⁾ | |
| GVK Hancock Kevin's Corner Project (EPBC 2009/5033) | Nil. ⁽⁵⁾ | Not applicable. |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 42; (2) EPBC Act Approval 2013/6885 Condition 3; (3) EPBC Act Approval 2008/4468 Condition 2; (4) EPBC Act Approval 2008/4648 Condition 2; (5) EPBC Act Approval 2009/5033.

A total of 88.1 ha of the Caley Valley Wetland will be directly disturbed by infrastructure associated with the NGBR, T3 development and the rail loop of the Alpha Coal project. A combined total of 42.5 ha of wetland habitat to be directly disturbed occurs immediately adjacent to the Project Area, associated with the T3 development and Alpha Coal Rail Loop. An additional 99 ha of wetland will be enclosed by the Alpha Coal Rail Loop (indirect impacts). Some of the areas predicted to be subject to off-site and indirect impacts (e.g. noise, dust) from the Abbot Point Growth Gateway Project will be directly disturbed by the approved T3 project.

The scale of impacts from the Abbot Point Growth Gateway Project on wetland habitats for migratory shorebirds and the Australian Painted Snipe is small in comparison with that of other approved projects. There will be no direct disturbance of shorebird habitat from the Project's development activities, with off-site disturbance associated with noise and dust occurring temporarily during construction. Impacts will be insignificant in magnitude and may not occur at all if works occur outside of the migratory shorebird season, or during a period of dry weather when sections of the wetland adjacent to the Project Area are dry.

There is a temporal component relevant to the consideration of cumulative impacts. Construction of the NGBR project is likely to commence at the end of 2015, although the schedule for the small part of the rail alignment adjacent to the wetland is unknown. While the GVK Hancock T3 and Kevin's Corner projects are approved, a commencement date for construction works has not yet been announced. It is therefore unlikely that construction of these projects will occur at the same time as the Abbot Point Growth Gateway Project.

Cumulative impacts on shorebirds as a result of the Project area assessed to be low. The Project involves no direct disturbance to the shorebird habitat, unlike other approved projects in the Study Area. Off-site and indirect impacts are expected to be short in duration (several months) and not occur concurrently with other foreseeable projects.

8.9 Residual impacts and outcome

As discussed above, the overall impacts of the Project on migratory shorebirds and the Australian Painted Snipe are expected to be minimal, for the following reasons:

- the Project Area does not contain habitat for migratory shorebirds or the Australian Painted Snipe, so the only potential impacts are from disturbance.
- the area of terrestrial land between the Project Area and wetland is not preferred habitat for any species and will effectively act as a buffer from direct impacts within the disturbance footprint

- the area of habitat that may potentially be disturbed by noise/dust/light is small (up to 0.4% of wetland for noise; and 2.2% of wetland for PM₁₀ dust) relative to the total area of habitat available and shown to be used by the birds
- construction activities that will generate the disturbances will be in place for a short period of time (~3 months, which is less than an entire migratory bird season) and may occur outside the season entirely
- ecological values supporting foraging behaviour (e.g. macroinvertebrates) and roosting (e.g. vegetation complexes and wetland areas) are very unlikely to be degraded by construction and will still be available to the species following the temporary disturbance period
- numerous management and mitigation measures will be implemented to keep disturbance to a minimum
- shorebirds are highly mobile and can move to other areas for foraging and roosting if disturbed
- shorebirds have been shown to become habituated to noise in other port settings (e.g. at the Port of Brisbane).

However, a range of mitigation measures should nonetheless be implemented to manage any minor impacts and facilitate the on-going use of the Study Area by the species. Mitigation measures discussed in Section 6 will be sufficient to maintain impacts within acceptable levels. Offsets are not considered necessary.

9 Assessment of impacts on migratory birds (non-shorebirds)

9.1 Species overview

Table 22 provides a list of the migratory bird species (non-shorebird) that have been identified as known, likely or with the potential to occur within the Project Area, and a summary of their ecological requirements. Information on the presence of each species at Abbot Point is provided in the impact assessment section (Section 9.2).

Table 22: Other migratory species ecology overview

| Scientific name | Common name | Species' ecology overview |
|-----------------------|---------------------|--|
| <i>Apus pacificus</i> | Fork-tailed Swift | Non-breeding visitor Broad distribution across Australia Almost exclusively aerial No known threats in Australia (DoE 2015b) |
| <i>Ardea modesta</i> | Eastern Great Egret | Wide spread in Australia in a variety of wetland habitats Australian population estimated at 25,000 to 100,000 Most important populations occur in the northern territory (DoE 2015b) |
| <i>Ardea ibis</i> | Cattle Egret | Highly mobile, wide ranging migratory species that has been recorded throughout most of Australia Population for Australia, New Guinea and New Zealand is estimated at |

| Scientific name | Common name | Species' ecology overview |
|-------------------------------|-------------------------|---|
| | | <p>100,000 birds (DoE 2015b)</p> <p>Found in open, grassy areas, such as pastures, meadows, marshes, flood plains and swamps</p> <p>Has a preference for freshwater and is rarely found near marine environments.</p> <p>A diurnal feeder which commonly associates with native grazing mammals or domesticated livestock (and may follow farm machinery to capture disturbed prey (Birdlife International 2012)</p> |
| <i>Chlidonias leucopterus</i> | White-winged Black Tern | <p>Non-breeding migrant to Australia 23,200 km² area of occupancy in Australia Populations vary greatly from year to year Forages aerially (DoE 2015b)</p> |
| <i>Egretta sacra</i> | Eastern Reef Egret | <p>Occurs along most of Australia's coastline in rocky shores, coral islands and reefs, but is most common on the Queensland coast (Birdlife Australia 2012)</p> <p>Highly territorial species with an extensive range No known population estimates (Heron Conservation 2012)</p> |
| <i>Haliaeetus leucogaster</i> | White-Bellied Sea Eagle | <p>Occurs along Australia's coastline, including offshore islands, 10 – 30% of the world population occurs in Australia Widespread and relatively common within the distribution but breeds in a small part of the distribution No estimate of the area of occupancy is available, and changes in the area (DoE 2015b)</p> |
| <i>Hydroprogne caspia</i> | Caspian Tern | <p>While found in North America, Europe, Africa, Asia, Australia and New Zealand the Caspian Tern does not generally migrate outside its resident continent Total global population estimated to be 240,000 to 420,000 Widespread in Australia using both coastal and inland habitats Breeds on a variety of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. Nests may be in the open, or among low or sparse vegetation Urban encroachment is the primary threat (DoE 2015b)</p> |
| <i>Merops omatus</i> | Rainbow Bee-Eater | <p>Widely distributed throughout Australia and eastern Indonesia Occurs across most of mainland Australia; although extent of occurrence and areas of occupancy are not well understood The total Australian population size has not been estimated although it</p> |

| Scientific name | Common name | Species' ecology overview |
|-----------------------------|---------------------|---|
| | | <p>is thought to be reasonably large based on reporting rates (over 30,000 recorded sightings since 1998)</p> <p>Usually occurs in cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water</p> <p>Feeds on insects and less commonly earthworms, spiders and tadpoles</p> <p>Primary threat in north eastern Australia is the cane toad which feeds on eggs and nestlings and displaces nesting birds</p> <p>(DoE 2015b)</p> |
| <i>Monarcha melanopsis</i> | Black-faced Monarch | <p>Winters in southern New Guinea and migrates to eastern Australia to breed</p> <p>Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies and in more open woodland when migrating</p> <p>Feeds on insects (foraging and on the wing)</p> <p>(Birdlife Australia 2012)</p> |
| <i>Myiagra cyanoleuca</i> | Satin Flycatcher | <p>Inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, will use coastal areas on migration flights</p> <p>(DoE 2015b)</p> <p>Occurs along the east coast of Australia and PNG from far northern Queensland to Tasmania, including south-eastern South Australia. Not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant</p> <p>(Birdlife Australia 2012)</p> |
| <i>Pandion cristatus</i> | Eastern Osprey | <p>Global range includes Indonesia, Philippines, Palau Islands, New Guinea, Solomon Islands, New Caledonia and Australia</p> <p>Global population size not precisely known, but estimated to number less than 212,000 pairs</p> <p>Occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands</p> <p>Medium-sized raptor that feeds on fish rarely taking molluscs, crustaceans, insects, reptiles, birds or mammals</p> <p>Considered to be moderately common, particularly in northern Australia</p> <p>Major threats nationally and internationally include loss, degradation and alteration of habitat for urban or tourism development. (DoE 2015b)</p> |
| <i>Plegadis falcinellus</i> | Glossy Ibis | <p>Highly nomadic species with an extremely large range</p> <p>Shows a preference for marshes at the edges of lakes and rivers (as well as lagoons, flood-plains, wet meadows swamps, reservoirs sewage ponds, and irrigated cultivation). It less often occurs in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons</p> <p>Population in Australia is estimated to be approximately 12% of the species' total population of 1,200,000 – 3,200,000 worldwide.</p> <p>(DoE 2015b)</p> |
| <i>Rhipidura rufifrons</i> | Rufous Fantail | <p>Has a wide range in the south-west Pacific, occurring in Indonesia, the</p> |

| Scientific name | Common name | Species' ecology overview |
|-------------------------------|---------------------|--|
| | | <p>Northern Mariana Islands the Federated States of Micronesia, Papua New Guinea, the Solomon Islands and Australia</p> <p>The species is common and widely distributed especially throughout north eastern Australia</p> <p>Inhabits rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas</p> <p>Feeds on insects</p> <p>(Birdlife Australia 2012)</p> |
| <i>Sterna albifrons</i> | Little Tern | <p>Widely but patchily spread through Europe, southern, eastern and south-eastern Asia, Indonesia and Australasia</p> <p>Global population estimates range from 140,000 to 410,000 birds</p> <p>Australia has both breeding and non-breeding populations. Breeding sites are widely distributed from north-western Western Australia, around the northern and eastern Australian coasts to south-eastern Australia</p> <p>Australia has an estimated 10% of the global population</p> <p>Susceptible to breeding failure due to ground nesting</p> <p>Inhabits sheltered coastal areas feeding primarily on small fish</p> <p>(DoE 2015b)</p> |
| <i>Sterna hirundo</i> | Common Tern | <p>Globally widespread throughout Europe and Asia</p> <p>Global population thought to be stable and estimated at 1,100,000 – 4,500,000</p> <p>Non-breeding migrant to Australia, where it is mainly found along the eastern coast although their distribution is sparse from the Torres Strait south to Rockhampton</p> <p>Australian percentage of global population is not known but densities of up to 35,000 have been found in single sites on the north Queensland coast</p> <p>The species is marine, pelagic and coastal</p> <p>(DoE 2015b)</p> |
| <i>Thalasseus bengalensis</i> | Lesser Crested Tern | <p>Unevenly distributed from Australia to the Persian Gulf</p> <p>Global population estimated at 180,000 to 210,000</p> <p>Breeds in subtropical coastal parts of the world mainly from the Red Sea across the Indian Ocean to the western Pacific, and Australia, (Borg, J 2012)</p> <p>Australian birds are thought to be sedentary, but other populations are migratory</p> <p>Inhabits tropical and subtropical sandy and coral coasts and estuaries, breeding on low-lying offshore islands, coral flats, sandbanks and flat sandy beaches, (foraging in the surf and over offshore waters</p> <p>Breeds in large dense colonies of up to 20,000 pairs. Gregarious throughout the year, foraging in single or mixed-species flocks of up to</p> |

| Scientific name | Common name | Species' ecology overview |
|-----------------|-------------|--|
| | | <p>400 individuals</p> <p>Diet consists predominantly of small pelagic fish and shrimps</p> <p>The overall population trend appears to be stable, although some details of this species' movements are poorly known</p> <p>(Birdlife International 2012)</p> |

9.2 Potential impacts of the Project

Potential impacts on other migratory birds have been considered within the context of two key concepts commonly applied under the EPBC Act for migratory species (DoE 2013):

- Important habitat
- Ecologically significant proportion of the population.

Where neither of these two features of a migratory species are present, impacts are generally not considered of significance under the EPBC Act (DoE 2013; DEWHA 2009a).

Table 23 provides an analysis of the potential presence of important habitat or an ecologically significant proportion of the population for each species. The analysis is tailored to the specific behaviours of each group of species. However, key information used to determine the potential importance of the Project Area includes:

- General information for each species in relation to distribution, habitat requirements, population and potential threats
- Site specific information for the Study Area including the results of surveys and habitat use.

For the terns and other wetland species, the issue of ecologically significant proportion has also been informed by the use of 0.1% of the population as a threshold for importance. Where less than 0.1% was observed for these species the area was not considered important. This approach is widely accepted for species that use wetlands and aggregate in large numbers and has been applied regularly in EPBC Act assessment processes (DEWHA 2009a).

Table 23: Analysis of the potential presence of important habitat or an ecologically significant proportion of the population for migratory species

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|-----------------------|---------------------|---|---|------------------------------|
| <i>Apus pacificus</i> | Fork-tailed Swift | <p>Potential to occur as an occasional visitor.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered highly unlikely as the area does not support:</p> <ul style="list-style-type: none"> • breeding habitat; or • important feeding or roosting areas | None likely | No |
| <i>Ardea modesta</i> | Eastern Great Egret | <p>Recorded within the Caley Valley Wetland by BAAM (2012). Surveys recorded 232 and 289 respectively in the February and March wet season surveys. A total of 386 individuals were recorded during the dry season survey although it is estimated that the actual number present at this time was 583.</p> <p>Likely that presence within the wetland varies as water levels changes over time.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered likely as greater than 0.1% of the population present at Abbot Point.</p> | <p>No direct disturbance of habitat, as DMCP and pipeline located outside of wetland.</p> <p>Off-site and indirect impacts possible from noise, light and human disturbance associated with construction activity.</p> <p>Species utilises a range of areas throughout the wetland, including those adjacent to the Project Area.</p> | Yes |
| <i>Ardea ibis</i> | Cattle Egret | <p>Recorded within the Caley Valley Wetland by BAAM (2012). Surveys recorded 2 in February and 36 in March.</p> <p>Most records found this species foraging and roosting at the southern-most edge of the Closed Marsh.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • Caley Valley Wetland does not represent preferred breeding or foraging habitat for this species; and • less than 0.1% of the population present at Abbot Point | None likely | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|-------------------------------|-------------------------|--|--|------------------------------|
| <i>Chlidonias leucopterus</i> | White-winged Black Tern | 19 individuals (BAAM March 2012) recorded in the Closed Marsh Zone. This is less than 0.1% of the total estimated population, therefore presence of important habitat or an ecologically significant proportion of the species considered unlikely. | None likely | No |
| <i>Egretta sacra</i> | Eastern Reef Egret | Recorded within the Caley Valley Wetland by BAAM (2012). Surveys recorded 0 in February and 1 in March Presence of important habitat or an ecologically significant proportion of the species considered unlikely as: <ul style="list-style-type: none"> • Caley Valley Wetland does not represent preferred breeding or foraging habitat for this species; and • the area does not support a sufficient population of the species to be considered an ecologically significant proportion. | None likely | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|-------------------------------|-------------------------|---|--|------------------------------|
| <i>Haliaeetus leucogaster</i> | White-Bellied Sea Eagle | <p>6 to 8 individuals recorded foraging across the Caley Valley Wetland and perching near Abbot Point Road during the BAAM wet season survey (BAAM 2012)</p> <p>Survey recorded two nests/roosts in eucalypts on the fringe of the wetland near to the proposed T2 and T3. BAAM also identified potential nest sites on the opposite side of the wetland near the causeway (BAAM 2012)</p> <p>Likely that the Caley Valley Wetland provides a locally important foraging resource for the White-Bellied Sea Eagle when conditions are favourable but not important habitat.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • while the area is locally important to the individuals that occur there, the area does not support a sufficient population of the species to be considered an ecologically significant proportion; • other suitable habitat is likely to occur within the region; • large areas of potential foraging habitat will remain undisturbed; and • potential nesting / roosting trees are not considered to be a limiting feature in the landscape | Disturbance to nest/roosts on the fringe of the wetland. | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|---------------------------|-------------------|--|---|------------------------------|
| <i>Hydroprogne caspia</i> | Caspian Tern | <p>BAAM (2012) recorded:</p> <ul style="list-style-type: none"> • 14 individuals in Jan • 81 individuals in Feb • 204 individuals in June – this is approximately 0.2% of the total population of this species. <p>The Abbot Point area may also provide breeding habitat as the species nests on beaches.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered likely as greater than 0.1% of the population present at Abbot Point.</p> | <p>No direct disturbance of habitat from the DMCP or pipeline.</p> <p>Off-site and indirect impacts may include disturbance from noise, light, human presence, and changes to stormwater flow.</p> <p>While an ecologically significant proportion of the species utilises the wetland system, areas adjacent to the Project Area are not heavily utilised, compared with those of the Closed Marsh and Open Pan.</p> | Yes |
| <i>Merops omatus</i> | Rainbow Bee-Eater | <p>Surveys from 1999 to 2008 consistently record the species at Abbot Point.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • broad distribution across Australia; • reasonably large Australian population; and • general habitat use and therefore habitat availability within the region. | None likely | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|----------------------------|---------------------|---|--|------------------------------|
| <i>Monarcha melanopsis</i> | Black-faced Monarch | <p>Previous surveys have recorded the Black-faced Monarch at the proposed action site.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • broad distribution across Australia; and • general habitat use and therefore habitat availability within the region | None likely | No |
| <i>Myiagra cyanoleuca</i> | Satin Flycatcher | <p>Previously been recorded in the Abbot Point area by Ecoserve (2007) (no count info).</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • broad distribution across Australia; and • limited records at Abbot Point. | None likely | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|-----------------------------|----------------|---|--|------------------------------|
| <i>Pandion haliaetus</i> | Eastern Osprey | <p>Surveys from 1999 to 2007 consistently record the species at Abbot Point.</p> <p>A single Eastern Osprey was recorded on two separate occasions during the BAAM wet season survey. The individual was observed foraging along the coast near the proposed action site</p> <p>BAAM note that the individual was not foraging over the wetland and that there are no Eastern Osprey nests in the area of the proposed action.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as:</p> <ul style="list-style-type: none"> • while the area is locally important to the individuals that occur there, the area does not support a sufficient population of the species to be considered an ecologically significant proportion; • other suitable habitat is likely to occur within the region • large areas of potential foraging habitat will remain undisturbed; and • potential nesting / roosting trees are not considered to be a limiting feature in the landscape | None likely | No |
| <i>Plegadis falcinellus</i> | Glossy Ibis | <p>Recorded within the Caley Valley Wetland by BAAM (2012). Surveys recorded 0 in February and 41 in March.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as less than 0.1% of the population present at Abbot Point.</p> | None likely | No |
| <i>Rhipidura rufifrons</i> | Rufous Fantail | <p>BAAM dry season survey found Rufous Fantail in the forest and forest-thicket to the south of the wetland.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as common and widely distributed across Australia.</p> | None likely | No |

| Scientific name | Common name | Potential presence of important habitat or an ecologically significant proportion of the species | Potential impacts from the proposed action | Significant impact possible? |
|-------------------------------|---------------------|---|---|------------------------------|
| <i>Sterna albifrons</i> | Little Tern | <p>BAAM (2012) recorded 48 individuals across the Closed Marsh Zone. Feeding activity by more than 300 little terns was recorded by BMT WBM (2012) on beaches adjacent to the Open Pan, approximately 6 km west of the Project Area. Nesting activity and 50 individuals also recorded on a sand spit in the wetland's Intertidal Zone.</p> <p>Considered likely that the species uses the wetland in moderate numbers on an irregular basis.</p> <p>Presence of important habitat or an ecologically significant proportion of the species possible based on the numbers observed feeding and nesting by BMT WBM (2012).</p> | The key habitats within the wetland used by little terns for feeding and nesting are located at least 6 km from the Project Area. However, roosting and feeding behaviour have been observed in the Open Marsh. | Yes |
| <i>Sterna hirundo</i> | Common Tern | Presence of important habitat or an ecologically significant proportion of the species considered unlikely as the species only has a moderate potential to occur at Abbot Point | None likely | No |
| <i>Thalasseus bengalensis</i> | Lesser Crested Tern | <p>6 individuals recorded in the February BAAM 2012 survey.</p> <p>Presence of important habitat or an ecologically significant proportion of the species considered unlikely as less than 0.1% of the population present at Abbot Point.</p> | None likely | No |

9.3 Residual impacts of the Project

As discussed above, the overall impacts on the other migratory species are not likely to be significant (with the exception of the Eastern Great Egret, Caspian Tern and Little Tern, which are addressed below as they have ecologically significant populations within the Caley Valley Wetland). However, a range of mitigation measures should nonetheless be implemented to manage any minor impacts and facilitate the on-going use of the Study Area by the species. Mitigation measures discussed in Section 6 will be generally applicable to other migratory species and will further reduce potential impacts. Offsets are not considered necessary.

9.4 Eastern Great Egret (*Ardea modesta*)

9.4.1 Species overview

The Eastern Great Egret is listed as Migratory under the EPBC Act.

The Eastern Great Egret is a moderately large bird (83 - 103 cm long and 700 – 1,200 g) with white plumage (DoE 2015b). The species was until recently considered a subspecies of the Great Egret (*Ardea modesta*; DoE 2015b).

Eastern Great Egrets are widespread in Australia. They occur in all states/territories of mainland Australia and in Tasmania. They have also been recorded as vagrants on Lord Howe, Norfolk and Macquarie Islands.

In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the top end of the Northern Territory (DoE 2015b), but small breeding colonies occur widely across the species' distribution including central Queensland. The breeding season is variable and to some extent dependent upon rainfall. Breeding usually extends from November until April (DoE 2015b).

The Eastern Great Egret has been reported in a wide range of wetland habitats including inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial.

Birds snare their prey by walking slowly or standing still for long periods, waiting for prey to come within range. Animals are killed usually with one blow from the bill and swallowed whole. Eastern Great Egrets take prey from the water and vegetation but are not sedimentary foragers (DoE 2015b).

Notably the Eastern Great Egret is capable of feeding at many different levels of a particular habitat, both in terms of habitat mosaics and water depth. Eastern Great Egrets will feed at a water level up to their feathers but no further. The Eastern Great Egret's feathers are not waterproof and feathers can soak up water increasing bodyweight and making flight more difficult (Rosso 2012).

Eastern Great Egret nests are normally positioned over water at a height of 1-15 m in reed beds, bushes, trees, mangroves and other plants near water or on islands in sites that are protected from ground predators. Nests are constructed largely of sticks. The species usually nests colonially in single or mixed-species groups where nests may be less than 1 m apart or touching. Breeding pairs may also reuse nests from previous years (DoE 2015b).

Egrets generally gather together to breed. They will feed collectively near the colony but after the young have fledged they will disperse from the breeding area (Rosso 2012).

9.4.2 Occurrence within the Project Area

The highest number of Eastern Great Egrets was found during the BAAM (2012) dry season survey. In the four day survey period from 26 to 29 June 2012, BAAM recorded 386 individuals (Table 24). Approximately a third of these birds were recorded around the edges of the Closed Marsh Zone with the remainder on the eastern edge of the Open Marsh. BAAM (2012) estimates indicate that the number of Eastern Great Egrets present within the wetland during this time was 583 individuals.

Based on these numbers, the Caley Valley Wetland provides important habitat for the Eastern Great Egret. The numbers recorded by BAAM (2012) indicate that the Caley Valley Wetland supports $\geq 0.1\%$ of the estimated Australian population of the species and is therefore an ecologically significant proportion.

Table 24: Counts, population estimates and % flyway population for the Eastern Great Egret in the main wetland (taken from BAAM 2012)

| Scientific name | Common name | Feb count | Feb est | Mar count | Mar est | June count | June est | 0.1% level | % pop |
|----------------------|---------------------|-----------|---------|-----------|---------|------------|----------|------------|-------|
| <i>Ardea modesta</i> | Eastern Great Egret | 232 | 331 | 289 | 342 | 386 | 583 | 100 | 0.58 |

Appendix A shows the locations and numbers of Eastern Great Egret found adjacent to the Project Area and throughout the broader Study Area. The species is found throughout the wetland system in a variety of habitats. Surveys of the foreshore adjacent to the Project Area have demonstrated a presence of the species within this section of the wetland.

It is unlikely that the Eastern Great Egret uses the Caley Valley Wetland as breeding habitat. Both the BAAM (2012) wet and dry season surveys found no evidence of Eastern Great Egret nests. This observation is consistent with the Australian distribution of Eastern Great Egrets and the indication that the species' main breeding areas are in the top end of the Northern Territory.

The ephemeral nature of the Caley Valley Wetland suggests that it would provide optimum feeding habitat primarily during favourable wet conditions. During other times Eastern Great Egrets are likely to move in search of other water bodies and are therefore not solely reliant upon the Caley Valley wetland for all non-breeding activities.

9.4.3 Potential impacts of the project on the Eastern Great Egret

Given the overlap in habitat use between the Eastern Great Egret and migratory shorebirds generally, the impact assessment issues and ongoing management requirements are similar for these taxa (Section 8).

The key findings of the impact assessment in relation to the Eastern Great Egret and potential impacts on their habitat within the Caley Valley Wetland are:

- The Caley Valley Wetland supports an ecologically significant proportion of the Great Egret population and provides important habitat for this species
- There will be no direct disturbance to Eastern Great Egret habitat from construction of the Project.
- Off-site impacts from construction, including noise, lighting and increased human presence are likely to be minor. The provisions described above for the Caley Valley Wetland, migratory shorebirds and the Australian Painted Snipe can be considered appropriate for also addressing impacts on the Eastern Great Egret.

9.4.4 Consequential impacts

Two approved projects facilitated by the Abbot Point Growth Gateway Project involve the disturbance of Eastern Great Egret habitat (Table 25). The majority of this disturbance is associated with clearing for the construction of a rail corridor from the Carmichael Coal Mine to Abbot Point. The species is known to be locally common in wetland habitats along the rail alignment, although such habitats are unlikely to support an ecologically significant proportion of the population. The Caley Valley Wetland, which supports an ecologically significant proportion of the population, is not directly impacted by the Terminal 0 Project at Abbot Point.

Table 25 Summary of consequential impacts on the Eastern Great Egret

| Project | Area of Eastern Great Egret habitat to be disturbed (ha) |
|--|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 320 ⁽¹⁾ |
| North Galilee Basin Rail Project (EPBC 2013/6885) | Unquantified. Locally common along the length of the rail corridor wherever suitable wetland habitat occurs (including 45.6 ha at Caley Valley Wetland). ⁽²⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 0 |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 42; (2) EPBC Act Approval 2013/6885 Condition 3.

9.4.5 Cumulative impacts

There is potential for impacts of the Abbot Point Growth Gateway Project to act cumulatively with those of other projects located in close proximity to the Caley Valley Wetland and involving disturbance of habitat from the construction of rail and coal mine projects further inland. However, only those cumulative impacts on important habitat for the species are likely to be significant. A summary of the potential for such impacts is provided in Table 26.

Table 26 Summary of impacts of Project on Eastern Great Egret Habitat

| Project | Summary of impacts on Eastern Great Egret and its habitat | Ecologically Significant Proportion of population? |
|--|--|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | Disturbance of 320 ha of habitat for development of mine and rail infrastructure. ⁽¹⁾ Ongoing disturbance during operations. | No |
| North Galilee Basin Rail Project (EPBC 2013/6885) | Disturbance of unquantified area of habitat along the rail alignment, in locations such as rivers and farm dams. Disturbance to 45.6 ha of wetland habitats on the fringe of the Caley Valley Wetland. ⁽²⁾ Ongoing disturbance during train operations. | No for inland components. Yes for direct disturbance of Caley Valley Wetland approximately 4 km south east of the Project Area near the entrance of Saltwater Creek. |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | No direct disturbance of wetland habitats. Minimal off-site and indirect impacts from noise, dust, light and stormwater runoff. | No direct disturbance of habitat. |
| GVK Hancock Terminal 3 Project (EPBC 2008/4468) | Direct disturbance to 28 ha of the Caley Valley Wetland. ⁽³⁾ | Yes |

| Project | Summary of impacts on Eastern Great Egret and its habitat | Ecologically Significant Proportion of population? |
|---|--|--|
| | Off-site and indirect impacts from noise, lighting, dust and stormwater runoff. | |
| GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648) | Construction of a rail loop involving direct disturbance to 14.5 ha of the Caley Valley Wetland and 99 ha of wetland enclosed by rail loop. ⁽⁴⁾ Disturbance of unquantified area of habitat along the rail alignment, in locations such as rivers and farm dams. Ongoing disturbance during train operations. | Yes |
| GVK Hancock Kevin's Corner Project (EPBC 2009/5033) | 762 ha disturbance limit comprising inland wetland habitats ⁽⁵⁾ | No |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 42; (2) EPBC Act Approval 2013/6885 Condition 3; (3) EPBC Act Approval 2008/4468 Condition 2; (4) EPBC Act Approval 2008/4648 Condition 2; (5) EPBC Act Approval 2009/5033 Condition 7.

A total of 88.1 ha of the Caley Valley Wetland will be directly disturbed by infrastructure associated with the NGBR, Terminal 3 development and rail loop aspects of the Alpha Coal project. Of this area, 42.5 ha are located immediately adjacent to the Project Area, associated with the T3 development and associated rail loop. An additional 99 ha of wetland will be enclosed by the Alpha Coal Rail Loop (indirect impacts). Some of the areas predicted to be subject to off-site impacts (e.g. noise, dust) from the Abbot Point Growth Gateway Project will be directly disturbed by other projects.

The scale of impacts from the Abbot Point Growth Gateway Project on wetland habitats used by the Eastern Great Egret is small in comparison with other approved projects. There will be no direct disturbance of habitat from development activities, with off-site disturbance associated with noise and dust occurring temporarily for a period of several months during construction. Impacts may be reduced further if works occur during a period of dry weather when sections of the wetland adjacent to the Project Area are dry.

The potential for cumulative impacts on the Eastern Great Egret are assessed to be low. The species appears to be a habitat generalist across the Caley Valley Wetland, utilising a variety of locations within the region (Appendix A). Measures to reduce impacts of the Project on migratory shorebirds, will be beneficial to the Eastern Great Egret and will adequately address potential impacts on this migratory species.

9.5 Caspian Tern (*Hydroprogne caspia*)

9.5.1 Species overview

The Caspian Tern is listed as Migratory under the EPBC Act.

The Caspian Tern is the largest of the Australian terns, and grows to a size of 53-60 cm and 0.68 kg. The species is gregarious when breeding, though single nesting does occur. Outside of breeding, the Caspian Tern occurs mostly singly or in small groups. Occasional larger groups of 30 or more birds are seen, often at rich fishing areas or at nightly roost sites, where they may roost with other terns. The species may also aggregate into flocks on migration (DoE 2015b).

Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. It is found in all states and territories of Australia. In Queensland, this species is widespread in coastal regions from the southern Gulf of Carpentaria to the Torres Strait, and along the eastern coast. It has been recorded in the western districts, especially the Lake Eyre Drainage Basin, north-west to the Gulf Country north of Mt Isa and Cloncurry, there are also scattered records for central Queensland (DoE 2015b).

The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks. In offshore areas the species prefers sheltered situations, particularly near islands, and is rarely seen beyond reefs. Large numbers may shelter along the coast, behind coastal sand-dunes or coastal lakes during rough weather, and have been recorded inland after storms (DoE 2015b).

9.5.2 Occurrence within the Project Area

The greatest number of Caspian Terns was found during the BAAM (2012) dry season survey. In the four day survey period from 26 to 29 June BAAM recorded 204 individuals (Table 27). The majority of individuals were recorded in the Open Marsh Zone to the west of the Project Area.

Based on these numbers, the Caley Valley Wetland provides important habitat for the Caspian Tern. The numbers recorded by BAAM (2012) indicate that the Caley Valley Wetland supports $\geq 0.1\%$ of the estimated Australian population of the species and is therefore an ecologically significant proportion.

Appendix A shows the locations and numbers of Caspian Tern found in the Study Area for both the wet and dry season surveys. During all survey periods, individuals were sighted at numerous sites throughout the wetland.

Table 27: Counts, population estimates and % flyway population for the Caspian Tern in the main wetland (taken from BAAM 2012)

| Scientific name | Common name | Feb count | Mar count | June count | 0.1% level | % pop |
|---------------------------|--------------|-----------|-----------|------------|------------|-------|
| <i>Hydroprogne caspia</i> | Caspian Tern | 14 | 81 | 204 | 100 | 0.2 |

The ephemeral nature of the Caley Valley Wetland suggests that it would provide optimum feeding habitat primarily during favourable wet conditions. During other times populations are likely to move in search of other water bodies and are therefore not solely reliant upon the Caley Valley wetland for all non-breeding events.

9.5.3 Potential impacts of the Project on the Caspian Tern

Given the overlap in habitat use of the Caley Valley Wetland, the impact assessment issues and ongoing management requirements relating to the Caspian Tern are generally the same as for migratory shorebirds and the Australian Painted Snipe (Section 8).

The key findings of the impact assessment in relation to the Caspian Tern and potential impacts on the Caley Valley Wetland are:

- The Caley Valley Wetland supports an ecologically significant proportion of the Caspian Tern population and provides important habitat for this species

- No direct disturbance of the wetland will occur from the Project. Off-site and indirect impacts will be minor in magnitude and scale.
- Avoidance, mitigation and management measures would reduce the potential impacts on this species.

The provisions described above for the Caley Valley Wetland, migratory shorebirds and the Australian Painted Snipe can be considered appropriate in addressing impacts on the Caspian Tern.

9.5.4 Consequential impacts

The NGBR project involves the disturbance of habitat suitable for the Caspian Tern at the Caley Valley Wetland and further inland at freshwater wetlands such as large farm dams which may be used by individuals or small numbers (Table 28). The Caley Valley Wetland supports an ecologically significant proportion of the population, and will not be directly impacted by the Terminal 0 Project at Abbot Point.

Table 28 Summary of consequential impacts on the Caspian Tern

| Project | Area of Caspian Tern habitat to be disturbed (ha) |
|--|--|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 20 ⁽¹⁾ |
| North Galilee Basin Rail Project (EPBC 2013/6885) | 45.6 ha of wetland habitat and undefined area of habitat comprising large freshwater wetlands ⁽²⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 0 |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 42; (2) EPBC Act Approval 2013/6885 Condition 3.

The species is not in decline or at the limit of its range within the NGBR project footprint or Abbot Point region.

9.5.5 Cumulative impacts

There is potential for impacts of the Abbot Point Growth Gateway Project to act cumulatively with those of other projects located in close proximity to the Caley Valley Wetland and involving disturbance of habitat from the construction of rail and coal mine projects further inland. However, only those cumulative impacts on important habitat for the species are likely to be significant. A summary of the potential for such impacts is provided in Table 29.

Table 29 Summary of impacts of Project on Caspian Tern Habitat

| Project | Summary of impacts on Caspian Tern and its habitat | Ecologically Significant Proportion of population? |
|--|---|---|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | Progressive loss of approximately 20 ha of potential habitat from mining. ⁽¹⁾ | No. |
| North Galilee Basin Rail Project (EPBC 2013/6885) | Disturbance of unquantified area of habitat along the rail alignment, in locations such as large farm dams. Disturbance to 45.6 ha of wetland habitats on the fringe of the Caley Valley Wetland. ⁽²⁾ Ongoing disturbance during train operations. | No for inland components. Yes for direct disturbance of Caley Valley Wetland approximately 4 km south east of the Project Area near the entrance of Saltwater Creek. |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | No direct disturbance of wetland habitats. Minimal off-site and indirect impacts from noise, dust, light and stormwater runoff. | No direct disturbance of habitat. |

| Project | Summary of impacts on Caspian Tern and its habitat | Ecologically Significant Proportion of population? |
|---|--|--|
| GVK Hancock Terminal 3 Project (EPBC 2008/4468) | Direct disturbance to 28 ha of the Caley Valley Wetland. ⁽³⁾ Off-site and indirect impacts from noise, lighting, dust and stormwater runoff. | Yes |
| GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648) | Construction of a rail loop involving direct disturbance to 14.5 ha of the Caley Valley Wetland and 99 ha of wetland enclosed by rail loop. ⁽⁴⁾ Disturbance of unquantified area of habitat along the rail alignment, in locations such as rivers and farm dams. Ongoing disturbance during train operations. | Yes |
| GVK Hancock Kevin's Corner Project (EPBC 2009/5033) | Possible disturbance of inland wetland habitats. | No |

Source: (1) Coordinator-General's evaluation report Carmichael Coal Mine and Rail Project page 42; (2) EPBC Act Approval 2013/6885 Condition 3; (3) EPBC Act Approval 2008/4468 Condition 2; (4) EPBC Act Approval 2008/4648 Condition 2.

A total of 88.1 ha of the Caley Valley Wetland will be disturbed by infrastructure associated with the NGBR, Terminal 3 development and rail loop aspects of the Alpha Coal project. Of this area, 42.5 ha are located immediately adjacent to the Project Area, associated with the T3 development and associated rail loop. An additional 99 ha of wetland will be enclosed by the Alpha Coal Rail Loop (indirect impacts). Some of the areas predicted to be subject to off-site impacts (e.g. noise, dust) from the Abbot Point Growth Gateway Project will be directly disturbed by other projects.

The scale of impacts from the Abbot Point Growth Gateway Project on wetland habitats used by the Caspian Tern is small in comparison with other approved projects. There will be no direct disturbance of habitat from development activities, with off-site disturbance associated with noise and dust occurring temporarily for a period of several months during construction. Impacts may be reduced further if works occur during a period of dry weather when sections of the wetland adjacent to the Project Area are dry.

The potential for cumulative impacts on the Caspian Tern are assessed to be low. The species appears to be a habitat generalist across the Caley Valley Wetland, utilising a variety of locations within the area (Appendix A). Measures to reduce impacts of the Project on migratory shorebirds, will be beneficial to the Caspian Tern and will adequately address potential impacts on this migratory species.

9.6 Little Tern (*Sternula albifrons*)

9.6.1 Species overview

The Little Tern is listed as Migratory under the EPBC Act.

The Little Tern is a small and slender marine tern with narrow wings, and grows to a size of 20-28 cm. The species is typically gregarious throughout the year and are observed commonly in small flocks and sometimes in larger flocks comprising over 1000 individuals (DoE 2015b). In Australia, the species is comprised of a breeding population (for which there are two subpopulations) and a migratory population from Asia which does not breed in Australia. The Australian breeding population estimate is 3000, but the reliability of this estimate is low (DoE 2015b).

Within Australia, Little Terns inhabit sheltered coastal environments, including lagoons and estuaries, ocean beaches and coastal environments with sandbanks and sand spits where roosting and nesting occurs. Foraging occurs mainly on fish in shallow waters of estuaries, coastal lagoons and lakes, often close to breeding colonies or close to shore. The species in Australia is comprised of individuals that are resident, or wholly or partly migratory. Threats to the species include degradation of coastal habitats and high rates of breeding failure from natural and human-related events.

9.6.2 Occurrence within the Project Area

BMT WBM (2012) reported more than 300 Little Terns feeding adjacent to the Open Pan Zone of the wetland (6 km west of the Project Area), and 50 little terns including nests on a sand spit in the wetland's Intertidal Zone (Table 30). BAAM (2012) recorded 48 little terns within the Open March Zone of the wetland in March and 2 individuals in December. It is likely that the species uses the wetland in moderate numbers on an irregular basis.

There is some difficulty in calculating the presence of an ecologically significant proportion of the population for the species, as migratory and resident populations overlap in their geographic range. However, at the numbers recorded by BMT WBM (2012), the wetland is considered likely to support an ecologically significant proportion of the Little Tern population.

Appendix A shows the locations and numbers of Little Tern found in the Study Area.

Table 30: Counts, population estimates and % flyway population for the Little Tern in the main wetland (taken from BAAM 2012 and BMT WBM 2012)

| Scientific name | Common name | BMT WBM | Mar count | Dec count | 0.1% level ¹ | % pop |
|---------------------------|-------------|---------|-----------|-----------|-------------------------|-------|
| <i>Sternula albifrons</i> | Little Tern | 350 | 48 | 2 | 3 | 1+ |

¹ Based on breeding/resident population of the species.

The ephemeral nature of the Caley Valley Wetland suggests that it would provide optimum feeding habitat primarily during favourable wet conditions. During other times populations are likely to move in search of other water bodies. The wetland is also likely to support nesting Little Terns on adjacent beaches of the region.

9.6.3 Potential impacts of the Project on the Little Tern

Given the overlap in habitat use of the Caley Valley Wetland, the impact assessment issues and ongoing management requirements relating to the Little Tern are generally the same as for migratory shorebirds and the Australian Painted Snipe (Section 8).

The key findings of the impact assessment in relation to the Little Tern and potential impacts on the Caley Valley Wetland are:

- The Caley Valley Wetland is likely to support an ecologically significant proportion of the Little Tern population and provides important habitat for this species
- Key habitats where aggregations of 50+ individuals have been recorded are located well west of the Project Area, outside of the influence of Project activities
- Avoidance, mitigation and management measures would reduce the potential impacts on this species.

The provisions described above for the Caley Valley Wetland, migratory shorebirds and the Australian Painted Snipe can be considered appropriate in addressing impacts (including residual impacts) on the Little Tern.

9.6.4 Consequential impacts

The NGBR project involves the disturbance of habitat potentially suitable for the Little Tern at the Caley Valley Wetland (Table 31), although much better habitat occurs in estuarine areas of the wetland. There will be no direct impact on the wetland from the Terminal 0 project at Abbot Point.

Table 31 Summary of consequential impacts on the Caspian Tern

| Project | Area of Little Tern habitat to be disturbed (ha) |
|--|--|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | 0 |
| North Galilee Basin Rail Project (EPBC 2013/6885) | 45.6 ha of potentially suitable wetland habitat ⁽¹⁾ |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | 0 |

Source: (1) NGBR Coordinator-General's evaluation report page 15.

The species is not known to be in decline or at the limit of its range within the Abbot Point region.

9.6.5 Cumulative impacts

There is potential for impacts of the Abbot Point Growth Gateway Project to act cumulatively with those of other projects located in close proximity to the Caley Valley Wetland and involving disturbance of wetland habitat from the construction of rail projects. However, only those cumulative impacts on important habitat for the species are likely to be significant. A summary of the potential for such impacts is provided in Table 32.

Table 32 Summary of impacts of Project on Little Tern habitat

| Project | Summary of impacts on Little Tern and its habitat | Ecologically Significant Proportion of population? |
|---|---|--|
| Carmichael Coal Mine and Rail Project (EPBC 2010/5736) | Nil. | Not applicable. |
| North Galilee Basin Rail Project (EPBC 2013/6885) | Disturbance to 45.6 ha of wetland habitats on the fringe of the Caley Valley Wetland. ⁽¹⁾ | Yes for direct disturbance of Caley Valley Wetland approximately 4 km south east of the Project Area near the entrance of Saltwater Creek. |
| Abbot Point Terminal 0 Project (EPBC 2011/6194) | No direct disturbance of wetland habitats. Minimal off-site and indirect impacts from noise, dust, light and stormwater runoff. | No direct disturbance of habitat. |
| GVK Hancock Terminal 3 Project (EPBC 2008/4468) | Direct disturbance to 28 ha of the Caley Valley Wetland. ⁽²⁾ Off-site and indirect impacts from noise, lighting, dust and stormwater runoff. | Yes. |
| GVK Hancock Alpha Coal Mine and Rail Project (EPBC 2008/4648) | Construction of a rail loop involving direct disturbance to 14.5 ha of the Caley Valley Wetland and 99 ha of wetland enclosed by rail | Yes. |

| Project | Summary of impacts on Little Tern and its habitat | Ecologically Significant Proportion of population? |
|---|--|--|
| | loop. ⁽³⁾ Ongoing disturbance during train operations. | |
| GVK Hancock Kevin's Corner Project (EPBC 2009/5033) | Nil. | Not applicable. |

Source: (1) NGBR Coordinator-General's evaluation report page 15; (2) EPBC Act Approval 2008/4468 Condition 2; (3) EPBC Act Approval 2008/4648 Condition 2.

A total of 88.1 ha of the Caley Valley Wetland will be disturbed by infrastructure associated with the NGBR, Terminal 3 development and rail loop aspects of the Alpha Coal project. Of this area, 42.5 ha are located immediately adjacent to the Project Area, associated with the T3 development and associated rail loop. An additional 99 ha of wetland will be enclosed by the Alpha Coal Rail Loop (indirect impacts). Some of the areas predicted to be subject to off-site impacts (e.g. noise, dust) from the Abbot Point Growth Gateway Project will be directly disturbed by other projects.

The scale of impacts from the Abbot Point Growth Gateway Project on wetland habitats used by the Little Tern is small. There will be no direct disturbance of habitat from development activities, with off-site disturbance associated with noise and dust occurring temporarily for a period of several months during construction. Areas to be affected by off-site impacts are not suitable for nesting. Impacts may be reduced further if works occur during a period of dry weather when sections of the wetland adjacent to the Project Area are dry.

The potential for cumulative impacts on the Little Tern are assessed to be low. It is likely that the species uses the wetland in moderate numbers on an irregular basis, with key areas used for foraging and nesting located away from the Project Area (Appendix A). Measures to reduce impacts of the Project on migratory shorebirds, will be beneficial to the Little Tern and will adequately address potential impacts on this migratory species.

10 Outstanding Universal Value of the Great Barrier Reef World Heritage Area

10.1 Background

The GBRWHA covers an area of approximately 348,000 km² and was inscribed on the World Heritage List in 1981. The World Heritage Area extends along the Queensland coast from Cape York to just north of Fraser Island, and from the low water mark on the Queensland coast seaward to the outer boundary of the GBR Marine Park (beyond the edge of the continental shelf). The GBRWHA is a MNES and impacts on its World Heritage Values are relevant to the assessment of matters under the EPBC Act.

The GBRWHA is recognised under the World Heritage Convention as having Outstanding Universal Value (OUV). The concept of OUV is defined by UNESCO (2013) as “cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity”.

The GBRWHA has been listed against all four of the natural heritage criteria outlined by UNESCO (2013), which relate to geological phenomena, ecological and biological processes, aesthetics and natural beauty and biological diversity including threatened species.

In addition, all World Heritage properties are required to meet the conditions of integrity, defined as “a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes” (UNESCO 2013). A Statement of OUV for the GBRWHA concluded that the integrity of the property is enhanced by its unparalleled size, good state of conservation and capacity to recover from disturbance or withstand ongoing pressure. A Long Term Sustainability Plan for the Great Barrier Reef has recently been finalised, which seeks to recognise and protect the World Heritage property’s OUV (Commonwealth of Australia 2015).

The GBRWHA has a great variety of natural heritage attributes that contribute to its OUV, with 29 attributes identified by Lucas *et al.* (1997) in a comprehensive review. Of those attributes, three were identified by ELA and Open Lines (2012) as being relevant to Abbot Point (aesthetics, birds and marine mammals). While several other natural heritage attributes are present within the Abbot Point region, they were assessed not to be present at a scale or value that was relevant to the GBRWHA as a whole. Thus, for the assessment of Project impacts on World Heritage values, a focus on aesthetics, birds and marine mammals is warranted. Birds fall within the scope of this terrestrial ecology report and are considered in the following section.

10.2 Assessment

Lucas *et al.* (1997) noted that areas of international importance for migratory shorebirds located both adjacent to and within the World Heritage Area are important natural heritage attributes of the GBRWHA. Whilst the Caley Valley Wetland is not located within the World Heritage Area, it is a significant aggregation site for migratory shorebirds and other waterbirds.

Relevant aspects of the Caley Valley Wetland in the context of assessing potential impacts on World Heritage values associated with birds include (ELA and Open Lines 2012):

- Location of the wetland adjacent to the World Heritage Area, allowing connectivity between the two, which is an important ecological process (Criterion 9 of UNESCO 2013).
- The presence of threatened species such as the Eastern Curlew, Curlew Sandpiper and Australian Painted Snipe, which contribute to the *in situ* conservation of diversity (Criterion 10 of UNESCO 2013).
- Aggregations of large numbers of birds over the wet season and summer months can be considered superlative natural phenomenon (Criterion 7 of UNESCO 2013).

Assessment of the potential impacts of the Project on the OUV of the GBRWHA in relation to birds should consider these values.

10.2.1 Connectivity

The Project Area is located outside of the Caley Valley Wetland and there will be no modification or alienation of the wetland as a result of Project construction activities. While there will be some clearing of land adjacent to the wetland, this will not result in significant fragmentation of the landscape or influence the existing connectivity between the wetland and adjacent parts of the GBRWHA. Project activities will not alter the existing hydrological function of the wetland, which contributes to its ecological value as waterbird habitat.

10.2.2 Diversity

The continued presence of threatened waterbird species at the Caley Valley Wetland is an important objective in maintaining the *in situ* conservation of diversity and associated World Heritage Values. The wetland is important habitat for several migratory and resident shorebird species and supports populations of birds that are ecologically significant. Additionally, some species are observed irregularly at the wetland in small numbers, and contribute to local diversity and species richness when they are present.

A detailed assessment of the impacts of the Project on threatened and migratory species was provided in Sections 8 and 9 of this report. The assessment concluded that there will be no direct impacts of the Project on the habitats of waterbird species utilising the wetland. While off-site impacts are possible from noise, dust and light, the magnitude of these impacts, even when considered cumulatively with those of other projects, are considered to be low and not significant from an EPBC Act perspective. Measures in place to reduce impacts on threatened species utilising the wetland will also benefit species that are common and contribute to World Heritage values.

10.2.3 Superlative natural phenomena

The ephemeral nature of the Caley Valley Wetland and seasonal migration of shorebirds to the region creates significant variability in the number and species of waterbirds present. Large parts of the wetland can remain dry and largely devoid of waterbird activity for many continuous months. However, the onset of wet seasonal conditions, combined with the arrival of migratory shorebirds, can create a significant aggregation of waterbirds with in excess of 48,000 individuals (BAAM 2012). Many resident species breed during this time, building nests in a variety of wetland-dependent habitats such as sedges, reeds and floating vegetative masses.

The Project will not affect the values of the Caley Valley Wetland in relation to the aggregation of a significant number of waterbirds. While it is possible that construction works will be undertaken during a period when the wetland is full and migratory shorebirds are present, there will be no direct impact or disturbance of the wetland habitats. Off-site impacts from dust, noise and light may temporarily influence the behaviour of waterbirds on the eastern fringe of the wetland, but the area affected (2.2% for dust, up to 0.4% for noise) is small in comparison with the entire wetland complex (5,154 ha). The Project will not influence the connectivity of waterways feeding into the wetland, which is an important driver of wetland conditions and resultant aggregations of birds following periods of high flow into the wetland.

10.3 Summary

The Caley Valley Wetland contributes to the World Heritage Values of the GBR, despite not being located within the World Heritage boundaries. Birds are an important natural heritage attribute of the Abbot Point region, contributing to the connectivity, diversity and superlative natural phenomena that are present across the entire GBRWHA.

The Project will not impact the Caley Valley Wetland in a manner that will affect its connectivity, diversity or habitat values for the seasonal aggregation of waterbirds. In this context, there will be no impact of the Project on the OUV of the GBRWHA. Consequential and cumulative impacts from the Project on World Heritage Values are also highly unlikely.

11 Monitoring and Reporting

11.1 Objectives and purpose

Monitoring of MNES will be completed at various stages of the Project, to meet the following objectives:

- Inform the management on-ground construction works to reduce impacts on MNES
- Document any difference between predicted and actual impacts
- Identify if impacts exceed a threshold value, beyond which additional mitigation measures should be implemented
- Demonstrate compliance with environmental management commitments

11.2 Monitoring plan

Monitoring will be completed before, during and after construction works, with a focus on assessing the impacts of Project-related activities on key MNES. A description of monitoring tasks to be implemented is provided in Table 33. Monitoring activities will be focussed on:

- Identifying the location of MNES in the area to be cleared, to avoid/reduce impacts
- Monitoring of terrestrial land between the development footprint and the Caley Valley Wetland
- Monitoring fauna during construction works to minimise injury and disturbance of nests

11.3 Reporting

The results of all monitoring activities will be provided to DoE in accordance with the requirements of approval conditions and as outlined in relevant environmental management plans. Monitoring results will be reported to DoE in a timely manner following their collection and analysis, to facilitate adaptive management of potential impacts on MNES.

Table 33 Monitoring measures to be implemented for the Project

| Parameter | Description | Objectives | Trigger for corrective action | Timing and frequency |
|---|---|--|---|--|
| Pre-clearance surveys. | Survey of areas to be cleared, prior to disturbance. | <p>Confirm the spatial extent of vegetation to be cleared.</p> <p>Confirm assumptions about the disturbance of MNES, including threatened species habitat.</p> <p>Identify TECs adjacent to the pipeline alignment (to avoid disturbance during works).</p> <p>Inform prioritisation of spotter-catcher effort to flush out and relocate threatened species during clearing works.</p> | <p><u>Trigger:</u> Identification within the disturbance footprint of MNES not known at impact assessment stage.</p> <p><u>Action:</u> Notify DoE. Review and update mitigation measures, offset strategy and environmental management plans.</p> | One off survey not more than six months before the commencement of construction works. |
| Monitoring of land between wetland and Project Area (off-site impact zone). | Visual assessment of integrity of zone (undisturbed) between works site and Caley Valley Wetland. | Ensure that zone between wetland and Project Area remains undisturbed and is not subject to human activity. | <p><u>Trigger:</u> Identification of earth works moving into buffer zone.</p> <p><u>Action:</u> Stop any works being undertaken in the buffer zone. Review work site protocols to ensure buffer zone remains in place prior to recommencing work.</p> | Weekly during the period of construction works. |
| Spotter-catcher surveys | Inspection of disturbed areas adjacent habitats to minimise injury to animals and disturbance of nests. | Minimise impacts of Project construction activities on fauna and nests. | <p><u>Trigger:</u> identification of fauna or nests in works area</p> <p><u>Action:</u> relocate fauna or nest if practical. Manage any fauna injuries in accordance with Animal Welfare legislation and guidelines.</p> | Daily during construction works and clearing activities. |

12 Summary and Conclusion

The Queensland Department of State Development is proposing to conduct capital dredging at the Port of Abbot Point, involving the placement of dredged material on land. The Project has been designed to avoid the placement of dredged material at sea within the Great Barrier Reef World Heritage Area, and to avoid disturbance to the Caley Valley Wetland.

The Project was referred to DoE for assessment under the EPBC Act. The Project (EPBC 2015/7467) was declared a controlled action subject to assessment through an EIS under six controlling provisions:

- World Heritage Properties (sections 12 and 15A)
- National Heritage Places (section 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth marine areas (sections 24 and 24A); and
- Great Barrier Reef Marine Park (sections 24B and 24C)

The information provided in this documentation specifically addressed the EIS Guidelines issued by DoE in June 2015 in relation to terrestrial ecology. The report outlines the results of extensive previous ecological surveys regarding the occurrence and potential impacts on MNES as a result of the Project. This report has provided a detailed impact assessment for key MNES considered as part of the Project.

Potential impacts of the Project have been managed according to the hierarchy of avoid, mitigate and offset, with a focus on avoidance by designing and locating the development footprint to be outside of the Caley Valley Wetland and the SEVT TEC in the region. Where indirect impacts on MNES could not be completely avoided, a range of mitigation and management measures have been proposed to reduce and manage these impacts. This report has outlined these measures in detail.

Direct impacts (within the development footprint) of the Project on MNES associated with construction and operational phases of the Project are likely to be avoided. Where direct impacts occur (e.g. fauna strike) they will not be significant. A detailed assessment of off-site and indirect impacts of the Project on MNES has concluded that these are unlikely to be significant and will be managed through a range of mitigation and environmental management planning processes.

It is considered that the Project is unlikely to result in residual significant impacts on MNES after all measures to first avoid and then mitigate have been taken into account. Accordingly, offsets for the Project are not necessary.

References

- Adani 2012. Carmichael Coal Mine and Rail Project Environmental Impact Statement, Prepared by GHD.
- Adani 2013. North Galilee Basin Rail Project Environmental Impact Statement, Prepared by GHD.
- Atlas of Living Australia 2012. Australian Painted Snipe.
<http://bie.ala.org.au/species/Rostratula+australis>
- Austecology 2011. Black-throated Finch and Water Mouse Habitat Assessments: Galilee Coal Project Northern Export Facility Abbot Point. Prepared for Waratah Coal Pty Ltd.
- BAAM 2012. *Cumulative Impact Assessment: Migratory Shorebird and Waterbird Surveys, Caley Valley Wetland, Port of Abbot Point*. Report prepared for North Queensland Bulk Ports Corporation, (including follow up survey results reported in June, Nov, Dec 2012).
- BirdLife International 2012. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on 22 June 2015.
- BMT WBM 2012. Kaili (Caley) Valley Wetlands Baseline Report. Prepared by BMT WBM Pty Ltd for the Office of the Coordinator-General, Department of State Development, Infrastructure, and Planning. Available at: <http://www.dip.qld.gov.au/resources/plan/cg/abbot/baseline-profile-for-the-kail-valley-wetlands.pdf>
- BMT WBM 2015. Abbot Point Growth Gateway Project - Technical Report for Wetland Hydrology, Water Quality and Aquatic Ecology Components, BMT WBM Consulting, July 2015.
- BOM 2015. Bureau of Meteorology <http://www.bom.gov.au/>
- Borg J 2012. Diomediamalta, Malta's Seabirds. [Factsheet] Available from: <http://www.diomedeamalta.com/index.html>. Accessed 13 September 2012.
- Bostock PD and Holland AE (eds) 2013. Introduction to the Census of the Queensland Flora 2013, and Census of the Queensland Flora 2013 (census lists) Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts: Toowong.
- Brown RE, Brain JD and Wang N 1997. The avian respiratory system - a unique model for studies of respiratory toxicosis and for monitoring air quality *Environmental Health Perspectives* 105:188-200
- CDM Smith 2013. Adani Coal Terminal EIS.
- Clemens RS, Haslem A, Oldland J, Shelley L, Weston MA and Diyan, MAA 2008. *Identification of significant shorebird areas in Australia: Mapping, thresholds and criteria*. Birds Australia report to the Australian Government's Department of Environment and Water Resources.
- Collins M 1986. Effects of stable dust on farm animals – a review *Veterinary Research Communications* 10:415-428.
- Commonwealth of Australia 2009. National Assessment Guidelines for Dredging, 92 pp.
<http://www.environment.gov.au/system/files/resources/8776675b-4d5b-4ce7-b81e-1959649203a6/files/guidelines09.pdf>

Commonwealth of Australia 2015. Reef 2050 Long-Term Sustainability Plan, 111 pp.

Coordinator General 2010. Abbot Point State Development Area Multi-user Infrastructure Corridor Study. November 2010, 136 pp.

Department of the Environment (DoE) 2008. Rangelands 2008 – Taking the Pulse, Commonwealth of Australia, Canberra. <http://www.environment.gov.au/system/files/resources/a8015c25-4aa2-4833-ad9c-e98d09e2ab52/files/bioregion-brigalow-belt-north.pdf>

Department of the Environment (DoE) 2013. Matters of National Environmental Significance. Significant Impact Guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999*.

Department of the Environment (DoE) 2015a. Guidelines for an EIS to undertake capital dredging, onshore placement and reuse of dredged material at Abbot Point, 25 km north of Bowen, North Queensland (EPBC2015/7467). Department of the Environment.

Department of the Environment (DoE) 2015b. Community and Species Profile and Threats Database, Department of the Environment, Canberra, Available at: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009a. Draft EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species. Commonwealth Department of the Environment, Water, Heritage and Arts, Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009b. Draft EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species – Background paper to EPBC Act policy statement 3.21.. Commonwealth Department of the Environment, Water, Heritage and Arts, Canberra.

Department of Infrastructure and Planning (DIP) 2012. Abbot Point State Development Area Multi-User Infrastructure Corridor. Coordinator-General Report. Available at: <http://www.statedevelopment.qld.gov.au/resources/plan/cg/abbot/multi-user-infrastructure-corridor.pdf>

Driscoll PV 1993. Summary of Banding Data and a Literature Review for Five Species of Migratory Bird: Red-necked Stint (*Calidus ruficollis*), Little Tern (*Sterna albifrons sinensis*), Eastern Curlew (*Numenius madagascariensis*), Great Knot (*Calidris tenuirostris*) and Latham's Snipe (*Gallinago hardwickii*). Report for the Australian National Parks and Wildlife Service, Canberra. Ecoserve 2007. Abbot Point and Caley Valley Wetlands 2007. Wet Season Flora and Fauna Surveys. Draft report for Newlands Collinsville Abbot Point Project (NCA).

Dwyer RG, Bearhop S, Campbell HA, Bryant DM 2013. Shedding light on light: benefits of anthropogenic illumination to a nocturnally foraging shorebird. *Journal of Animal Ecology* 82: 478-485.

Ecoserve 2007. Abbot Point and Caley Valley Wetlands 2007: Wet Season Flora and Fauna Surveys, Draft report prepared for Newlands Collinsville Abbot Point Project (NCA).

Eco Logical Australia (ELA) and OpenLines 2012. Abbot Point Cumulative Impact Assessment, Prepared for Eco Logical Australia (ELA) and OpenLines (2012b), Abbot Point Cumulative Impact Assessment (CIA) Synthesis Report, Report prepared for the Abbot Point Working Group, October 2012.

ELA 2014a. Abbot Point Expert Witness: Terrestrial Ecological Assessment. Prepared for North Queensland Bulk Ports, September 2014.

ELA 2014b. Semi Evergreen Vine Thicket Verification Survey for Abbot Point. Technical memo prepared for WorleyParsons.

ELA 2014c. Offset Assessment Results for Abbot Point Project. Technical Memo prepared for WorleyParsons.

ELA 2014d. Survey for threatened species presence at Abbot Point: Rufous Owl and Coastal Sheath-tailed Bat. Technical Memo for WorleyParsons.

ELA 2014e. Survey of RE11.2.2 patch on eastern beach. Technical Memo prepared for WorleyParsons.

ELA 2014f. Abbot Point Terrestrial Ecology Assessment Report. Prepared for WorleyParsons.

Ferguson D and Mathieson M 2014. Targeted Species Survey Guidelines – Yakka Skink *Egernia rugosa*, DSITIA, Queensland Government. Available at: <https://www.qld.gov.au/environment/assets/documents/plants-animals/biodiversity/yakka-skink.pdf>

Garnett ST and Crowley GM 2000. The Action Plan for Australian Birds 2000. [Online]. Canberra, ACT: Environment Australia and Birds Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/index.html>.

Garnett ST, Szabo JK and Dutson G 2011. The action plan for Australian Birds 2010. (CSIRO Publishing/Birds Australia, Melbourne).

GHD 2009. Report for Proposed Abbot Point Multi Cargo Facility: Terrestrial and Aquatic Ecological Assessment, Prepared for North Queensland Bulk Ports Corporation Limited

GHD 2010. Proposed Abbot Point Multi Cargo Facility Draft Environmental Impact Statement for North Queensland Bulk Ports Corporation Limited.

GHD 2011. Railway Corridor – Caley Valley Wetland Freshwater Aquatic Flora and Fauna Assessment for Rail Loop. Alpha Coal Project Supplementary EIS. Hancock Prospecting.

GHD 2012. Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging, Public Environment Report, Prepared for North Queensland Bulk Ports Corporation.

Glover HK, Weston MA, Maguire GS, Miller KK and Christie BA 2011. Towards ecologically meaningful and socially acceptable buffers: Response distances of shorebirds in Victoria, Australia to human disturbance. *Landscape and Urban Planning*, 103(3-4):326-334.

Gosbell K and Clemens R 2006. Population Monitoring in Australia: Some Insights After 25 Years and Future Directions. *The Stilt*, 50:162-175.

Griffioen PA and Clarke MF 2002. Large-scale bird movement patterns evident in eastern Australian atlas data. *Emu*. 102: 99-125.

Hancock Coal Infrastructure Pty Ltd (HCIPL) 2012. Abbot Point Coal Terminal 3: Matters of National Environmental Significance Preliminary Documentation. Vol 1. & 2.

Hancock Galilee 2011. Kevin's Corner Environmental Impact Statement.

Hancock Prospecting 2012. Alpha Coal Project Environmental Impact Statement.

Hayter RB and Besch EL 1974. Airborne-particle deposition in the respiratory tract of chickens Poultry Science 53:1507-1511.

Heron Conservation 2012. Eastern Reef Heron *Egretta sacra* (Gmelin). The IUCN-SSC Heron Specialist Group. [Online]. Available from <http://www.heronconservation.org/styled-5/styled-22/> Accessed 29 May 2012.

Hicks JT, King BR and Chaloupka MY 1987. Seaplane and vessel disturbance of nesting seabird colonies on Michaelmas Cay, Queensland National Parks and Wildlife Service Management Report No. 1. 8 pp.

IFC 2013. Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. International Finance Corporation.

Katestone 2015. Air Quality Assessment of the Abbot Point Growth Gateway Project. Katestone Environmental Pty Ltd.

Kiama SG, Adekunle JS and Maina JN 2008. Comparative in vitro study of interactions between particles and respiratory surface macrophages, erythrocytes, and epithelial cells of the chicken and the rat Journal of Anatomy 213:452-463.

Lewis Consulting Services 2009. Terrestrial Fauna Assessment for Water for Bowen Project.

Lucas PHC, Webb T, Valentine PS, Marsh H 1997. The Outstanding Universal Value of the Great Barrier Reef World Heritage Area. Published by the Great Barrier Reef Marine Park Authority.

Maina JN, West JB, Orgeig S, Foot NJ, Daniels CB, Kiama SG, Gehr P, Mühlfeld C, Blank F, Müller L, Lehmann A, Brandenberger C and Rothen-Rutishauser B (2010). Recent advances into understanding some aspects of the structure and function of mammalian and avian lungs Physiological and Biochemical Zoology 83: 792-807.

Marchant S, Higgins PJ 1993. Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings. Melbourne, Victoria: Oxford University Press.

McDonald, WJF 2010. National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community. Report to Department of the Environment, Water, Heritage and the Arts, Canberra. Queensland Department of Environment and Resource Management, Brisbane.

Neldner VJ, Wilson BA, Thompson EJ and Dillewaard HA 2012. Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2. Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane. 124 pp.

North Queensland Bulk Ports Limited (NQBP) 2009. Report for Abbot Point X110 Expansion: Infrastructure Development Project Preliminary Documentation.

North Queensland Bulk Ports (NQBP) 2010. Port of Abbot Point - Environmental Management Plan.

Oldland J, Rogers D, Clemens R, Berry L, Maguire G and Gosbell K 2009. Shorebird Conservation in Australia. Birds Australia Conservation Statement, no. 14, 2009.

Parsons Brinckerhoff Australia Pty Ltd (PB) 2009. Water for Bowen Draft, Environmental Impact Statement. Risk Assessment of the Proposed Splitters Creek Balance Storage Facility on the EPBC listed Black-throated Finch.

Parsons Brinckerhoff (PB) 2010. Preliminary Draft Central Abbot Point State Development Area Land and Infrastructure Planning Study for Department of Industry and Planning.

Paton DC, Ziembicki M, Owen P and Heddle C 2000. Disturbance distances for water birds and the management of human recreation with special reference to the Coorong region of South Australia. Final report for the Migratory Waterbird component of the National Wetlands Program.

Peter Hollingsworth and Associates, 1979 and 1981. Impact Assessment Study – Expert Coal Proposal. Prepared for Collinsville Coal Company. 1979 and Addendum to Impact Assessment Study 1981.

Robinson, JA and Oring, LW 1996. Long distance movements by American Avocets and Black-necked Stilts. *Journal of Field Ornithology*, 67:307-320.

Rosso J 2012. Bird Central. [Online] Available from: www.birdcentral.net Accessed 12 November 2014

SLR 2012. Abbot Point Cumulative Impact Assessment Technical Report - Operation Noise – Terrestrial. Commissioned for the Abbot Point Working Group Rev 1.

SLR 2015. Terrestrial Noise Impact Assessment – Abbot Point Growth Gateway Project. SLR Consulting.

State of Queensland 2015. Referral of proposed action – Abbot Point Growth Gateway Project, 64 pp.

Threatened Species Scientific Committee (TSSC) 2001. Commonwealth Listing Advice on Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions, www.ea.gov.au/biodiversity/threatened/communities/sevt.html Accessed 22 June 2015

TSSC 2013. Approved Conservation Advice for *Rostratula australis* (Australian painted snipe).

Threatened Species Scientific Committee

<http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf>

TSSC 2015a. Conservation Advice *Numenius madagascariensis* Eastern Curlew. Threatened Species Scientific Committee <http://www.environment.gov.au/biodiversity/threatened/species/pubs/847-conservation-advice.pdf>

TSSC 2015b. Conservation Advice *Calidris ferruginea* Curlew Sandpiper. Threatened Species Scientific Committee <http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf>

Tudor L. 2002. *Coastal migratory shorebird management system and data base*. Maine Department of Inland Fisheries and Wildlife.

UNESCO 2013. Operational Guidelines for the Implementation of the World Heritage Convention. United Nations Educational, Scientific and Cultural Organisation, WHC 13/01 July 2013.

Unidel 2011. Abbot Point Facilities Terrestrial Flora and Fauna Report, Prepared for Waratah Coal Pty Ltd.

WBM 2006. Abbot Point Coal Terminal, Stage 3 Expansion, Environmental Impact Statement, Report prepared for Ports Corporation Queensland.

West A and Caldow R 2006. The development and use of individual based models to predict the effects of habitat loss and disturbance on waders and waterfowl. *Ibis*, 148:158-168.

WorleyParsons (2015). Abbot Point Growth Gateway Project – Marine Ecology Technical Report.

Appendix A Maps Showing Sightings of MNES

Maps present sightings of migratory shorebirds and migratory birds at the Caley Valley Wetland (excluding those already presented in the main body of the report).

Wandering Tattler Sightings - Caley Valley Wetlands



Note:
 1. Number labels on the map represent the total number of individuals of the species recorded during all surveys
 2. The exact location of sightings along transects is unknown

| | | | | |
|---|---|--|--|--|
| <p> Dredged Material Containment Pond Area</p> <p> Project Area</p> <p> Wandering Tattler (BAAM 2012)</p> | <p>Wetlands (BMT-WBM 2012)</p> <p> Closed Marsh</p> <p> Intertidal</p> <p> Open Marsh</p> <p> Open Pan</p> | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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Whimbrel Sightings - Caley Valley Wetlands



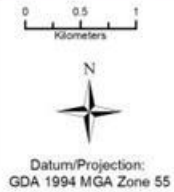
| | | | | |
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| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area Whimbrel (DEHP 2015) Whimbrel (BAAM 2012) Whimbrel (BMT-WBM 2012) Whimbrel (BAAM 2012) | <p>Wetlands (BMT-WBM 2012)</p> <ul style="list-style-type: none"> Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
|--|---|--|--|--|

Little Curlew - Caley Valley Wetlands



Note:
 1. Number labels on the map represent the total number of individuals of the species recorded during all surveys
 2. The exact location of sightings along the transect is unknown

| | |
|--|-------------------------|
| Dredged Material Containment Pond Area | Wetlands (BMT-WBM 2012) |
| Project Area | Closed Marsh |
| Little Curlew (BAAM 2012) | Intertidal |
| | Open Marsh |
| | Open Pan |



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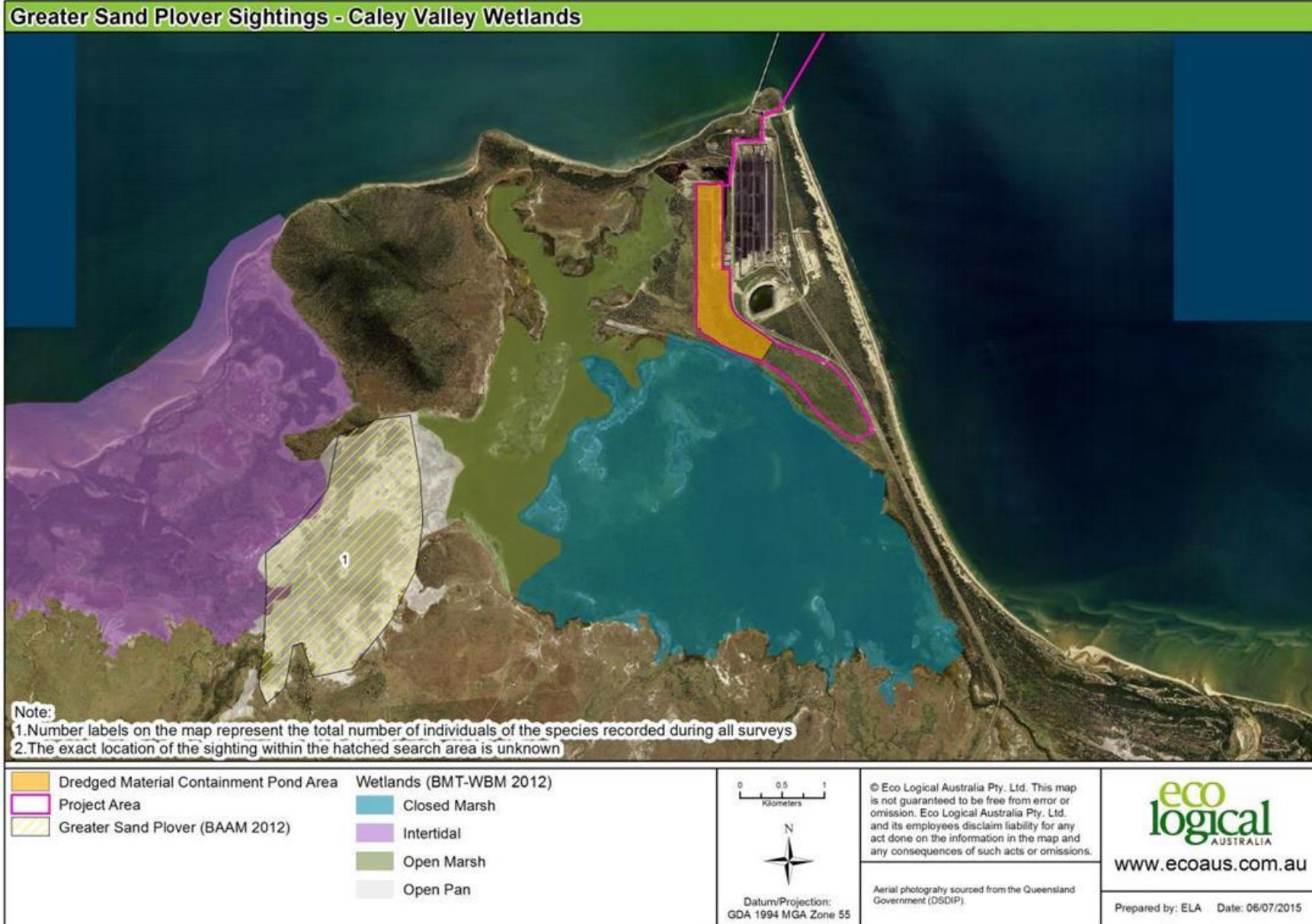
Aerial photography sourced from the Queensland Government (DSDIP).

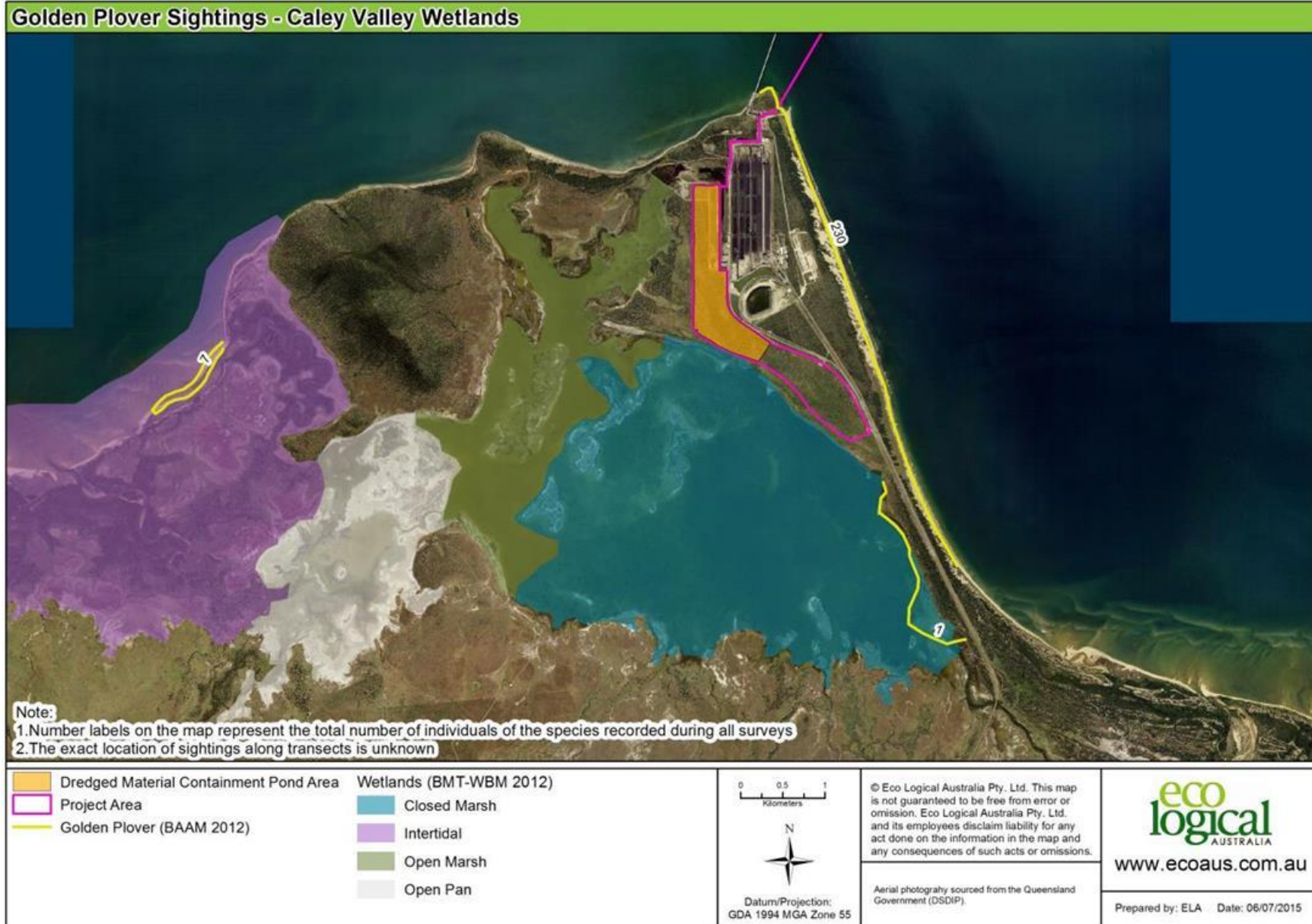
Prepared by: ELA Date: 06/07/2015

Grey-tailed Tattler Sightings - Caley Valley Wetlands



| | | | | |
|---|--|---|---|---|
| Dredged Material Containment Pond Area Project Area Grey-tailed Tattler (DEHP 2015) Grey-tailed Tattler (BMT-WBM 2012) | Wetlands (BMT-WBM 2012) Closed Marsh Intertidal Open Marsh Open Pan | Datum/Projection: GDA 1994 MGA Zone 55 | © Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions. Aerial photography sourced from the Queensland Government (DSDIP). | www.ecoaus.com.au Prepared by: ELA Date: 06/07/2015 |
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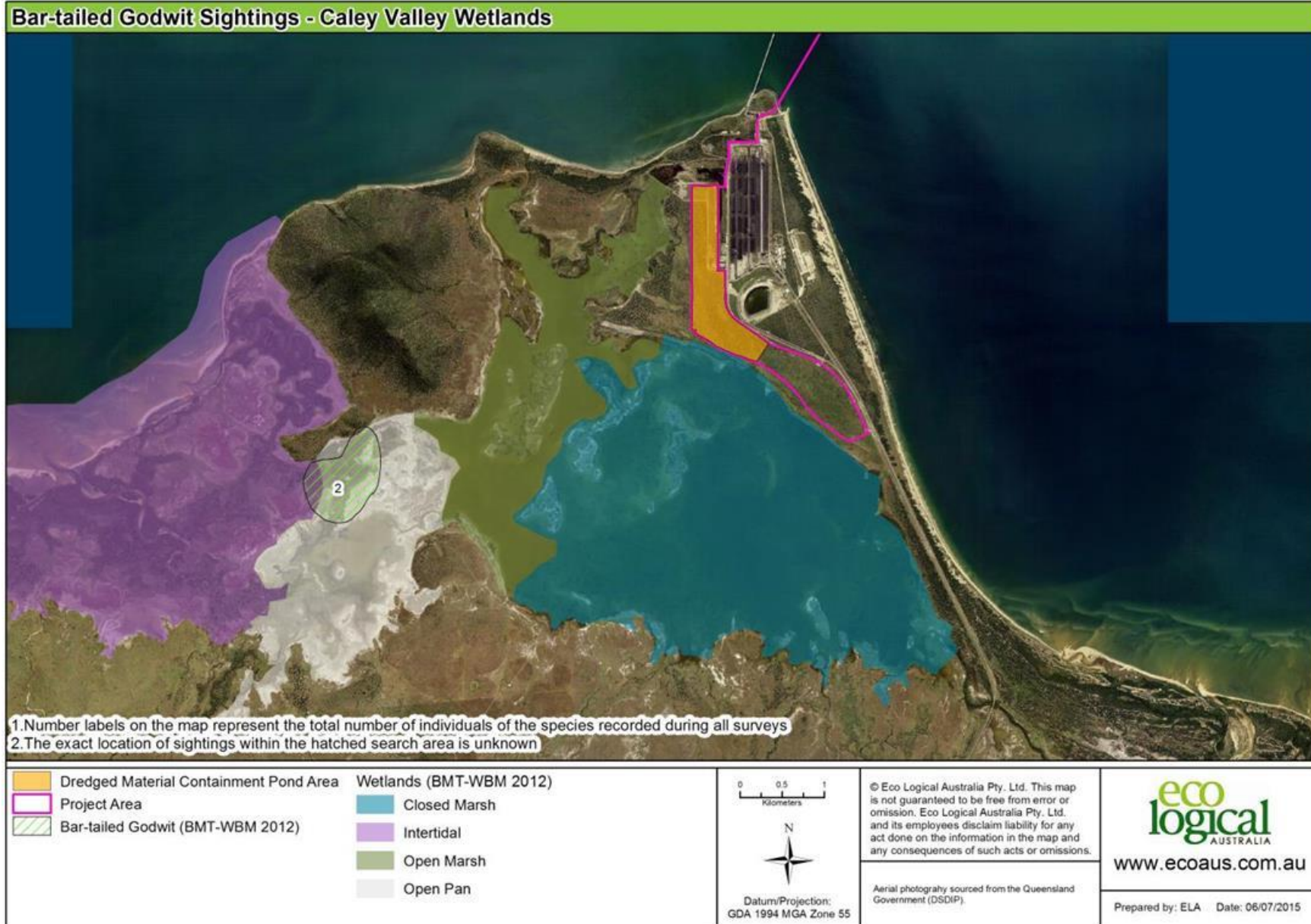


Black-tailed Godwit Sightings - Caley Valley Wetlands



- Notes:
1. Number labels on the map represent the total number of individuals of the species recorded during all surveys
 2. The exact location of sightings along transects is unknown
 3. The exact location of sightings within the hatched search area is unknown

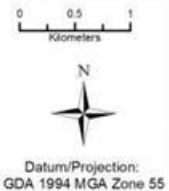
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| <p> Dredged Material Containment Pond Area</p> <p> Project Area</p> <p> Black-tailed Godwit (BAAM 2012)</p> <p> Black-tailed Godwit (BAAM 2012)</p> | <p>Wetlands (BMT-WBM 2012)</p> <p> Closed Marsh</p> <p> Intertidal</p> <p> Open Marsh</p> <p> Open Pan</p> | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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White-winged Tern Sightings - Caley Valley Wetlands



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|--|--------------------------------|
| Dredged Material Containment Pond Area | Wetlands (BMT-WBM 2012) |
| Project Area | Closed Marsh |
| White-winged Tern (BAAM 2012) | Intertidal |
| | Open Marsh |
| | Open Pan |



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White-bellied Sea Eagle Sightings - Caley Valley Wetlands





Note:
 1. Dot points represent known locations
 2. If no number label occurs next to a feature, the number of individuals recorded is unknown

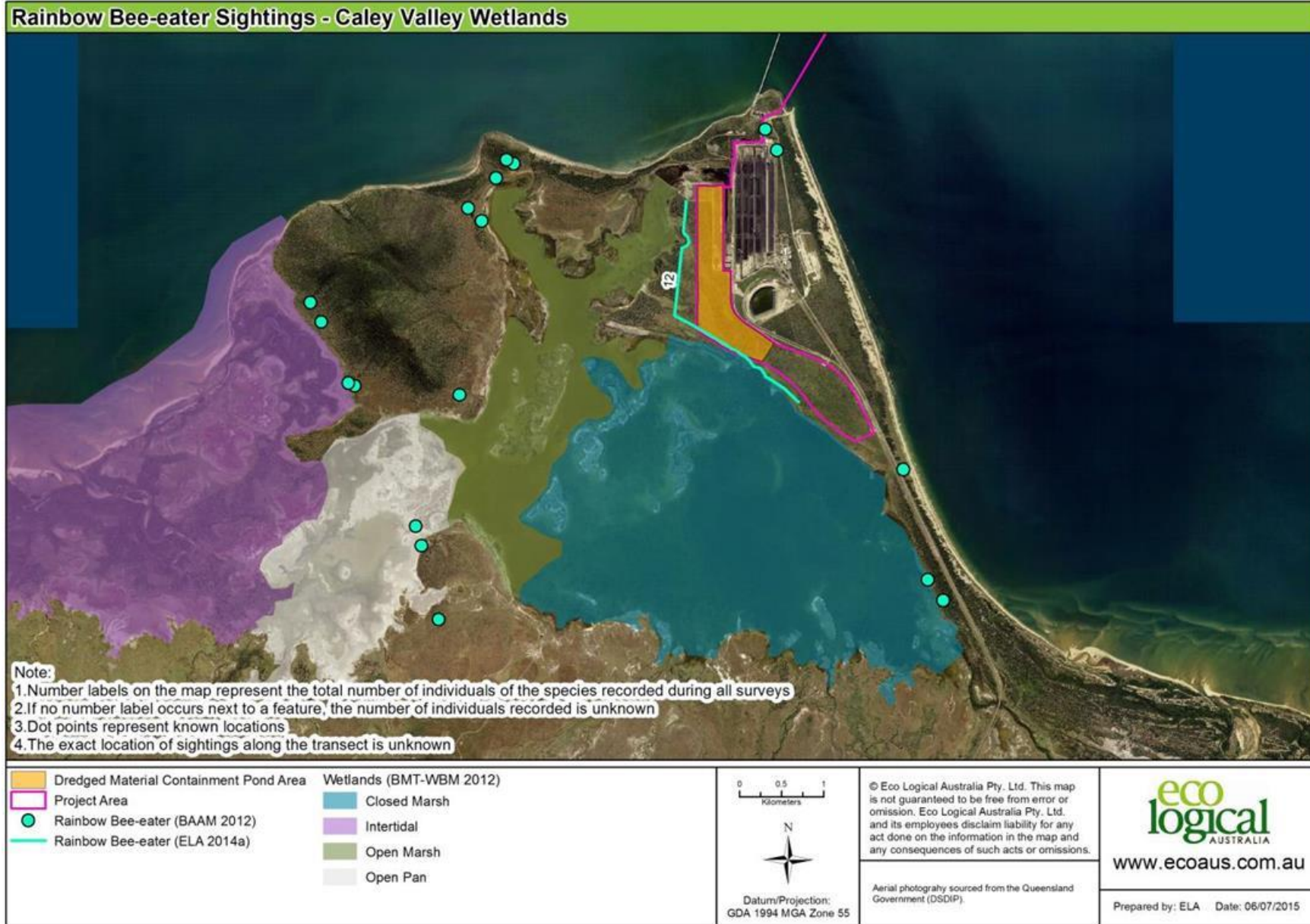
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| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area White-bellied Sea Eagle (BAAM 2012) White-bellied Sea Eagle (DEHP 2015) | <p>Wetlands (BMT-WBM 2012)</p> <ul style="list-style-type: none"> Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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Rufous Fantail Sightings - Caley Valley Wetlands



Note:
 1. Dot points represent known locations
 2. If no number label occurs next to a feature, the number of individuals recorded is unknown

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| <p> Dredged Material Containment Pond Area Project Area Rufous Fantail (BAAM 2012) </p> | <p> Wetlands (BMT-WBM 2012) Closed Marsh Intertidal Open Marsh Open Pan </p> | <p> 0 0.5 1 Kilometers N  Datum/Projection: GDA 1994 MGA Zone 55 </p> | <p> © Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions. </p> | <p>  www.ecoaus.com.au </p> |
| | | <p>Aerial photography sourced from the Queensland Government (DSDIP)</p> | | <p>Prepared by: ELA Date: 06/07/2015</p> |



Osprey Sightings - Caley Valley Wetlands



Note:
 1. Dot points represent known locations
 2. If no number label occurs next to a feature, the number of individuals recorded is unknown

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|---|--|--|---|--|
| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area Osprey (BAAM 2012) Osprey (DEHP 2015) | <p>Wetlands (BMT-WBM 2012)</p> <ul style="list-style-type: none"> Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP)</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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Little Tern Sightings - Caley Valley Wetlands





Note:
 1. Number labels on the map represent the total number of individuals of the species recorded during all surveys
 2. If no number label occurs next to a feature, the number of individuals recorded is unknown
 3. Dot points represent known locations
 4. The exact location of sightings along transects is unknown
 5. The exact location of sightings within hatched search areas is unknown

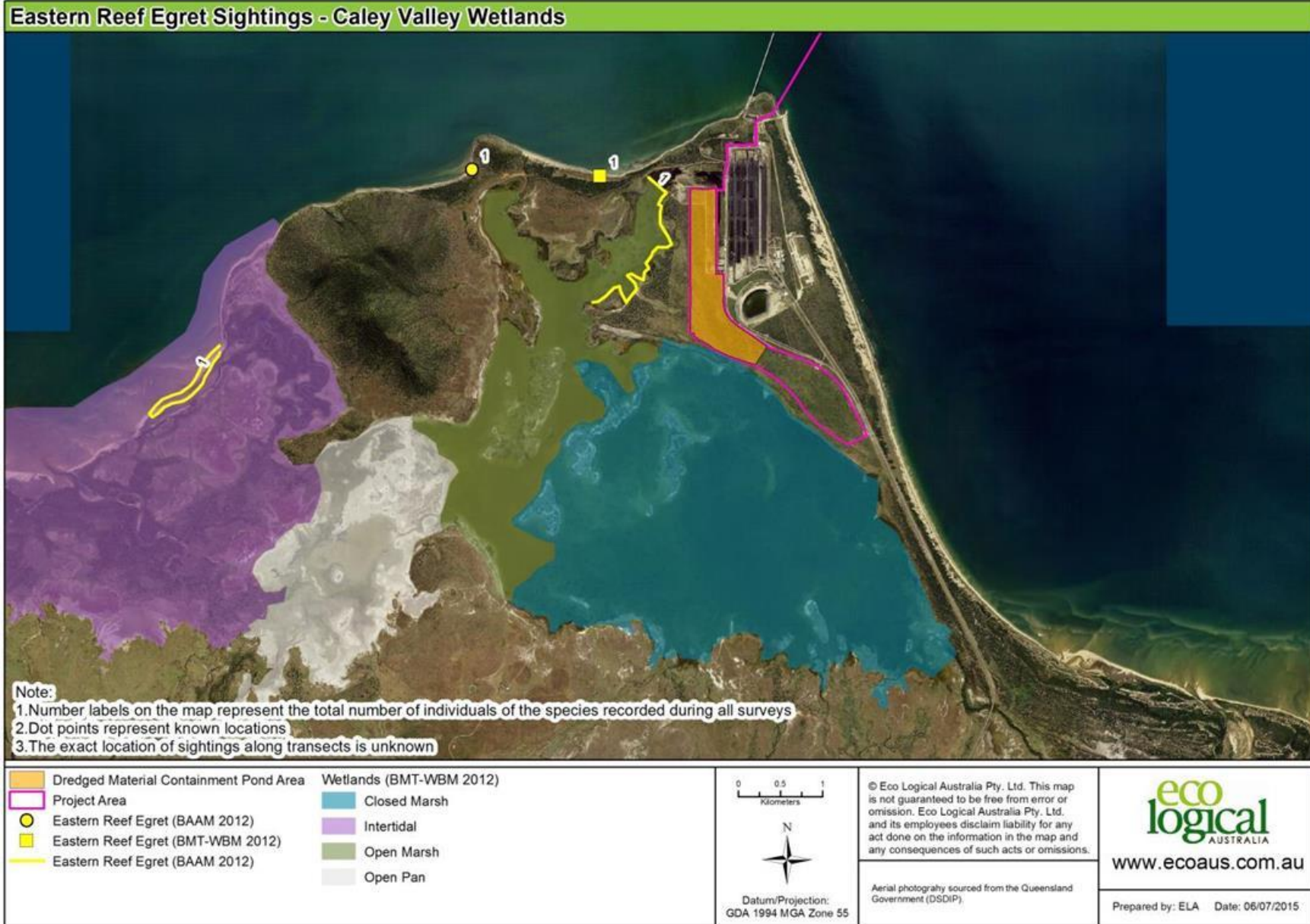
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| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area Little Tern (BAAM 2012) Little Tern (BMT-WBM 2012) Little Tern (DEHP 2015) Little Tern (CDM 2013) | <ul style="list-style-type: none"> Little Tern (BAAM 2012) Little Tern (WBM 2006 in BMT-WBM 2012) Little Tern (BAAM 2012) Little Tern (BMT-WBM 2012) | <p>Wetlands (BMT-WBM 2012)</p> <ul style="list-style-type: none"> Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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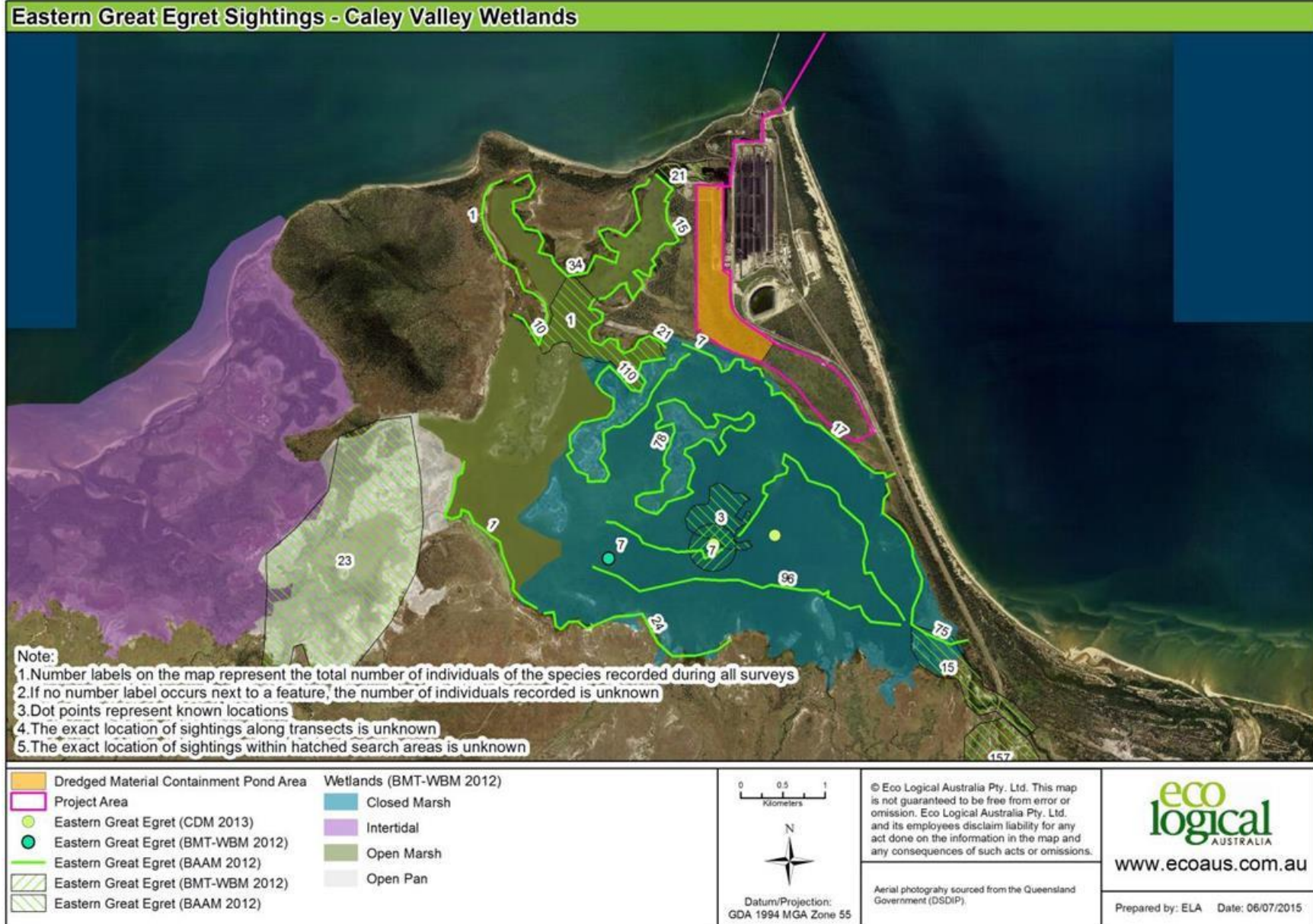
Lesser Crested Tern Sightings - Caley Valley Wetlands



Note:
 1. Number labels on the map represent the total number of individuals of the species recorded during all surveys
 2. The exact location of sightings along the transect is unknown

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| <p> Dredged Material Containment Pond Area Project Area Lesser Crested Tern (BAAM 2012) </p> | <p> Wetlands (BMT-WBM 2012) Closed Marsh Intertidal Open Marsh Open Pan </p> | <p> 0 0.5 1 Kilometers  Datum/Projection: GDA 1994 MGA Zone 55 </p> | <p> © Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions. Aerial photography sourced from the Queensland Government (DSDIP). </p> | <p>  www.ecoaus.com.au Prepared by: ELA Date: 06/07/2015 </p> |
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Cattle Egret Sightings - Caley Valley Wetlands



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| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area Cattle Egret (BAAM 2012) Cattle Egret (BAAM 2012) | <ul style="list-style-type: none"> Wetlands (BMT-WBM 2012) Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP)</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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Caspian Tern Sightings - Caley Valley Wetlands



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| <ul style="list-style-type: none"> Dredged Material Containment Pond Area Project Area Caspian Tern (BMT-WBM 2012) Caspian Tern (BAAM 2012) Caspian Tern (BMT-WBM 2012) Caspian Tern (BAAM 2012) | <p>Wetlands (BMT-WBM 2012)</p> <ul style="list-style-type: none"> Closed Marsh Intertidal Open Marsh Open Pan | <p>0 0.5 1 Kilometers</p> <p>N</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> | <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> <p>Aerial photography sourced from the Queensland Government (DSDIP).</p> | <p>eco logical AUSTRALIA</p> <p>www.ecoaus.com.au</p> <p>Prepared by: ELA Date: 06/07/2015</p> |
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MEMORANDUM

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| TO | Allison Hanly (Advisian) |
| FROM | Miles Yeates and Ailsa Kerswell (Eco Logical Australia) |
| DATE | 24 July 2015 |
| SUBJECT | Assessment of alternative pipeline alignments and soil stockpile / pipeline laydown area – terrestrial ecology |

Updated 13/11/2013

Background

In July 2015, Eco Logical Australia prepared separate terrestrial ecology technical reports addressing Commonwealth (ELA 2015a) and State (ELA 2015b) environmental matters as part of an impact assessment for the Abbot Point Growth Gateway Project (the Project). This technical memorandum provides additional information to support environmental assessment of the Project, after the following changes to the project design:

- Identification of an area of terrestrial land to be used as a site office, soil stockpile area and laydown storage area (18.6 ha in area), hereafter referred to as the 'laydown area', and
- Development of two alternative options for the location of temporary pipeline alignments to facilitate the transport of dredged material and return water.

Scope

The scope of the assessment includes environmental matters under Commonwealth and State legislation relevant to terrestrial ecology (including shorebirds), which may be affected by the laydown area and alternative pipeline alignments (excluding areas below the level of highest astronomical tide).

Description of additional project elements

An area comprising exotic grassland habitat located immediately south of the proposed dredged material containment ponds (DMCPs) is proposed to be utilised during construction stages of the Project for the following purposes:

- Establishing a temporary site office for construction workers
- Temporarily stockpile soil to facilitate construction of the DMCPs
- Temporarily store equipment and materials associated with the Project (e.g. pipelines, machinery and plant).

The location of the laydown area is presented in Figure 1. For the purposes of the assessment, it has been assumed that all existing habitats within this area will be directly disturbed by project activities.

Terrestrial Project Elements



Legend

- Dredged material pipeline (Option 2)
- Return water pipeline (Option 2)
- Dredged material pipeline (Option 3)
- Return water pipeline (Option 3)
- Dredged material pipeline (Option 1)
- Return water pipeline (Option 1)
- Dredge material containment pond
- Soil stockpile area, site office and laydown area
- Dredge material containment pond study area

0 0.25 0.5
Kilometers

Datum/Projection:
GDA 1994 MGA Zone 55



Data Sources:
Adani Mining

Imagery:
Queensland
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Prepared by: ELA Date: 22/07/2015

Figure 1 Location of the laydown area, original (Option 1) pipeline alignment and alternative (Options 2 and 3) pipeline alignments.

Additionally, two new design options for the location of temporary pipelines have been developed since the original assessment of impacts on terrestrial ecology (ELA 2015a, b). Temporary pipelines will be established within alignments between the DMCPs and the Coral Sea, comprising:

- Dredged material delivery pipeline to transport dredged material from the dredging area to the DMCPs
- Return water pipeline from the DMCPs to a sub-tidal discharge location

The pipelines are expected to be approximately 750 mm to 1000 mm in diameter and established within an alignment approximately 12 m in width. The location of the original (Option 1) and two alternative (Option 2 and Option 3) pipeline alignments is shown in Figure 1.

Assessment of potential impacts on environmental values

Potential impacts on terrestrial ecology values of the proposed additions to the project design and associated works are described below. This information should be read in conjunction with the detailed assessment of Project impacts on terrestrial ecology values relevant to Commonwealth (ELA 2015a) and State (ELA 2015b) matters.

Laydown Area

The area to be disturbed for establishment of the laydown area consists entirely of non-remnant exotic grassland habitat (Figure 2). The proposed use will therefore not result in the disturbance of any threatened flora species or ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Commonwealth) or threatened flora listed under the *Nature Conservation Act 1992* (NC Act; State). Similarly, the area to be disturbed does not comprise regulated vegetation (Figure 3), as defined under the *Queensland Vegetation Management Act 1999* and discussed within the Significant Residual Impact Guidelines (Queensland Government 2014).

A summary of the results of an assessment of the likelihood of fauna species listed under the EPBC Act and NC Act being present within the Abbot Point region is presented in Table 1 (ELA 2015a, b). Of those species that are known, likely or have potential to occur within the Abbot Point region, the Squatter Pigeon is the only species likely to utilise habitats (exotic grasslands) to be disturbed by the laydown area.

Table 1 Summary of the status of threatened species known, likely or with potential to occur within the Abbot Point region and their use of the laydown area to be disturbed (ELA 2015a, b)

| Species | EPBC Act status | NC Act status | Habitat disturbed? |
|--------------------------|------------------------|-----------------|--------------------|
| Australian Painted Snipe | Endangered | Vulnerable | No |
| Curlew Sandpiper | Critically Endangered* | | No |
| Eastern Curlew | Critically Endangered* | Near Threatened | No |
| Squatter Pigeon | Vulnerable | Vulnerable | Yes |
| Glossy Black-Cockatoo | | Vulnerable | No |
| Beach-stone Curlew | | Vulnerable | No |
| Coastal Sheathtail Bat | | Vulnerable | No |

*not listed at the time of referral determination

The Squatter Pigeon occurs at Abbot Point in low numbers which do not represent a significant part of the broader population (ELA 2015a, b) because:

- the species is ubiquitous in this part of its geographic range
- the species is not restricted by habitat availability in the region (this is particularly the case because the species is a habitat generalist)
- the numbers recorded at Abbot Point are small and the species is neither rare nor disjunct from the broader population (which occurs across a large range)
- it is not at the edge of the range of the species and is therefore not important in terms of range expansion and recovery.

Given the above, there is no evidence to suggest the individuals found at Abbot Point are important in terms of maintaining genetic diversity.

The disturbance of approximately 18.6 ha of Squatter Pigeon habitat, in addition to the 75 ha of habitat to be disturbed by the DMCPs and original pipeline alignment, is therefore likely to have only minor impacts on the species. Mitigation measures outlined in the original assessment (ELA 2015a, b) are considered appropriate for the area that will be subject to additional disturbance. These mitigation measures include the implementation of a Species Management Program for animal breeding places (ELA 2015c) and actions to reduce habitat loss, nest disturbance and habitat quality. The implementation of measures additional to those outlined in the original assessments is not considered necessary.

The remaining species listed in Table 1 are highly unlikely to be affected by the proposed use of the laydown area. The Australian Painted Snipe, Curlew Sandpiper and Eastern Curlew are shorebirds, which may occur within the adjacent Caley Valley Wetland and nearby coastal foreshores. The Glossy Black-Cockatoo is likely to occur sporadically in Coastal She-Oak (*Casuarina equisetifolia*) along the beach of Abbot Point (CDM Smith 2013). The Beach-stone Curlew and Coastal Sheath-tail Bat are likely to occur within coastal woodlands of the Abbot Point region. Mitigation measures outlined in the original assessments (ELA 2015a, b) will be sufficient to reduce the risk of indirect impacts on these species.

There are no additional impacts arising from the laydown area on species listed as Migratory under the EPBC Act. Migratory species with ecologically significant proportions of their population recorded in the Caley Valley Wetland are the Caspian Tern, Little Tern and Eastern Great Egret (ELA 2015a). The laydown area does not provide habitat suitable for these species.



Figure 2 Map of regional ecosystems within the Abbot Point region

Regulated Vegetation



| | | | |
|--|--|--|--|
| <p>Legend</p> <ul style="list-style-type: none"> — Dredged material pipeline (Option 2) — Return water pipeline (Option 2) — Dredged material pipeline (Option 3) — Return water pipeline (Option 3) — Dredged material pipeline (Option 1) — Return water pipeline (Option 1) Dredge material containment pond | <ul style="list-style-type: none"> ■ Soil stockpile area, site office and laydown area Dredge material containment pond study area Essential Habitat V4.71 Vegetation Management Wetlands V2.7 Regulated Remnant Vegetation (V8) - Category B Least Concern Of Concern - Dominant | <p>0 0.25 0.5 Kilometers</p> <p>Datum/Projection: GDA 1994 MGA Zone 55</p> <p style="text-align: center;">N ↑ ↓ ← →</p> <p>Data Sources: Adani Mining, QLD Gov</p> <p>Imagery: Queensland Government (DSDIP)</p> | <p style="text-align: center;">eco logical AUSTRALIA</p> <p style="text-align: center;">www.ecoaus.com.au</p> |
| <p>© Eco Logical Australia Pty. Ltd. This map is not guaranteed to be free from error or omission. Eco Logical Australia Pty. Ltd. and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.</p> | | <p>Prepared by: ELA Date: 06/07/2015</p> | |

Figure 3 Regulated vegetation within the Abbot Point region

Alternative pipeline alignments

The two alternative pipeline alignments have been selected to minimise disturbance of remnant vegetation, by utilising existing cleared areas, road alignments and storage areas. The following considerations are most relevant to assessment of potential impacts associated with the alternative pipeline alignments:

- Both Options 2 and 3 traverse an existing cleared area located 5 m from a patch of Semi-Evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT) Threatened Ecological Community (TEC). This setback distance from the SEVT TEC is less than the 50 m setback associated with the original alignment (Option 1).
- Option 3 traverses a patch of remnant vegetation comprising RE 11.2.2 (foredune habitat) approximately 0.15 ha in area. This area is also designated as Of Concern – Dominant Regulated Vegetation under Queensland legislation. The original alignment (Option 1) and Option 2 involve disturbance of a smaller area (approximately 0.05 ha) of the mapped RE11.2.2 comprising Of Concern – Dominant Regulated Vegetation.
- The Beach-stone Curlew (listed as Vulnerable under the NC Act) and Squatter Pigeon (listed as Vulnerable under the EPBC Act and NC Act) may nest in the coastal woodland or dune habitats where the three pipeline alignments are proposed.

These three matters are assessed separately below.

SEVT communities are comprised of dry seasonal subtropical rainforest (McDonald 2010), and are known to contain 11 plant species and five animal species listed as threatened under Commonwealth or Queensland legislation. Within the Abbot Point region (from Cape Upstart south to Bowen) the occurrence of SEVT corresponds to only one of the REs; 11.2.3 Microphyll vine forest ('beach scrub') on sandy beach ridges. No other REs identified as SEVT TEC occur within the Abbot Point region.

While the Project does not involve any clearing or direct disturbance of SEVT, there are potential indirect impacts from the introduction of weeds, from fire or from chemical spills caused by Project activities. Reducing the setback of the pipeline alignment from SEVT from 50 m (Option 1) to 5 m (Options 2 and 3) has the potential to increase the likelihood of these indirect impacts occurring. The potential modes of impact most relevant to the reduced setback distance of 5 m are:

- Introducing weeds directly to the SEVT
- Sparks arising from machinery (e.g. booster pumps) or plant, causing fire within the dry rainforest habitats
- Trampling of SEVT habitat from continuous use of areas adjacent to the alignment by workers and their vehicles

The following mitigation measures were recommended as appropriate for the 50 m setback (Option 1; ELA 2015a):

- Areas to be cleared within the Project Area will be surveyed, marked out and authorised by an appropriate person prior to clearing to ensure no areas of SEVT TEC are inadvertently disturbed
- All high risk materials (e.g. imported soil) should be certified as weed-free prior to acceptance on-site
- Soil and fill material from weed-affected areas within the Project should not be transported to clean sites within the Project Area
- Flammable materials should be stored correctly to avoid spills
- Fire prevention measures should be employed, which may include fitting spark arresters to equipment; avoiding where practicable the use of spark-generating machinery and equipment on all total fire ban days; and restricting employee smoking to specific areas

- Development areas should be provided with adequate firefighting equipment.

In the event that an option involving a reduced setback is selected (Option 2 and 3), the following mitigation measures additional to those outlined above are also recommended:

- Weed monitoring and control activities (e.g. spot spraying and physical removal and bagging) be implemented along the fringe of the portion of the SEVT TEC lying adjacent to the pipeline alignment for a period of 12 months following completion of the works
- Disturbed sections of the pipeline alignment lying adjacent to the SEVT which are not used for alternative purposes (e.g. roads) be restored to their original condition following the completion of works
- Where operationally practical, booster pumps are located in areas of the pipeline alignment where their setback from the SEVT is maximised.
- The storage of construction materials and other equipment (e.g. fuels) should not occur in areas immediately adjacent to the SEVT.
- Access to the SEVT by people and vehicles should be minimised or avoided where practical.

With the implementation of these additional mitigation measures, the potential for impacts of the alternative pipeline alignments (Options 2 and 3) on the SEVT TEC is minimised. While Option 1 has a lower risk of environmental impacts on the SEVT than Options 2 or 3, all options are likely to result in only minor indirect impacts on the SEVT. These minor impacts can be managed through appropriate environmental controls.

In relation to Matters of State Environmental Significance, the primary consideration in the assessment of the three pipeline options is disturbance of Regulated Vegetation. Option 1 (0.05 ha), Option 2 (0.05 ha) and Option 3 (0.15 ha) involve the disturbance of Of Concern – Dominant Regulated Vegetation. The Queensland Significant Residual Impact Guidelines (Queensland Government 2014) provide criteria for assessment of the disturbance of Regulated Vegetation. Where these criteria are exceeded, this indicates a significant residual impact is likely. Where the criteria are not exceeded, the impact is not considered to be significant.

In relation to Regulated Vegetation, the significant impact criteria for clearing/disturbance is summarised in Table 1 of the Significant Residual Impact Guidelines (Queensland Government 2014). For Of Concern Regional Ecosystems in the mid-dense structural category (relevant to RE 11.2.2), clearing an area >10 m wide for linear infrastructure, or clearing >0.5 ha for other than linear infrastructure, are considered to constitute a significant residual impact.

The term 'linear infrastructure' isn't defined in the guidelines, but would generally refer to works that are constructed and remain in place as infrastructure for ongoing use (rather than temporary works). Examples of linear infrastructure include roads, power lines or stormwater systems. The proposed temporary pipelines, while linear, will only be in place for a period of 3-4 months, and therefore are not considered to be infrastructure for the purposes of this assessment. The 'other than for linear infrastructure' criterion is therefore considered to be most relevant to this assessment.

All three options under consideration for the pipeline alignment involve clearing of less than 0.5 ha of Regulated Vegetation. Therefore there will be no significant residual impact arising from any of the pipeline options. While Option 3 involves clearing of more Regulated Vegetation than Options 1 and 2, the magnitude of the difference is low (0.1 ha). In the event that the temporary pipelines were assessed to be linear infrastructure by the Queensland Government, those portions of the pipeline alignments traversing the regulated vegetation could be reduced to a width of 10 m (subject to engineering constraints), to avoid a significant residual impact.

In relation to potential impacts of the pipeline alignments on threatened and migratory fauna, ground nests of the Beach-stone Curlew and Squatter Pigeon are the primary consideration relevant to the assessment. These species may establish nests within coastal dune and/or woodland habitats of the Abbot Point region, which could be susceptible to disturbance from establishment, maintenance and removal of temporary pipelines. Option 3 involves the disturbance of an additional 0.1 ha of potentially suitable nesting habitat when compared with Options 1 and 2.

Having examined the potential for such impacts, we consider that the risk of disturbing nesting activities of these threatened species is minor for the following reasons:

- The beach and dune systems of Abbot Point are several kilometres in length, with the section of habitat to be disturbed by the pipeline alignment (once selected) a small fraction of this area.
- Direct disturbance will occur within a 12 m corridor, and indirect disturbance of birds could be expected within a distance of approximately 100 m either side of the pipeline alignment.
- The pipelines will be in place for approximately 3-4 months, and will be removed following the completion of dredging. Ongoing impacts following the removal of pipelines are unlikely, with a rapid recovery of disturbed areas expected.
- The existing coastal dune system and foreshore at the locations under consideration is partially disturbed from existing land-uses (e.g. construction and operation of a marine offloading facility, roads and the presence of weeds within the dune system).
- Environmental values to be affected by the works are widespread throughout the Abbot Point region and are likely to be in better condition (less disturbed) further south along the eastern beach (where works are not proposed).

A Species Management Program has been prepared for the Project, outlining measures to reduce the impact of construction activities on animal breeding places (ELA 2015c). The measures outlined in the Species Management Program will be sufficient to manage the risk of disturbing Squatter Pigeon and Beach-stone Curlew nests.

There are no additional implications of the alternative pipeline alignments for the assessment of impacts on threatened or migratory species under Commonwealth or State legislation, beyond those outlined in the original assessments (ELA 2015a, b).

Discussion and Conclusion

There is minimal potential for additional environmental impacts associated with changes to the Project design involving the establishment of a laydown area and the selection of a pipeline alignment different to that assessed for the original project description. A summary of the additional impacts is as follows:

- Disturbance of an additional 18.6 ha of Squatter Pigeon habitat
- Possible reduction in the pipeline alignment setback from SEVT TEC from 50 m to 5 m (if Option 2 or 3 are selected). In this instance, some additional mitigation measures are recommended, to reduce the likelihood of indirect impacts on the SEVT from fire, weeds and spills.
- An increase in the amount of regulated vegetation to be cleared of 0.1 ha if Option 3 is selected.
- An increase in the amount of potentially suitable nesting habitat disturbed for the Vulnerable Squatter Pigeon and Beach-stone Curlew of 0.1 ha if Option 3 is selected.

The revisions to the Project design have not changed the conclusions of the original terrestrial ecology assessment (ELA 2015a, b), that the Project can proceed with minimal potential impact on terrestrial ecology values.

There is a small difference in the impact of the three pipeline options on terrestrial ecology values. The original alignment (Option 1) and Option 2 will result in the least amount of disturbance of mapped regulated vegetation. Option 1 has the largest buffer to the SEVT TEC (50 m).

References

CDM Smith 2013. Adani Coal Terminal EIS.

ELA 2015a. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (Matters of National Environmental Significance). Prepared for Advisian, July 2015.

ELA 2015b. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (State Matters). Prepared for Advisian July 2015.

ELA 2015c. Abbot Point Growth Gateway Project – Species Management Program. Prepared for Advisian July 2015.

McDonald, WJF 2010. National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community. Report to Department of the Environment, Water, Heritage and the Arts, Canberra. Queensland Department of Environment and Resource Management, Brisbane.

Queensland Government 2014. Significant Residual Impact Guideline. Queensland Environmental Offsets Policy, December 2014. <http://www.ehp.qld.gov.au/assets/documents/pollution/management/offsets/significant-residual-impact-guide.pdf>

MEMORANDUM

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| TO | Allison Hanly (Advisian) |
| FROM | Miles Yeates and Ailsa Kerswell (Eco Logical Australia) |
| DATE | 24 July 2015 |
| SUBJECT | Assessment of alternative pipeline alignment – habitat for shorebirds below Highest Astronomical Tide |

Updated 13/11/2013

Background

In July 2015, Eco Logical Australia prepared separate terrestrial ecology technical reports addressing Commonwealth (ELA 2015a) and State (ELA 2015b) environmental matters as part of the impact assessment for the Abbot Point Growth Gateway Project (the Project). This technical memorandum provides additional information to support environmental assessment of the Project, following the development of alternative options for the location of pipeline alignments to facilitate the transport of dredged material and return water.

Scope

The scope of the assessment includes environmental matters under Commonwealth and State legislation relevant to terrestrial ecology (including shorebirds), which may be affected by aspects of the alternative pipeline alignments which are below the level of Highest Astronomical Tide (HAT). The focus of the assessment is therefore the intertidal zone on the eastern beach of Abbot Point, where the pipeline alignments traverse the beach and potential impacts on shorebirds (including species found in coastal foreshore habitats, migratory and resident shorebirds) and their habitats.

Description of alternative pipeline alignment/s

The following temporary pipelines will be established within alignments between the dredged material containment ponds (DMCPs) and the Coral Sea:

- Dredged material delivery pipeline to transport dredged material from the dredging area to the DMCPs
- Return water pipeline from the DMCPs to a sub-tidal discharge location

The pipelines are expected to be approximately 750 mm to 1000 mm in diameter and established within an alignment approximately 12 m in width. The location of the original (Option 1) and two alternative (Option 2 and Option 3) pipeline alignments are shown in Figure 1.

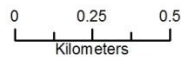
In relation to the scope of this assessment, the primary consideration is the potential relocation of the pipeline alignment immediately south of the original alignment (Option 2) or approximately 150 m to the south east of the original alignment (Option 3).

Terrestrial Project Elements



Legend

- Dredged material pipeline (Option 2)
- Return water pipeline (Option 2)
- Dredged material pipeline (Option 3)
- Return water pipeline (Option 3)
- Dredged material pipeline (Option 1)
- Return water pipeline (Option 1)
- Dredge material containment pond
- Soil stockpile area, site office and laydown area
- Dredge material containment pond study area



Datum/Projection:
GDA 1994 MGA Zone 55



Data Sources:
Adani Mining

Imagery:
Queensland
Government (DSDIP)



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Prepared by: ELA Date: 22/07/2015

Figure 1 Location of original (Option 1) and alternative (Options 2 and 3) pipeline alignments

Ecological values

The ecological values of the three pipeline alignments under consideration are similar where they cross the eastern foreshore of Abbot Point. Habitats within the coastal foreshore are generally comprised of sandy, partially exposed beaches, facing east north east towards the Coral Sea. Coastal foreshores at all locations under consideration for the pipeline crossing are partially disturbed and are located adjacent to (within 100 m of) existing rock revetments of a marine offloading facility (ELA 2014). Rocky foreshores occur to the north of the pipeline crossings (adjacent to the original alignment and Option 2).

Intertidal foreshores of Abbot Point below the level of HAT provide general foraging and roosting habitat for a range of shorebirds, including migratory species. A review of the species that are known, likely or have potential to occur in the Abbot Point region was provided in the detailed ecological assessments completed for the Project (ELA 2015a, b).

BAAM (2012) undertook extensive shorebird surveys of the Abbot Point region including the eastern beach (at high and low tides) in 2012. Transect C1 presented in BAAM (2012) incorporated the entire eastern beach from adjacent to the existing coal trestle south for a distance of 6.5 km. This transect includes the three sites under consideration for a pipeline crossing of the beach. These data have informed the assessment of potential impacts associated with the original and alternative pipeline alignments.

Species sighted by BAAM (2012) and their conservation status under Commonwealth (*Environment Protection and Biodiversity Conservation Act 1999*; EPBC Act) and Queensland (*Nature Conservation Act 1992*; NC Act) legislation are summarised in Table 1. The eastern beach habitat supports relatively small numbers of shorebird species, including migratory and resident species. Sighting records include six species listed as Migratory under the EPBC Act, and one species (the Beach-stone Curlew), listed as Vulnerable under the NC Act.

Table 1 Records of shorebird sightings along the eastern beach of Abbot Point (BAAM 2012)

| Species | EPBC Act status | NC Act status | Total number of individuals sighted |
|-----------------------|-----------------|-----------------------|-------------------------------------|
| Pied Oystercatcher | - | Least Concern | 23 |
| Wandering Tattler | Migratory | Special Least Concern | 2 |
| Beach-stone Curlew | - | Vulnerable | 6 |
| Caspian Tern | Migratory | Special Least Concern | 8 |
| Pacific Golden Plover | Migratory | Special Least Concern | 230 |
| Australasian Darter | - | Least Concern | 3 |
| Gull-billed Tern | Migratory | Least Concern | 29 |
| Silver Gull | - | Least Concern | 2 |
| Whimbrel | Migratory | Special Least Concern | 4 |
| Red-necked Stint | Migratory | Special Least Concern | 10 |
| Red-capped Plover | - | Least Concern | 25 |
| White-faced Heron | - | Least Concern | 2 |

The information presented above, in addition to that contained within the detailed ecological assessments for the Project (ELA 2015a, b), suggest that the eastern beach environment at Abbot Point provides general habitat for a small number of shorebird species. The significance of the eastern beach as a shorebird habitat is low when compared with the adjacent Caley Valley wetland, which may support thousands of individual shorebirds, comprising dozens of resident and migratory species (BAAM 2012; BMT WBM 2012).

Abbot Point's eastern beach is likely to be utilised by shorebirds as a general foraging resource at low tide. Prey items may include polychaete worms, bivalve molluscs and crustaceans. Additionally, some shorebird species are likely to roost along sections of the beach at high tide (around the level of HAT). Some resident species (e.g. Beach-stone Curlew) may also nest within the adjacent dune and coastal woodland environments, above the level of HAT.

Assessment of impacts

Establishment, operation and dismantling of the temporary pipelines within the intertidal area of the eastern beach at Abbot Point can be expected to result in minor impacts on the coastal habitat values of the foreshore for shorebirds. Such impacts may include:

- small scale disturbance of sediments and associated fauna which are prey for some bird species
- production of localised turbidity plumes within the intertidal area through the disturbance of sand underneath the pipelines, reducing the quality of foraging habitat
- disturbance from noise and increased numbers of people and vehicles associated with establishing, monitoring and removing the temporary pipeline (discouraging feeding, roosting and nesting behaviour in the immediate vicinity of the pipeline)

We consider that environmental impacts from establishment, operation and dismantling of the temporary pipelines will be relatively minor in the three locations under consideration, for the following reasons:

- The eastern beach of Abbot Point is approximately 6.5 km in length, with the section of coastal foreshore to be disturbed by the pipeline alignment (once selected) a small fraction of this habitat.
- Direct disturbance will occur within a 12 m corridor, and indirect disturbance of birds could be expected within a distance of approximately 100 m either side of the pipeline alignment.
- The pipelines will be in place for approximately 3-4 months, and will be removed following the completion of dredging. Ongoing impacts following the removal of pipelines are unlikely, with a rapid recovery of disturbed areas expected.
- The existing coastal dune system and foreshore at the locations under consideration is partially disturbed from existing adjacent land-uses (e.g. construction and operation of a marine offloading facility, roads and the presence of weeds within the dune system).
- Environmental values to be affected by the works are widespread throughout the Abbot Point region and are likely to be in better condition (less disturbed) further south along the eastern beach (where works are not proposed).
- Impacts from establishing, maintaining and removing the pipelines on the feeding, roosting and nesting behaviour of birds will be small in scale and localised.

Environmental impacts below HAT arising from the original pipeline alignment are likely to be very similar to those of the two alternative alignments under consideration. In this context, there is no strong basis for choosing one alignment over the others on the grounds of potential impacts on terrestrial ecology values below HAT.

Conclusion

Environmental impacts associated with two alternative pipeline alignments located south of the original alignment are likely to be minor and short-term. The alternative alignments neither increase nor decrease the potential for minor and localised impacts on terrestrial ecology values (below HAT) when compared with the original alignment.

References

BAAM 2012. Cumulative Impact Assessment: Migratory Shorebird and Waterbird Surveys, Caley Valley Wetland, Port of Abbot Point. Report prepared for North Queensland Bulk Ports Corporation, (including follow up survey results reported in June, Nov, Dec 2012).

BMT WBM 2012. Kaili (Caley) Valley Wetlands Baseline Report. Prepared by BMT WBM Pty Ltd for the Office of the Coordinator-General, Department of State Development, Infrastructure, and Planning. Available at: <http://www.dip.qld.gov.au/resources/plan/cg/abbot/baseline-profile-for-the-kail-valley-wetlands.pdf>

ELA 2014. Survey of RE11.2.2 patch on eastern beach. Technical Memo prepared for Advisian.

ELA 2015a. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (Matters of National Environmental Significance). Prepared for Advisian, July 2015.

ELA 2015b. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (State Matters). Prepared for Advisian July 2015.

MEMORANDUM

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| TO | Allison Hanly (Advisian) |
| FROM | Miles Yeates and Ailsa Kerswell (Eco Logical Australia) |
| DATE | 13 August 2015 |
| SUBJECT | Implications of revised dust modelling results on Terrestrial Ecology |

Updated 13/11/2013

Background and Scope

In July 2015, Eco Logical Australia (ELA) prepared separate terrestrial ecology technical reports addressing Commonwealth (ELA 2015a) and State (ELA 2015b) environmental matters as part of the impact assessment for the Abbot Point Growth Gateway Project (the Project).

ELA's assessment of Project impacts on terrestrial ecology values considered information from a variety of sources, including preliminary results of dust modelling completed by Katestone (2015a). Following finalisation of ELA's terrestrial ecology assessment, final results of dust modelling became available (Katestone 2015b), with some differences to those reported in the preliminary results used by ELA in the impact assessment.

This technical memorandum summarises the implications of the final dust modelling results for the assessment of potential Project impacts on terrestrial ecology values. This memorandum should be read in conjunction with the terrestrial ecology technical report (ELA 2015a) and air quality modelling report (Katestone 2015b).

Assessment

The results of the preliminary and final air quality modelling were similar, when considering the predicted dust deposition rates ($\text{mg}/\text{m}^2/\text{d}$) and the predicted concentrations of TSP, $\text{PM}_{2.5}$ and PM_{10} ($\mu\text{g}/\text{m}^3$). In relation to the air quality criteria for environmental protection discussed by Katestone (2015b) and ELA (2015a, b), the key differences in the results were as follows:

- The final modelling predicted PM_{10} concentrations to comply with criteria for environmental protection at a maximum distance of 1,500 m from the source (compared with 600 m in the preliminary modelling)
- The revised modelling predicted TSP concentrations to comply with criteria for environmental protection at a maximum distance of 300 m from the source (preliminary results did not predict an exceedance of the criteria within the Caley Valley Wetland).

ELA understands that the differences between the preliminary and final modelling results are associated with more detailed consideration of dust produced by existing operations at Abbot Point within the final modelling. The final modelling results are therefore more conservative for the purposes of impact assessment.

In the context of assessing potential impacts of the Project on terrestrial ecology values including migratory shorebirds, the final modelling results indicate that:

- A maximum area of wetland habitat of approximately 302 ha (5.9% of the Caley Valley Wetland) is predicted to be above the PM₁₀ criterion for environmental protection (compared with 111.5 ha predicted from the preliminary modelling)
- A maximum area of wetland habitat of approximately 34 ha (0.7% of the Caley Valley Wetland) is predicted to be above the TSP criterion for environmental protection (compared with 0 ha predicted from the preliminary modelling).

The final air quality modelling results indicate that potential impacts of dust on terrestrial ecology values are likely to be marginally higher than those considered in ELA's original assessment (ELA 2015a, b). However, ELA considers that the magnitude of any increase in environmental risk is small and that the original findings of the impact assessment are valid, for the following reasons:

- The human health criteria applied to interpretation of the modelling results to assess levels of environmental protection are conservative and are generally applied to activities involving long-term exposure (e.g. residential development)
- The maximum area of wetland habitats where the PM₁₀ and TSP criteria are predicted to be exceeded are equivalent to 5.9% (PM₁₀) and 0.7% (TSP) of the Caley Valley Wetland
- Dust management strategies that are more stringent than those assumed in the air quality model will be implemented, reducing actual dust concentrations below those of the modelled results (Katestone 2015b)
- Shorebirds are mobile and are unlikely to stay continuously within any areas of the wetland. Any exposure to dust is therefore highly unlikely to be continuous.
- Construction stages of the Project may be conducted during periods when the wetland is dry or migratory shorebirds are not present
- Dust deposition rates were predicted to be below the thresholds at which impacts on wetland vegetation would occur
- Dust concentrations were predicted to comply with the PM_{2.5} criteria (24 hour and annual) for environmental protection

It is recommended that:

- the final air quality modelling results be incorporated into the impact assessment documentation, and
- this technical memorandum be included as an appendix to the impact assessment, to assist readers understand the reasons for differences in dust results presented in the ELA (2015a) technical report and the impact assessment chapters.

References

ELA 2015a. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (Matters of National Environmental Significance). Prepared for Advisian, July 2015.

ELA 2015b. Abbot Point Growth Gateway Project – Terrestrial Ecology Report (State Matters). Prepared for Advisian July 2015.

Katestone 2015a. Preliminary Air Quality Results – Abbot Point Growth Gateway Project. Prepared by Katestone Environmental Pty Ltd for Advisian, June 2015.

Katestone 2015b. Air Quality Assessment of the Abbot Point Growth Gateway Project. Prepared by Katestone Environmental Pty Ltd for Advisian, July 2015.

**Approved Conservation Advice for
Rostratula australis (Australian painted snipe)**

(s266B of the *Environment Protection and Biodiversity Conservation Act 1999*)

This Conservation Advice has been developed based on the best available information at the time this Conservation Advice was approved; this includes existing plans, records or management prescriptions for this species.

Description

Rostratula australis (Australian painted snipe), Family Rostratulidae, is a stocky wading bird approximately 240–300 mm in length, with a wingspan of 500–540 mm and weighing 125–130 g (Birds Australia, 2012). The adult female is more colourful and larger than the male. It has a chocolate-brown head with chestnut patch in the nape, a comma-shaped white marking around the eye and metallic green back and wings, densely barred olive and black (Rogers pers. comm., 2012). A diagnostic white ‘harness marking’ runs from the mantle onto the breast (Rogers pers. comm., 2012). It has a brown eye, white belly, bluish-green legs and long pink-orange bill darkening towards the tip (Reader’s Digest, 1997). The male is smaller than the female and has a duller head pattern (Rogers pers. comm., 2012). It has a mottled grey-brown head and neck, with buff stripe down the centre of the crown and through the eyes. Wings and back are barred black, buff and white, and the breast has a broad black band (Reader’s Digest, 1997). There is no seasonal variation in the plumage of the Australian painted snipe. The juvenile is separable though very similar to the adult male (Marchant and Higgins, 2003).

Conservation Status

The Australian painted snipe is listed as **endangered** under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This species is eligible for listing as endangered as it is inferred to have undergone a severe decline in the number of mature individuals in excess of 50% over the last three generations (~26 years) associated with wetland loss and degradation (TSSC, 2012).

The Australian painted snipe is also listed as a marine species (as *Rostratula benghalensis*) and a migratory species (under the China-Australia Migratory Bird Agreement as *Rostratula benghalensis*) under the EPBC Act.

The species is listed as threatened under various state and territory lists and legislation:

| State | List/legislation | Listing status | Listed name |
|--------------------|--|----------------------------------|--|
| Queensland | <i>Nature Conservation (Wildlife) Regulations 2006</i> | vulnerable | <i>Rostratula australis</i> |
| New South Wales | <i>Threatened Species Conservation Act 1995</i> | endangered | <i>Rostratula benghalensis australis</i> |
| Victoria | <i>Flora and Fauna Guarantee Act 1988 – Threatened List – October 2010</i> | threatened | <i>Rostratula australis</i> |
| South Australia | <i>National Parks and Wildlife Act 1972</i> | vulnerable | <i>Rostratula benghalensis</i> |
| Western Australia | <i>Wildlife Conservation (Specially Protected Fauna) Notice 2010(2)</i> | rare or likely to become extinct | <i>Rostratula benghalensis australis</i> |
| | Threatened and Priority Fauna ranking | vulnerable | |
| Northern Territory | <i>Territory Parks and Wildlife Conservation Act 2000</i> | vulnerable | <i>Rostratula benghalensis australis</i> |

Cultural Significance

The Australian painted snipe is not known to be culturally significant.

Distribution and Habitat

The Australian painted snipe occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice crops, sewage farms and bore drains, generally with a good cover of grasses, rushes and reeds, low scrub, *Muehlenbeckia* spp. (lignum), open timber or samphire (Reader's Digest, 1997; Marchant and Higgins, 2003). It has been recorded at wetlands in all states and territories (Barrett et al., 2003; Blakers et al., 1984) and is most common in eastern Australia.

Important areas for this species in the past have included the Murray-Darling Basin (particularly the Riverina of Victoria and New South Wales), Queensland Channel Country, Fitzroy Basin of Central Queensland, south-eastern South Australia and adjacent parts of Victoria (Rogers et al., 2005). Records published over the past twenty years provide evidence for Australian painted snipe occurring more widely and frequently in the remote arid and tropical regions of Australia than was previously thought (Hassell and Rogers, 2002; Jaensch 2003a, 2003b; Jaensch et al., 2004; Black et al., 2010).

The Australian painted snipe is inferred to have undergone a severe decline in the number of mature individuals since the 1950s (Garnett and Crowley, 2000; Lane and Rogers, 2000; Rogers et al., 2005; Garnett et al., 2011; BirdLife Australia, 2012) and specifically over the last three generations (~26 years) due to the loss and degradation of its wetland habitat (Rogers et al., 2005). There has been an increase in the number of sightings in 2010–11 associated with increased rainfall; however, this must be considered within the context of overall, long-term population decline (Jaensch pers. comm., 2012; BirdLife Australia, pers. comm., 2012; Rogers pers. comm., 2012). It is estimated that the species' current population is 2500 mature individuals (Garnett et al., 2011; BirdLife Australia, pers. comm., 2012).

The species is widespread and is not considered to have a limited geographic distribution. Its current extent of occurrence estimated to be 7,100,000 km² and stable (Garnett et al., 2011). The species' area of occupancy was estimated by Garnett et al. (2011) to be 2000 km² and decreasing; however, given the exceptional rainfall of 2010-11 this figure is currently assumed to be higher. The Australian painted snipe occurs within many Natural Resource Management (NRM) Regions and Interim Biogeographic Regionalisation for Australia (IBRA) Bioregions across Australia.

The distribution of this species overlaps with a number of EPBC Act-listed threatened ecological communities, including Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains and Upland Wetlands of the New England Tablelands and the Monaro Plateau.

The Department of Sustainability, Environment, Water, Population and Communities has prepared survey guidelines for Australia's threatened birds (Commonwealth of Australia, 2010). These survey guidelines are intended to provide guidance for stakeholders on the effort and methods considered appropriate when conducting a presence/absence survey for listed threatened species.

Threats

The main identified threat to the Australian painted snipe is the loss and degradation of wetlands, through drainage and the diversion of water for agriculture and reservoirs (Lane and Rogers 2000; Garnett et al., 2011). Rogers et al. (2005) state that the loss of breeding habitat in the Murray-Darling Basin has occurred through: (1) the reduced frequency of

flooding in previously suitable habitat, exacerbated by a loss of fresh water to irrigation and other diversions; (2) water levels being stabilised in remaining wetlands so that water becomes too deep, or continuous reed beds develop; and (3) changes to vegetation through increased cropping, and possibly through altered fire regimes at some sites. These hydrological changes have occurred in parallel with an extended period of drought in Australia (BoM, 2010) and these conditions have intensified the impacts of wetland degradation and water diversion in the Murray-Darling Basin.

Grazing and the associated trampling of wetland vegetation/nests, nutrient enrichment and disturbance to substrate by livestock may threaten the Australian painted snipe in certain regions, particularly where grazing is concentrated around wetlands during dry seasons (Johnstone and Storr, 1998; Rogers et al., 2005; Jaensch pers. comm., 2012).

Reduced rainfall and runoff in the Murray-Darling Basin associated with climate change (CSIRO 2008, 2011) may threaten the Australian painted snipe in the future. The species is strongly affected by seasonal conditions and appears to depend on the Murray-Darling Basin for breeding; as such, these conditions could have a significant impact on the species if combined with other known and potential threats.

Predation by feral animals (e.g. nest predation by foxes (*Vulpes vulpes*) or cats (*Felis catus*)) may be a threat to the Australian painted snipe, however there is no evidence for this. Additional potential threats include coastal port and infrastructure development, shale oil mining near autumn-winter sites for this species on the central Queensland coast (Houston and Black, pers. comm., 2012) and the replacement of native wetland vegetation by invasive weeds (Rogers et al., 2005). The impacts of fire on the Australian painted snipe are unknown, but may have either a positive or negative influence (Rogers et al., 2005).

Research Priorities

Research priorities that would inform future regional and local priority actions include:

- Support and enhance existing programs for the Australian painted snipe that are managed by BirdLife Australia.
- Continue to monitor the species to more precisely assess population size, distribution and the relative impacts of threatening processes.
- Identify and describe the ecological and hydrological character of sites that are suitable for the Australian painted snipe, particularly those known to be used by the species for breeding.
- Investigate potential food resources for the species and monitor changes to the abundance and diversity of these resources (e.g. invertebrates).
- Directly monitor the breeding and non-breeding behaviour of the Australian painted snipe with the use of radio transmitters and/or tagging methods.

Regional Priority Actions

The following regional priority recovery and threat abatement actions can be done to support the recovery of the Australian painted snipe.

Habitat Loss, Disturbance and Modification

- Develop management guidelines for breeding and non-breeding habitat.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Ensure there is no disturbance in areas where the species is known to breed, excluding necessary actions to manage the conservation of the species.
- Control access routes to suitably constrain public access to existing and future breeding sites on public land.
- Suitably control and manage access on private land and other land tenure.

- Minimise adverse impacts from land use at known sites.
- Manage any changes to hydrology that may result in changes to water table levels, run-off, salinity, algal blooms, sedimentation or pollution.
- Manage any disruptions to water flows.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate/secure inclusion in reserve tenure if possible.
- Manage any other known, potential or emerging threats including inappropriate fire regimes and coastal port/infrastructure development.

Invasive Weeds

- Implement the Parkinsonia (*Parkinsonia aculeata*) Strategic Plan (Commonwealth of Australia, 2000) for the control of this species within the range of the Australian painted snipe.
- Identify and remove weeds in wetland areas that could become a threat to the Australian painted snipe, using appropriate methods.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the Australian painted snipe.

Trampling, Browsing or Grazing

- Develop and implement a stock management plan for roadside verges and travelling stock routes which include swamps, marshes or wetlands.
- If livestock grazing occurs in known Australian painted snips habitats, ensure land owners/managers use an appropriate management regime and density that does not detrimentally affect Australian painted snipe nesting.
- If appropriate, manage total grazing pressure at important breeding sites through exclusion fencing or other barriers.

Animal Predation or Competition

- Implement the national threat abatement plans for the European red fox (DEWHA, 2008a) and feral cats (DEWHA, 2008b) to control the adverse impacts of foxes (*Vulpes vulpes*) and cats (*Felis catus*) in the species' range.
- Continue baiting to control population numbers of feral animals.

Fire

- Develop and implement a suitable fire management strategy for the habitat of the Australian painted snipe.

Conservation Information

- Raise awareness of the Australian painted snipe within the local community and the importance of reporting observations to BirdLife Australia, using fact sheets and/or brochures.
- Advertise and encourage use of Australian painted snipe survey techniques and survey forms (Birds Australia, 2012).
- Organise field days with industry and interest groups to raise awareness and share information on the species. These groups may include natural resource management groups, catchment management authorities, Indigenous groups, conservation organisations, local and state governments, and private landholders.
- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.
- Raise awareness of banded individuals (see BirdLife Australia, 2012) to increase the likelihood of re-sighting and reporting.
- Facilitate the exchange of information between interested parties, including sightings, research and management approaches.

This list does not necessarily encompass all actions that may be of benefit to the Australian painted snipe, but highlights those that are considered to be of highest priority at the time of preparing the Approved Conservation Advice.

Existing Plans/Management Prescriptions that are Relevant to the Species

- Australian Painted Snipe Project (BirdLife Australia, 2012).
- Draft National Recovery Plan for the Australian Painted Snipe *Rostratula australis* 2005-2010 (Compiled by the Victorian Department of Sustainability and Environment for the Australian Government Department of the Environment and Heritage, June 2005).
- Threat abatement plan for predation by the European red fox (Commonwealth of Australia, 2008a).
- Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2008b).
- Australian painted snipe survey form, survey instructions, brochure and newsletters (Birds Australia, 2012).

These prescriptions were current at the time of publishing; please refer to the relevant agency's website for any updated versions.

References cited in the advice

Barrett G, Silcocks A, Barry S, Cunningham R and Poulter R (2003). The new atlas of Australian birds. Royal Australasian Ornithologists Union, Hawthorn East, Victoria.

BirdLife Australia (2012). Painted Snippets: the newsletter of the Australian painted snipe project. Volume 4, May 2012.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.birdlife.org.au/documents/APS-snippetsMay12.pdf>

BirdLife Australia (2012). Personal communication by email, 7 February 2012. BirdLife Australia acknowledges the input and information provided by the following individuals: C. Tzaros, A. Silcocks, D. Ingwersen, J. Thomas, C. Purnell, D. Rogers, A. Geering and D. Parker.

Birds Australia (2012). Australian painted snipe *Rostratula australis*.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.birdsaustralia.com.au/our-projects/australian-painted-snipe.html>

Black R, Houston W and Jaensch R (2010). Evidence of regular seasonal migration by Australian painted snipe *Rostratula australis* to the Queensland tropics in autumn and winter. *Stilt* 58:1–9.

Blakers M, Davies S J J F and Reilly PN (1984). The atlas of Australian birds. Royal Australasian Ornithologists Union. Melbourne University Press, Victoria.

Bureau of Meteorology (BoM) (2010). Special climate statement 22: Australia's wettest September on record but it is not enough to clear long-term rainfall deficits. Issued 1 October 2010; updated 5 October 2010. National Climate Centre, Bureau of Meteorology.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.bom.gov.au/climate/current/statements/scs22.pdf>

- Commonwealth of Australia (2000). Weeds of National Significance: Parkinsonia (*Parkinsonia aculeata*) Strategic Plan. Commonwealth of Australia and the National Weeds Strategy Executive Committee, 2000.
Viewed: 27 July 2012
Available on the Internet at: <http://www.weeds.org.au/docs/parstrat.pdf>
- Commonwealth of Australia (2008a). Threat Abatement Plan for predation by the European red fox. Prepared by the Department of Environment, Water, Heritage and the Arts in 2008.
Viewed: 27 July 2012
Available on the Internet at:
<http://www.environment.gov.au/biodiversity/threatened/publications/tap/foxes08.html>
- Commonwealth of Australia (2008b). Threat Abatement Plan for predation by feral cats. Prepared by the Department of Environment, Water, Heritage and the Arts in 2008.
Viewed: 17 July 2012
Available on the Internet at:
<http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/tap-cat-report.pdf>
- Commonwealth of Australia (2010). Survey Guidelines for Australia's Threatened Birds. Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Prepared by the Department of Environment, Water, Heritage and the Arts in 2010.
Viewed: 27 July 2012
Available on the Internet at:
<http://www.environment.gov.au/epbc/publications/threatened-birds.html>
- Commonwealth Scientific and Industrial Research Organisation (2008). Rainfall-runoff modelling across the Murray-Darling Basin. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project, June 2008.
Viewed: 11 May 2012
Available on the Internet at:
<http://www.clw.csiro.au/publications/waterforahealthycountry/mdbsy/technical/C-Rainfall-runoffModelling.pdf>
- Commonwealth Scientific and Industrial Research Organisation (2011). Planning for climate change in the Murray-Darling Basin. 16 March 2006; updated 14 October 2011.
Viewed: 11 May 2012
Available on the Internet at:
<http://www.csiro.au/Organisation-Structure/Flagships/Water-for-a-Healthy-Country-Flagship/Murray-Darling-climate-change.aspx>
- Garnett ST and Crowley GM (2000). The action plan for Australian birds 2000. Environment Australia, Canberra.
- Garnett ST, Szabo J and Dutson G (2011). The action plan for Australian birds 2010. CSIRO Publishing, Victoria.
- Hassell CJ and Rogers DI (2002). Painted snipe nesting at Taylor's Lagoon, near Broome, north-western Australia. *The Stilt* 41: 14–21.
- Houston W and Black R (2012). Personal communication by email, 7 February 2012. Centre for Environmental Management, Central Queensland University.
- Jaensch R (2003a). Breeding by Australian painted snipe in the Diamantina Channel Country, south-western Queensland. *The Stilt* 43: 20–22.

- Jaensch R (2003b). Recent records and breeding of painted snipe *Rostratula benghalensis* in the Mitchell Grass Downs and Sturt Plateau, Northern Territory. NT Naturalist 17: 31–37.
- Jaensch R (2012). Personal communication by email, 23 January 2012. Professional Associate, Wetlands international – Oceania.
- Jaensch R, McCabe J, Wahl J and Houston W (2004). Breeding by Australian painted snipe on the Torilla Plain, Brigalow Belt coast, Queensland. The Stilt 45: 40–43.
- Johnstone RE and Storr GM (1998). Handbook of Western Australia, Volume 1. Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Lane BA and Rogers D (2000). The Australian painted snipe *Rostratula (benghalensis) australis*: An endangered species? Stilt 36: 26–34.
- Marchant S and Higgins PJ (eds) (1993). Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: raptors and lapwings. Oxford University Press Australia.
- Readers Digest (1997). Complete Book of Australian Birds (second edition). Reader's Digest Australia Pty Ltd, Sydney.
- Rogers D (2012). Personal communication by email, 28 February 2012. Arthur Rylah Institute for Environmental Research.
- Rogers D, Hnace I, Paton S, Tzaros C, Griffioen P, Herring M, Jaensch R, Oring L, Silcocks A and Weston M (2005). The breeding bottleneck: Breeding habitat and population decline in the Australian painted snipe. Status and Conservation of Shorebirds in the East Asian-Australasian Flyway. Proceedings of the Australasian Shorebirds Conference, 13–15 December 2003, Canberra, Australia.
- Threatened Species Scientific Committee (TSSC) (2012). Listing advice for *Rostratula australis* (Australian painted snipe).

**Approved Conservation Advice for
Rostratula australis (Australian painted snipe)**

(s266B of the *Environment Protection and Biodiversity Conservation Act 1999*)

This Conservation Advice has been developed based on the best available information at the time this Conservation Advice was approved; this includes existing plans, records or management prescriptions for this species.

Description

Rostratula australis (Australian painted snipe), Family Rostratulidae, is a stocky wading bird approximately 240–300 mm in length, with a wingspan of 500–540 mm and weighing 125–130 g (Birds Australia, 2012). The adult female is more colourful and larger than the male. It has a chocolate-brown head with chestnut patch in the nape, a comma-shaped white marking around the eye and metallic green back and wings, densely barred olive and black (Rogers pers. comm., 2012). A diagnostic white ‘harness marking’ runs from the mantle onto the breast (Rogers pers. comm., 2012). It has a brown eye, white belly, bluish-green legs and long pink-orange bill darkening towards the tip (Reader’s Digest, 1997). The male is smaller than the female and has a duller head pattern (Rogers pers. comm., 2012). It has a mottled grey-brown head and neck, with buff stripe down the centre of the crown and through the eyes. Wings and back are barred black, buff and white, and the breast has a broad black band (Reader’s Digest, 1997). There is no seasonal variation in the plumage of the Australian painted snipe. The juvenile is separable though very similar to the adult male (Marchant and Higgins, 2003).

Conservation Status

The Australian painted snipe is listed as **endangered** under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This species is eligible for listing as endangered as it is inferred to have undergone a severe decline in the number of mature individuals in excess of 50% over the last three generations (~26 years) associated with wetland loss and degradation (TSSC, 2012).

The Australian painted snipe is also listed as a marine species (as *Rostratula benghalensis*) and a migratory species (under the China-Australia Migratory Bird Agreement as *Rostratula benghalensis*) under the EPBC Act.

The species is listed as threatened under various state and territory lists and legislation:

| State | List/legislation | Listing status | Listed name |
|--------------------|--|----------------------------------|--|
| Queensland | <i>Nature Conservation (Wildlife) Regulations 2006</i> | vulnerable | <i>Rostratula australis</i> |
| New South Wales | <i>Threatened Species Conservation Act 1995</i> | endangered | <i>Rostratula benghalensis australis</i> |
| Victoria | <i>Flora and Fauna Guarantee Act 1988 – Threatened List – October 2010</i> | threatened | <i>Rostratula australis</i> |
| South Australia | <i>National Parks and Wildlife Act 1972</i> | vulnerable | <i>Rostratula benghalensis</i> |
| Western Australia | <i>Wildlife Conservation (Specially Protected Fauna) Notice 2010(2)</i> | rare or likely to become extinct | <i>Rostratula benghalensis australis</i> |
| | Threatened and Priority Fauna ranking | vulnerable | |
| Northern Territory | <i>Territory Parks and Wildlife Conservation Act 2000</i> | vulnerable | <i>Rostratula benghalensis australis</i> |

Cultural Significance

The Australian painted snipe is not known to be culturally significant.

Distribution and Habitat

The Australian painted snipe occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice crops, sewage farms and bore drains, generally with a good cover of grasses, rushes and reeds, low scrub, *Muehlenbeckia* spp. (lignum), open timber or samphire (Reader's Digest, 1997; Marchant and Higgins, 2003). It has been recorded at wetlands in all states and territories (Barrett et al., 2003; Blakers et al., 1984) and is most common in eastern Australia.

Important areas for this species in the past have included the Murray-Darling Basin (particularly the Riverina of Victoria and New South Wales), Queensland Channel Country, Fitzroy Basin of Central Queensland, south-eastern South Australia and adjacent parts of Victoria (Rogers et al., 2005). Records published over the past twenty years provide evidence for Australian painted snipe occurring more widely and frequently in the remote arid and tropical regions of Australia than was previously thought (Hassell and Rogers, 2002; Jaensch 2003a, 2003b; Jaensch et al., 2004; Black et al., 2010).

The Australian painted snipe is inferred to have undergone a severe decline in the number of mature individuals since the 1950s (Garnett and Crowley, 2000; Lane and Rogers, 2000; Rogers et al., 2005; Garnett et al., 2011; BirdLife Australia, 2012) and specifically over the last three generations (~26 years) due to the loss and degradation of its wetland habitat (Rogers et al., 2005). There has been an increase in the number of sightings in 2010–11 associated with increased rainfall; however, this must be considered within the context of overall, long-term population decline (Jaensch pers. comm., 2012; BirdLife Australia, pers. comm., 2012; Rogers pers. comm., 2012). It is estimated that the species' current population is 2500 mature individuals (Garnett et al., 2011; BirdLife Australia, pers. comm., 2012).

The species is widespread and is not considered to have a limited geographic distribution. Its current extent of occurrence estimated to be 7,100,000 km² and stable (Garnett et al., 2011). The species' area of occupancy was estimated by Garnett et al. (2011) to be 2000 km² and decreasing; however, given the exceptional rainfall of 2010-11 this figure is currently assumed to be higher. The Australian painted snipe occurs within many Natural Resource Management (NRM) Regions and Interim Biogeographic Regionalisation for Australia (IBRA) Bioregions across Australia.

The distribution of this species overlaps with a number of EPBC Act-listed threatened ecological communities, including Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains and Upland Wetlands of the New England Tablelands and the Monaro Plateau.

The Department of Sustainability, Environment, Water, Population and Communities has prepared survey guidelines for Australia's threatened birds (Commonwealth of Australia, 2010). These survey guidelines are intended to provide guidance for stakeholders on the effort and methods considered appropriate when conducting a presence/absence survey for listed threatened species.

Threats

The main identified threat to the Australian painted snipe is the loss and degradation of wetlands, through drainage and the diversion of water for agriculture and reservoirs (Lane and Rogers 2000; Garnett et al., 2011). Rogers et al. (2005) state that the loss of breeding habitat in the Murray-Darling Basin has occurred through: (1) the reduced frequency of

flooding in previously suitable habitat, exacerbated by a loss of fresh water to irrigation and other diversions; (2) water levels being stabilised in remaining wetlands so that water becomes too deep, or continuous reed beds develop; and (3) changes to vegetation through increased cropping, and possibly through altered fire regimes at some sites. These hydrological changes have occurred in parallel with an extended period of drought in Australia (BoM, 2010) and these conditions have intensified the impacts of wetland degradation and water diversion in the Murray-Darling Basin.

Grazing and the associated trampling of wetland vegetation/nests, nutrient enrichment and disturbance to substrate by livestock may threaten the Australian painted snipe in certain regions, particularly where grazing is concentrated around wetlands during dry seasons (Johnstone and Storr, 1998; Rogers et al., 2005; Jaensch pers. comm., 2012).

Reduced rainfall and runoff in the Murray-Darling Basin associated with climate change (CSIRO 2008, 2011) may threaten the Australian painted snipe in the future. The species is strongly affected by seasonal conditions and appears to depend on the Murray-Darling Basin for breeding; as such, these conditions could have a significant impact on the species if combined with other known and potential threats.

Predation by feral animals (e.g. nest predation by foxes (*Vulpes vulpes*) or cats (*Felis catus*)) may be a threat to the Australian painted snipe, however there is no evidence for this. Additional potential threats include coastal port and infrastructure development, shale oil mining near autumn-winter sites for this species on the central Queensland coast (Houston and Black, pers. comm., 2012) and the replacement of native wetland vegetation by invasive weeds (Rogers et al., 2005). The impacts of fire on the Australian painted snipe are unknown, but may have either a positive or negative influence (Rogers et al., 2005).

Research Priorities

Research priorities that would inform future regional and local priority actions include:

- Support and enhance existing programs for the Australian painted snipe that are managed by BirdLife Australia.
- Continue to monitor the species to more precisely assess population size, distribution and the relative impacts of threatening processes.
- Identify and describe the ecological and hydrological character of sites that are suitable for the Australian painted snipe, particularly those known to be used by the species for breeding.
- Investigate potential food resources for the species and monitor changes to the abundance and diversity of these resources (e.g. invertebrates).
- Directly monitor the breeding and non-breeding behaviour of the Australian painted snipe with the use of radio transmitters and/or tagging methods.

Regional Priority Actions

The following regional priority recovery and threat abatement actions can be done to support the recovery of the Australian painted snipe.

Habitat Loss, Disturbance and Modification

- Develop management guidelines for breeding and non-breeding habitat.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Ensure there is no disturbance in areas where the species is known to breed, excluding necessary actions to manage the conservation of the species.
- Control access routes to suitably constrain public access to existing and future breeding sites on public land.
- Suitably control and manage access on private land and other land tenure.

- Minimise adverse impacts from land use at known sites.
- Manage any changes to hydrology that may result in changes to water table levels, run-off, salinity, algal blooms, sedimentation or pollution.
- Manage any disruptions to water flows.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate/secure inclusion in reserve tenure if possible.
- Manage any other known, potential or emerging threats including inappropriate fire regimes and coastal port/infrastructure development.

Invasive Weeds

- Implement the Parkinsonia (*Parkinsonia aculeata*) Strategic Plan (Commonwealth of Australia, 2000) for the control of this species within the range of the Australian painted snipe.
- Identify and remove weeds in wetland areas that could become a threat to the Australian painted snipe, using appropriate methods.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the Australian painted snipe.

Trampling, Browsing or Grazing

- Develop and implement a stock management plan for roadside verges and travelling stock routes which include swamps, marshes or wetlands.
- If livestock grazing occurs in known Australian painted snips habitats, ensure land owners/managers use an appropriate management regime and density that does not detrimentally affect Australian painted snipe nesting.
- If appropriate, manage total grazing pressure at important breeding sites through exclusion fencing or other barriers.

Animal Predation or Competition

- Implement the national threat abatement plans for the European red fox (DEWHA, 2008a) and feral cats (DEWHA, 2008b) to control the adverse impacts of foxes (*Vulpes vulpes*) and cats (*Felis catus*) in the species' range.
- Continue baiting to control population numbers of feral animals.

Fire

- Develop and implement a suitable fire management strategy for the habitat of the Australian painted snipe.

Conservation Information

- Raise awareness of the Australian painted snipe within the local community and the importance of reporting observations to BirdLife Australia, using fact sheets and/or brochures.
- Advertise and encourage use of Australian painted snipe survey techniques and survey forms (Birds Australia, 2012).
- Organise field days with industry and interest groups to raise awareness and share information on the species. These groups may include natural resource management groups, catchment management authorities, Indigenous groups, conservation organisations, local and state governments, and private landholders.
- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.
- Raise awareness of banded individuals (see BirdLife Australia, 2012) to increase the likelihood of re-sighting and reporting.
- Facilitate the exchange of information between interested parties, including sightings, research and management approaches.

This list does not necessarily encompass all actions that may be of benefit to the Australian painted snipe, but highlights those that are considered to be of highest priority at the time of preparing the Approved Conservation Advice.

Existing Plans/Management Prescriptions that are Relevant to the Species

- Australian Painted Snipe Project (BirdLife Australia, 2012).
- Draft National Recovery Plan for the Australian Painted Snipe *Rostratula australis* 2005-2010 (Compiled by the Victorian Department of Sustainability and Environment for the Australian Government Department of the Environment and Heritage, June 2005).
- Threat abatement plan for predation by the European red fox (Commonwealth of Australia, 2008a).
- Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2008b).
- Australian painted snipe survey form, survey instructions, brochure and newsletters (Birds Australia, 2012).

These prescriptions were current at the time of publishing; please refer to the relevant agency's website for any updated versions.

References cited in the advice

Barrett G, Silcocks A, Barry S, Cunningham R and Poulter R (2003). The new atlas of Australian birds. Royal Australasian Ornithologists Union, Hawthorn East, Victoria.

BirdLife Australia (2012). Painted Snippets: the newsletter of the Australian painted snipe project. Volume 4, May 2012.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.birdlife.org.au/documents/APS-snippetsMay12.pdf>

BirdLife Australia (2012). Personal communication by email, 7 February 2012. BirdLife Australia acknowledges the input and information provided by the following individuals: C. Tzaros, A. Silcocks, D. Ingwersen, J. Thomas, C. Purnell, D. Rogers, A. Geering and D. Parker.

Birds Australia (2012). Australian painted snipe *Rostratula australis*.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.birdsaustralia.com.au/our-projects/australian-painted-snipe.html>

Black R, Houston W and Jaensch R (2010). Evidence of regular seasonal migration by Australian painted snipe *Rostratula australis* to the Queensland tropics in autumn and winter. *Stilt* 58:1–9.

Blakers M, Davies S J J F and Reilly PN (1984). The atlas of Australian birds. Royal Australasian Ornithologists Union. Melbourne University Press, Victoria.

Bureau of Meteorology (BoM) (2010). Special climate statement 22: Australia's wettest September on record but it is not enough to clear long-term rainfall deficits. Issued 1 October 2010; updated 5 October 2010. National Climate Centre, Bureau of Meteorology.

Viewed: 11 May 2012

Available on the Internet at:

<http://www.bom.gov.au/climate/current/statements/scs22.pdf>

- Commonwealth of Australia (2000). Weeds of National Significance: Parkinsonia (*Parkinsonia aculeata*) Strategic Plan. Commonwealth of Australia and the National Weeds Strategy Executive Committee, 2000.
Viewed: 27 July 2012
Available on the Internet at: <http://www.weeds.org.au/docs/parstrat.pdf>
- Commonwealth of Australia (2008a). Threat Abatement Plan for predation by the European red fox. Prepared by the Department of Environment, Water, Heritage and the Arts in 2008.
Viewed: 27 July 2012
Available on the Internet at:
<http://www.environment.gov.au/biodiversity/threatened/publications/tap/foxes08.html>
- Commonwealth of Australia (2008b). Threat Abatement Plan for predation by feral cats. Prepared by the Department of Environment, Water, Heritage and the Arts in 2008.
Viewed: 17 July 2012
Available on the Internet at:
<http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/tap-cat-report.pdf>
- Commonwealth of Australia (2010). Survey Guidelines for Australia's Threatened Birds. Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Prepared by the Department of Environment, Water, Heritage and the Arts in 2010.
Viewed: 27 July 2012
Available on the Internet at:
<http://www.environment.gov.au/epbc/publications/threatened-birds.html>
- Commonwealth Scientific and Industrial Research Organisation (2008). Rainfall-runoff modelling across the Murray-Darling Basin. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project, June 2008.
Viewed: 11 May 2012
Available on the Internet at:
<http://www.clw.csiro.au/publications/waterforahealthycountry/mdbsy/technical/C-Rainfall-runoffModelling.pdf>
- Commonwealth Scientific and Industrial Research Organisation (2011). Planning for climate change in the Murray-Darling Basin. 16 March 2006; updated 14 October 2011.
Viewed: 11 May 2012
Available on the Internet at:
<http://www.csiro.au/Organisation-Structure/Flagships/Water-for-a-Healthy-Country-Flagship/Murray-Darling-climate-change.aspx>
- Garnett ST and Crowley GM (2000). The action plan for Australian birds 2000. Environment Australia, Canberra.
- Garnett ST, Szabo J and Dutson G (2011). The action plan for Australian birds 2010. CSIRO Publishing, Victoria.
- Hassell CJ and Rogers DI (2002). Painted snipe nesting at Taylor's Lagoon, near Broome, north-western Australia. *The Stilt* 41: 14–21.
- Houston W and Black R (2012). Personal communication by email, 7 February 2012. Centre for Environmental Management, Central Queensland University.
- Jaensch R (2003a). Breeding by Australian painted snipe in the Diamantina Channel Country, south-western Queensland. *The Stilt* 43: 20–22.

- Jaensch R (2003b). Recent records and breeding of painted snipe *Rostratula benghalensis* in the Mitchell Grass Downs and Sturt Plateau, Northern Territory. NT Naturalist 17: 31–37.
- Jaensch R (2012). Personal communication by email, 23 January 2012. Professional Associate, Wetlands international – Oceania.
- Jaensch R, McCabe J, Wahl J and Houston W (2004). Breeding by Australian painted snipe on the Torilla Plain, Brigalow Belt coast, Queensland. The Stilt 45: 40–43.
- Johnstone RE and Storr GM (1998). Handbook of Western Australia, Volume 1. Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Lane BA and Rogers D (2000). The Australian painted snipe *Rostratula (benghalensis) australis*: An endangered species? Stilt 36: 26–34.
- Marchant S and Higgins PJ (eds) (1993). Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: raptors and lapwings. Oxford University Press Australia.
- Readers Digest (1997). Complete Book of Australian Birds (second edition). Reader's Digest Australia Pty Ltd, Sydney.
- Rogers D (2012). Personal communication by email, 28 February 2012. Arthur Rylah Institute for Environmental Research.
- Rogers D, Hnace I, Paton S, Tzaros C, Griffioen P, Herring M, Jaensch R, Oring L, Silcocks A and Weston M (2005). The breeding bottleneck: Breeding habitat and population decline in the Australian painted snipe. Status and Conservation of Shorebirds in the East Asian-Australasian Flyway. Proceedings of the Australasian Shorebirds Conference, 13–15 December 2003, Canberra, Australia.
- Threatened Species Scientific Committee (TSSC) (2012). Listing advice for *Rostratula australis* (Australian painted snipe).

Conservation Advice

Numenius madagascariensis

eastern curlew

Taxonomy

Conventionally accepted as eastern curlew *Numenius madagascariensis* Linnaeus, 1766, Scolopacidae. Other common names include Australian or sea curlew, far eastern curlew and curlew.

Monotypic, no subspecies are recognised (Bamford et al., 2008). Taxonomic uniqueness: medium (22 genera/family, 8 species/genus, 1 subspecies/species; Garnett et al., 2011).

Summary of assessment

Conservation status

Critically endangered: Criterion 1 A2,(a)

Numenius madagascariensis has been found to be eligible for listing under the following listing categories:

Criterion 1: A2 (a): Critically Endangered

Criterion 2: Not eligible

Criterion 3: Not eligible

Criterion 4: Not eligible

Criterion 5: Not eligible

The highest category for which *Numenius madagascariensis* is eligible to be listed is Critically Endangered.

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see

<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by a committee nomination based on information provided in the *Action Plan for Australian Birds 2010* (Garnett et al., 2011), and experts from the University of Queensland.

Public Consultation

Notice of the proposed amendment and a consultation document were made available for public comment for 33 business days between 1 October 2014 and 14 November 2014. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species Information

Description

The eastern curlew is the largest migratory shorebird in the world, with a long neck, long legs, and a very long downcurved bill. The wingspan is 110 cm and the birds weigh approximately 900 g. The head and neck are dark brown and streaked with darker brown. The chin and throat

are whitish and there is a prominent white eye-ring; the iris is dark brown. The feathers of the upper parts of the body are brown, with blackish centres, and have broad pale rufous or olive-brown edges or notches. The tail is grey-brown with narrow dark banding on the feathers. The underside of the bird is dark brownish-buff, becoming paler on the rear belly. There is fine dark-brown streaking on the fore-neck and breast, which becomes thicker arrow-shaped streaks and barring on the fore-flanks. The upper belly and rear flanks have finer and sparser dark streaking. The underneath of the wing is whitish, but appears darker due to fine dark barring. The bill is dark brown with a pinkish base and the legs and feet are blue-grey.

The female is slightly larger than the male with noticeably longer bill (Higgins & Davies, 1996).

Distribution

Australian distribution

Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere.

In Victoria, the main strongholds are in Corner Inlet and Western Port Bay, with smaller populations in Port Phillip Bay and scattered elsewhere along the coast. Two thirds of the birds in the Victorian population are female (Nebel et al. 2013); given that the species is monogamous, it is likely there are male-skewed non-breeding populations elsewhere, but sex-ratios have not been studied outside Victoria. Eastern curlews are found on islands in Bass Strait and along the north-west, north-east, east and south-east coasts of Tasmania. In South Australia, the species is scarce between the Victorian border and Cape Jaffa and patchily distributed from the Coorong north-west to the Streaky Bay area, and has previously been recorded in Lake Alexandrina and Lake Albert, South Australia. In southern Western Australia, eastern curlews are recorded from Eyre, and there are scattered records from Stokes Inlet to Peel Inlet. The species is a scarce visitor to Houtman Abrolhos and the adjacent mainland, and is also recorded around Shark Bay. It is also recorded on Norfolk Island and Lord Howe Island (Marchant & Higgins, 1993).

Global distribution

The eastern curlew is endemic to the East Asian – Australasian Flyway. Eastern curlews breed in Russia in southern Ussuriland, the Iman River, scattered through south, west and north Kamchatka, the lower and middle Amur River basin, the Lena River basin, between 110° E and 130° E up to 65° N, and on the Upper Yana River, at 66° N. It also breeds in Mongolia and north-eastern China

The eastern curlew is a common passage migrant in Japan, Republic of Korea, China and Indonesia, and is occasionally recorded moving through Thailand and the Malay Peninsula. During the non-breeding season a few birds occur in southern Republic of Korea, Japan and China. About 25% of the population is thought to winter in the Philippines, Indonesia and Papua New Guinea but most (estimated at 73% or 28 000 individuals) spend the non-breeding season in Australia. Eastern curlews are regular non-breeding visitors to New Zealand in small numbers, and occur rarely on Kermadec Island and the Chatham Islands (Marchant & Higgins, 1993).

Relevant Biology/Ecology

Life history

The generation time is 10.1 years (Garnett et al., 2011).

Data extracted from the Australian Bird and Bat Banding Scheme (ABBBS) reports a longevity record of 19 years, 1 month (Australian Government, 2014).

Breeding

The eastern curlew does not breed in Australia.

Eastern curlews nest in the Northern Hemisphere summer, from early May to late June, often in small colonies of two to three pairs. They nest on small mounds in swampy ground, often near where wild berries are growing. The nest is lined with dry grass and twigs. The birds may delay breeding until three to four years of age (del Hoyo et al., 1996).

General habitat

During the non-breeding season in Australia, the eastern curlew is 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 (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes within the mangroves. The birds are also found in coastal saltworks and sewage farms (Marchant & Higgins, 1993).

Feeding habitat

The eastern curlew mainly forages during the non-breeding season on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes or in grassy areas (Marchant & Higgins, 1993).

Roosting habitat

The eastern curlew roosts during high tide periods on sandy spits, sandbars and islets, especially on beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. They occasionally roost on reef-flats, in the shallow water of lagoons and other near-coastal wetlands. Eastern curlews have occasionally been recorded roosting in trees and on the upright stakes of oyster-racks (Marchant & Higgins, 1993). At Roebuck Bay, Western Australia, birds have been recorded flying from their feeding areas on the tidal flats to roost 5 km inland on a flooded supratidal claypan (Collins et al., 2001). In some conditions, shorebirds may choose roost sites where a damp substrate lowers the local temperature. This may have important conservation implications where these sites are heavily disturbed beaches (Rogers, 1999). It may be possible to create artificial roosting sites to replace those destroyed by development (Harding et al., 1999). Eastern curlews typically roost in large flocks, separate from other shorebirds (Marchant & Higgins, 1993).

Feeding

The eastern curlew is carnivorous during the non-breeding season, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects. In studies at Moreton Bay, south-east Qld, three species of intertidal decapod dominated the diet: soldier crabs (*Myctyris longicarpus*), sentinel crabs (*Macrophthalmus crassipes*) and ghost-shrimps (*Trypea australiensis*) (Zharikov and Skilleter 2004). In Victoria, ghost-shrimps are an important part of the diet (Dann 1986, 1987). In Roebuck Bay, Western Australia, the birds feed mainly on large crabs, but will also catch mantis shrimps and chase mudskippers (Rogers, 1999).

The eastern curlew is extremely wary and will take flight at the first sign of danger, long before other nearby shorebirds become nervous. The birds are both diurnal and nocturnal with feeding and roosting cycles determined by the tides. Eastern curlews find the burrows of prey by sight during the day or in bright moonlight, but also locate prey by touch. The sexual differences in bill length lead to corresponding differences in diet and behaviour (Marchant & Higgins, 1993). Eastern curlews usually feed singly or in loose flocks. Occasionally, this species is seen in large feeding flocks of hundreds (Marchant & Higgins, 1993).

Migration patterns

The eastern curlew is migratory. After breeding, they move south for the Northern Hemisphere winter. The birds migrate by day and night at varying altitudes (Marchant & Higgins, 1993).

Departure from breeding grounds

Eastern curlews leave Kamchatka Peninsula (Eastern Russia) from mid-July. There is a weak migration through Ussuriland, Russia, from mid-July to late September and birds pass through Kurile Island and Sakhalin, (Eastern Russia), from mid-July to late August (P.S. Tomkovich pers comm. in Marchant & Higgins, 1993). Fewer birds appear in continental Asia on the southern migration than on the northern migration (Dement'ev & Gladkov, 1951). Eastern curlews are commonly seen in Republic of Korea, Japan and China during August-October. Migration from the Yellow Sea to Australia is usually undertaken in a single direct flight (Minton et al., 2013). There are also records of migrants in Thailand, the Malaysian Peninsular, Singapore, the Philippines, and Borneo (Indonesia), broadly between August and December (Marchant & Higgins, 1993). The birds arrive in north-west and eastern Australia as early as July (Lane, 1987). In north-west Australia, the maximum arrival was recorded between mid-August and the end of August (Minton & Watkins, 1993). At least some birds stopover in northern Australia or Papua New Guinea before moving on to non-breeding grounds in southern Australia (Minton et al. 2013, Lane, 1987), either in a series of short flights or one long flight. Many birds arriving in eastern Australia appear to move down the coast from northern Queensland with influxes occurring on the east coast have suggested a general southward movement until mid-February (Alcorn, 1988); this is presumably dominated by late-arriving juveniles. Records from Toowoomba, Broken Hill and the Murray-Darling region in August and September suggest that some birds move overland (Marchant & Higgins, 1993) and arrival along the east and south-east Australian coasts suggests some fly directly to these areas (Alcorn, 1988). In southern Tasmania, most arrive in late August to early October; later arrivals, probably of juveniles, occur until December (Marchant & Higgins, 1993). When eastern curlews first arrive in south-eastern Tasmania they are found at a number of localities before congregating at Barilla Bay or Orielson Lagoon (BirdLife Tasmania unpubl. data).

Eastern curlews arrive in New Zealand from the second week of August until mid-November with median date mid-October (Marchant & Higgins, 1993). These relatively late arrivals suggest that the small NZ population (<20 birds) is dominated by immatures.

Non-breeding season

During the non-breeding season small numbers of eastern curlew occur in southern Republic of Korea, Japan, China and Taiwan. Unquantified numbers occur in Papua New Guinea, Borneo, and possibly Peninsular Malaysia and the Philippines (Marchant & Higgins, 1993). The majority of the eastern curlew population is found in Australia during the non-breeding season (Bamford et al., 2008), mostly at a few sites on the east and south coasts and in north-western Australia (Lane, 1987). Population numbers are stable at most sites in November or between December-February, indicating little movement during this period (Lane, 1987; Alcorn, 1988). Eastern curlews move locally between high-tide roost-sites and intertidal feeding zones (Marchant & Higgins, 1993).

Return to breeding grounds

In Australia, most eastern curlews leave between late February and March-April (Marchant & Higgins, 1993). The birds depart New Zealand from mid-March to mid-May (Marchant & Higgins, 1993). Satellite-tracking (Driscoll and Ueta 2002) and geolocation studies (Minton et al., 2013) indicate that it is usual for eastern curlew to migrate from south-eastern Australian non-breeding grounds to the northern Yellow Sea in a single flight, but that birds may take additional stops if they encounter poor migration conditions. The species has been recorded on passage in various locations mostly between March and May, arriving at Kamchatka, Russia, during May (Marchant & Higgins, 1993).

Most shorebirds including eastern curlew, spend their first and second austral (southern) winters in Australia, and some or all may also spend their third winter here before undertaking their first northward migration to the breeding grounds (Wilson, 2000). Eastern curlews probably have longer-delayed maturity than any other Australian shorebird, with many individuals not migrating north until their third year and some not migrating north until their fourth (Rogers et al. 2008).

Descriptions of migratory pathways and important sites

Internationally, the Yellow Sea is extremely important as stopover habitat for eastern curlews. It supports about 80% of the estimated flyway population on the northern migration. Counts on southwards migration appear to be lower (Barter 2002) but this probably reflects search effort and timing, given that preliminary geolocator results suggest the same staging sites in the Yellow Sea are used on both southwards and northwards migration (Minton et al., 2013). Relatively few eastern curlews pass through Japan. Thirteen sites of international importance have been identified in the Yellow Sea (six in China, six in Republic of Korea and one in North Korea). Twelve sites are known to be important during the northern migration and seven during the southern migration, with six sites (Dong Sha, Shuangtaizihekou National Nature Reserve, Ganghwa Do, Yeong Jong Do, Mangyeong Gang Hagu and Dongjin Gang Hagu) important during both (Barter, 2002).

Threats

Threats in Australia, especially eastern and southern Australia, include ongoing human disturbance, habitat loss and degradation from pollution, changes to the water regime and invasive plants (Rogers et al., 2006; Australian Government, 2009; Garnett et al., 2011).

Human disturbance can cause shorebirds to interrupt their feeding or roosting and may influence the area of otherwise suitable feeding habitat that is actually used. Disturbance to pre-migratory eastern curlews may adversely affect their capacity to migrate, as the birds will use energy reserves to avoid disturbance, rather than for migration. Eastern curlews take flight when humans approach to within 30–100 metres (Taylor & Bester, 1999), or even up to 250 metres away (Peter, 1990). Coastal development, land reclamation, construction of barrages and stabilisation of water levels can destroy feeding habitat (Close & Newman, 1984). Pollution around settled areas may reduce the availability of food (Close & Newman, 1984).

Formerly, eastern curlews were shot for food in Tasmania (Marchant & Higgins, 1993). The species has been hunted intensively on breeding grounds and at stopover points while on migration (Marchant & Higgins, 1993).

Eastern curlews are threatened by wetland degradation in the Yellow Sea where it stages on migration (Bamford et al., 2008; van de Kam et al., 2010; Murray et al., 2014). Threats along their migratory route include sea level rise, environmental pollution, reduced river flows, human disturbance and reclamation for tidal power plants and barrages, industrial use and urban expansion (Barter, 2002; Kelin and Qiang, 2006; Moores, 2006; Iwamura et al., 2013). Additional threats include disturbance at nesting sites and hunting on the breeding grounds (Barter et al., 1997).

How judged by the Committee in relation to the EPBC Act Criteria and Regulations

| Criterion 1. Population size reduction (reduction in total numbers) | | | |
|---|---|--|---|
| Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4 | | | |
| | Critically Endangered Very severe reduction | Endangered Severe reduction | Vulnerable Substantial reduction |
| A1 | ≥ 90% | ≥ 70% | ≥ 50% |
| A2, A3, A4 | ≥ 80% | ≥ 50% | ≥ 30% |
| A1 | Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased. | | |
| A2 | Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible. | | |
| A3 | Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3] | | |
| A4 | An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. | | |
| | | <i>based on any of the following:</i> <ul style="list-style-type: none"> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites | |

Evidence:

Eligible under Criterion 1 A2 (a) for listing as Critically Endangered

The global population estimate was 38 000 individuals including 28 000 in Australia (Bamford et al., 2008), but numbers have recently declined (Garnett et al., 2011). This population estimate is out of date given the ongoing population declines.

Numbers appear to have declined on Eighty-mile Beach, WA by c.40% between 2000 and 2008, whereas numbers at Roebuck Bay, WA have remained relatively stable (Rogers et al., 2009). At Moreton Bay, QLD they declined by c. 2.4% per year between 1992 and 2008 (Wilson et al., 2011), across the whole of QLD they declined by c. 4.14% between 1992 and 2008 (Fuller et al., 2009), in Victoria by 2.2% per year between 1982 and 2011 (Minton et al., 2012) and in Tasmania by 80% between the 1950s and 2000 (Reid & Park, 2003) and by 40% across 49 Australian sites between 1983 and 2007 (BirdLife Australia *in litt.* 2011). An observation of over 2000 eastern curlews at Mud Islands, Port Phillip Bay in 1953 (Tarr and Launder 1954), *cf* current counts of fewer than 50 birds in Port Phillip Bay, suggests that population declines in eastern curlew may have begun well before regular shorebird counts were initiated in Australia.

An unpublished assessment of the numbers of eastern curlews at roost sites in Tasmania showed decreases of between 55% and 93%, depending on site (Woehler pers. comm., 2014). In the southeast, the decrease was 90% for the period 1964/65 – 2010/11, and in the north, the decrease was 93% between 1973/74 and 2010/11 (Woehler pers. comm., 2014). At both of these sites, and at other roost sites in Tasmania, the decreases have continued, with fewer birds seen in 2014 (Woehler pers. comm., 2014).

There are no clear trends in Japan between 1978 and 2008 (Amano et al., 2010), but this region lies outside the main migration route of eastern curlew.

A subsequent and more detailed assessment by a University of Queensland team (partly funded by the Department of the Environment under an Australian Research Council collaborative grant), puts the species into the critically endangered category (Fuller, pers. comm., 2014). Time series data from directly observed summer counts at a large number of sites across Australia

indicate a severe population decline of 66.8% over 20 years (5.8% per year; Fuller, pers. comm. 2014), and 81.4 % over 30 years which for this species is equal to three generations (Garnett et al., 2011).

In large part, the observed decline in eastern curlew numbers across Australia stems from ongoing loss of intertidal mudflat habitat at key migration staging sites in the Yellow Sea (Murray et al., 2014). As such, qualification under criterion A2 rather than A1 seems warranted. However, threats are also occurring in Australia including coastal development and recreational activities causing disturbance.

The Committee considers that the species has undergone a very severe reduction in numbers over three generation lengths (30 years for this assessment), equivalent to at least 81.4 percent and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it eligible for listing as critically endangered.

| Criterion 2. Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy | | | |
|---|--|----------------------------------|-------------------------------|
| | Critically Endangered Very restricted | Endangered Restricted | Vulnerable Limited |
| B1. Extent of occurrence (EOO) | < 100 km ² | < 5,000 km ² | < 20,000 km ² |
| B2. Area of occupancy (AOO) | < 10 km ² | < 500 km ² | < 2,000 km ² |
| AND at least 2 of the following 3 conditions: | | | |
| (a) Severely fragmented OR Number of locations | = 1 | ≤ 5 | ≤ 10 |
| (b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals | | | |
| (c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (number of mature individuals) | | | |

Evidence:

Not eligible

The extent of occurrence in Australia is estimated to be 30 000 km² (stable) and area occupied 8 500 km² (decreasing; Garnett et al., 2011). Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 3. Small population size and decline | | | |
|--|--|---|--|
| | Critically Endangered Very low | Endangered Low | Vulnerable Limited |
| Estimated number of mature individuals | < 250 | < 2,500 | < 10,000 |
| AND either (C1) or (C2) is true | | | |
| C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future | Very high rate 25% in 3 years or 1 generation (whichever is longer) | High rate 20% in 5 years or 2 generation (whichever is longer) | Substantial rate 10% in 10 years or 3 generations (whichever is longer) |
| C2 An observed, estimated, projected or | | | |

| | | | | |
|---|--|-----------|-----------|---------|
| inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions: | | | | |
| (a) | (i) Number of mature individuals in each subpopulation | ≤ 50 | ≤ 250 | ≤ 1,000 |
| | (ii) % of mature individuals in one subpopulation = | 90 – 100% | 95 – 100% | 100% |
| (b) | Extreme fluctuations in the number of mature individuals | | | |

Evidence:

Not eligible

The number of mature individuals in Australia was estimated at 28 000 in 2008 (Bamford et al., 2008; Garnett et al., 2011), but has declined since. There are no current data available to allow assessment against this criterion. Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 4. Very small population | | | |
|------------------------------------|--|------------------------|-------------------|
| | Critically Endangered Extremely low | Endangered Very Low | Vulnerable Low |
| Number of mature individuals | < 50 | < 250 | < 1,000 |

Evidence:

Not eligible

The total number of mature individuals was estimated at 28 000 in 2008 (Bamford et al., 2008; Garnett et al., 2011), but has declined since. The estimate is not considered extremely low, very low or low. Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 5. Quantitative Analysis | | | |
|---|--|--|----------------------------------|
| | Critically Endangered Immediate future | Endangered Near future | Vulnerable Medium-term future |
| Indicating the probability of extinction in the wild to be: | ≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.) | ≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.) | ≥ 10% in 100 years |

Evidence:

Not eligible

Population viability analysis has not been undertaken

Conservation Actions

Recovery Plan

There should not be a recovery plan for this species, as approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Significant management and research is being undertaken at international, state and local levels.

An International Single Species Action Plan will be developed and implemented across the East Asian – Australasian Flyway. Additionally, BirdLife Australia coordinates Australia's national shorebird monitoring program, Shorebirds 2020. This volunteer-based program conducts national shorebird surveys twice per year.

Primary Conservation Objectives

International objectives

1. Achieve a stable or increasing population.
2. Maintain and enhance important habitat.
3. Reduce disturbance at key roosting and feeding sites.

Australian objectives

1. Achieve a stable or increasing population.
2. Maintain and enhance important habitat.
3. Reduce disturbance at key roosting and feeding sites.
4. Raise awareness of eastern curlew within the local community.

Conservation and Management Actions

1. Work with governments along the East Asian – Australasian Flyway to prevent destruction of key migratory staging sites.
2. Develop and implement an International Single Species Action Plan for eastern curlew with all range states.
3. Support initiatives to improve habitat management at key sites.
4. Maintain and improve protection of roosting and feeding sites in Australia.
5. Incorporate requirements for eastern curlews into coastal planning and management.
6. Manage important sites to identify, control and reduce the spread of invasive species.
7. Manage disturbance at important sites when eastern curlews are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.
8. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Monitoring priorities

1. Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia

Information and research priorities

1. More precisely assess eastern curlew life history, population size, distribution and ecological requirements particularly across northern Australia.
2. Improve knowledge about dependence of eastern curlew on key migratory staging sites, and wintering sites to the north of Australia.

3. Improve knowledge about threatening processes including the impacts of disturbance and hunting.

Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Critically Endangered category:
Numenius madagascariensis
- (ii) The Committee recommends that there should not be a recovery plan for this species.

Threatened Species Scientific Committee

4/3/2015

References cited in the advice

Alcorn, R. (1988). Australasian Wader Study Group Regular Wader Counts Project. Interim report to June 1987: migratory waders. *Stilt* 12, 7-23.

Amano, T., Székely, T., Koyama, K., Amano, H., & Sutherland, W.J. (2010). A framework for monitoring the status of populations: an example from wader populations in the East Asian-Australasian flyway. *Biological Conservation* 143, 2238-2247.

Australian Government, (2009). Draft significant impact guidelines for 36 migratory shorebirds. Draft EPBC Act Policy Statement 3.21, Canberra, ACT: Department of the Environment and Heritage.

Australian Government, (2014). Australian Bird & Bat Banding Scheme Database, accessed 25 July 2014. Department of the Environment, Canberra.

Bamford, M., Watkins, D., Bancroft, W., Tischler, G., & Wahl, J. (2008). *Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites*. [Online]. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts, Wetlands International-Oceania. Available from: <http://www.environment.gov.au/biodiversity/migratory/publications/shorebirds-east-asia.html>.

Barter, M.A. (2002). *Shorebirds of the Yellow Sea: Importance, Threats and Conservation Status*. Wetlands International Global Series No. 8, International Wader Studies 12. Canberra, ACT: Wetlands International.

Barter, M., Fawen, Q., Sixian, T., Xiao, Y., & Tonkinson, D. (1997). Hunting of migratory waders on Chongming Dao: a declining occupation? *Stilt* 31, 19-22.

BirdLife International, (2014). Species factsheet: *Numenius madagascariensis*. Downloaded from <http://www.birdlife.org> on 23/06/2014. Recommended citation for factsheets for more than one species: BirdLife International (2014) IUCN Red List for birds. Downloaded from <http://www.birdlife.org> on 23/06/2014.

- Blakers, M., S.J.J.F. Davies & Reilly, P.M. (1984). *The Atlas of Australian Birds*. Melbourne, Victoria: Melbourne University Press.
- Close, D.H., & Newman, O.M.G. (1984). The decline of the Eastern Curlew in south-eastern Australia. *Emu* 84, 38-40.
- Collins, P., Boyle, A., Minton, C., & Jessop, R. (2001). The importance of inland claypans for waders in Roebuck Bay, Broome, NW Australia. *Stilt* 38, 4-8.
- Dann, P. (1986). The ecology of birds feeding in intertidal areas in Southern Victoria. PhD Thesis, Department of Zoology, University of Melbourne.
- Dann, P. (1987). The feeding behaviour and ecology of shorebirds. Pages 10-20 in B.A. Lane, editor. *Shorebirds in Australia*. Nelson Publishers, Melbourne.
- del Hoyo, J., Elliott, A., & Sargatal, J., (eds) (1996). *Handbook of the Birds of the World. Volume 3, Hoatzin to Auks*. Barcelona: Lynx Edicions.
- Dement'ev, G.P., & Gladkov, N.A. (eds) (1951). *Birds of the Soviet Union, Volume 3*. Jerusalem: Israel Program for Scientific Translations.
- Draffan, R.D.W., Garnett, S.T., Malone, G.J. (1983). Birds of the Torres Strait: an annotated list and biogeographic analysis. *Emu* 83, 207-234.
- Driscoll, P.V. & M. Ueta. (2002). The migration route and behaviour of Eastern Curlews *Numenius madagascariensis*. *Ibis* 144, E119-130.
- Fuller, R. (2014). Personal communication by email, 14 July 2014. University of Queensland.
- Fuller, R.A., Wilson, H.B., Kendall, B.E., & Possingham, H.P. (2009). Monitoring shorebirds using counts by the Queensland Wader Study Group. Report to the Queensland Wader Study Group and the Department of Environment and Resource Management, Melbourne.
- Garnett, S.T., Szabo, J.K., & Dutson, G. (2011). *The Action Plan for Australia Birds 2010*. Birds Australia, CSIRO Publishing, Melbourne.
- Harding, J., Harding, S., & Driscoll, P. (1999). Empire Point Roost: a purpose built roost site for waders. *Stilt* 34, 46-50.
- Higgins, P.J., & Davies, S.J.J.F. (eds) (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons*. Melbourne, Victoria: Oxford University Press.
- Iwamura, T., Possingham, H.P., Chadès, I., Minton, C., Murray, N.J., Rogers, D.I., Trembl, E.A. & Fuller, R.A. (2013). Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. *Proceedings of the Royal Society B*, 281: 20130325.
- Kelin, C., & Qiang, X. (2006). Conserving migratory shorebirds in the Yellow Sea region. In *Waterbirds around the World*. (Eds G Boere, C Galbraith and D Stroud) p. 319. The Stationary Office, Edinburgh, UK.
- Lane, B.A. (1987). *Shorebirds in Australia*. Sydney, NSW: Reed.

- Marchant, S., & Higgins, P.J. (eds). (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings*. Melbourne, Victoria: Oxford University Press.
- Minton, C., & Watkins, D. (1993). The 1992 North-west Australia Wader Expedition. *Stilt* 22, 10-12.
- Minton, C.D.T., Dann, P., Ewing, A., Jessop, R., Anton, P., & Clemens, R. (2012) Trends of shorebirds in Corner Inlet, Victoria, 1982-2011. *Stilt* 61:3-18.
- Minton, C., Gosbell, K., Johns, P. Christie, M., Klaassen, M., Hassel, C., Boyle, A., Jessop, R. & Fox, J. (2013). New insights from geolocators deployed on waders in Australia. *Wader Study Group Bulletin* 120, 37-46.
- Moore, N. (2006). South Korea's shorebirds: a review of abundance, distribution, threats and conservation status. *Stilt* 50, 62-72.
- Murray, N.J., Clemens, R.S., Phinn, S.R., Possingham, H.P., & Fuller, R.A. (2014). Tracking the rapid loss of tidal wetlands in the Yellow Sea. *Frontiers in Ecology and the Environment*.
- Nebel, S., Rogers, K.G., Minton, C.D.T., and Rogers, D.I. (2013). Is geographic variation in the size of Australian shorebirds consistent with hypotheses on differential migration? *Emu* 13, 99-111.
- Peter, J.M. (1990). Bird Study in the Nooramunga: The Possible Effects of Oyster Farming. *RAOU Report Series* 74, 1-18.
- Reid, T., & Park, P. (2003). Continuing decline of Eastern Curlew, *Numenius madagascariensis*, in Tasmania. *Emu* 103, 279-283.
- Rogers, D. (1999). Roost choice in the waders of Roebuck Bay: is avoiding heat stress their main consideration? *Stilt* 35, 65.
- Rogers, D., Hassell, C., Oldland, J., Clemens, R., Boyle, A., & Rogers, K. (2009). Monitoring Yellow Sea migrants in Australia (MYSMA): north-western Australian shorebird surveys and workshops, December 2008.
- Rogers, D.I, Piersma, T., & Hassell, C.J. (2006). Roost availability may constrain shorebird distribution: exploring the energetic costs of roosting and disturbance around a tropical bay. *Biological Conservation* 133, 225-235.
- Rogers, D.I., Minton, C.D.T., Boyle, A.N., Hassell, C.J. & Silcocks, A. (2008). Growing up slowly by the sea-side: Age of first northwards migration of shorebirds from Australian non-breeding grounds'. In D.I., Rogers, *Hidden costs: challenges faced by migratory shorebirds living on intertidal flats*. PhD Thesis, Charles Sturt University.
- Tarr, H., & Launder, J. (1954). Bird Observer.
- Taylor, I.R., & Bester, A. (1999). The response of foraging waders to human recreation disturbance at Rhyll, Phillip Island, Victoria. *Stilt* 35, 67.
- Thomas, D.G. (1968). Waders of Hobart. *Emu* 68, 95-125.
- Van de Kam, J., Battley, P.F., McCaffery, B.I., Roger, D.I., Hong, J-S., Moores, N., Ki, J.-Y., Lewis, J., & Piersma, T. (2010). Invisible Connections: Why Migrating Shorebirds Need the Yellow Sea. CSIRO Publishing, Melbourne.

- Wilson, J.R. (2000). The northward movement of immature Eastern Curlews in the austral winter as demonstrated by the population monitoring project. *Stilt* 36, 16-19.
- Woehler, E. (2014). Personal communication by email, 5 November 2014. *Birds Tasmania*.

Conservation Advice

Calidris ferruginea

curlew sandpiper

Taxonomy

Conventionally accepted as curlew sandpiper *Calidris ferruginea* Pontoppidan, 1763. Scolopacidae. Other common names are pygmy curlew, curlew stint and redcrop.

No subspecies are recognised (Bamford et al. 2008). Taxonomic uniqueness: medium (22 genera/family, 20 species/genus, 1 subspecies/species; Garnett et al. 2011).

Cox's sandpiper (*Calidris paramelanotos*) was described as a new species in 1982, but is now known to be a hybrid between a female curlew sandpiper and a pectoral sandpiper (*C. melanotos*) (McCarthy 2006; Christidis & Boles 2008). Before 1990 there were said to be 4-7 (unverified) Australian reports of Cox's sandpiper annually (Higgins & Davies 1996), but reports are now very rare. Curlew sandpipers have also been reported to hybridise with white-rumped sandpipers (*Calidris fuscicollis*) (McCarthy 2006).

Summary of assessment

Conservation status

Critically endangered: Criterion 1 A2, (a)

Calidris ferruginea has been found to be eligible for listing under the following listing categories:

Criterion 1: A2 (a): Critically Endangered

Criterion 2: Not eligible

Criterion 3: Not eligible

Criterion 4: Not eligible

Criterion 5: Not eligible

The highest category for which *Calidris ferruginea* is eligible to be listed is Critically Endangered.

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by a committee nomination based on information provided in the *Action Plan for Australian Birds 2010* (Garnett et al., 2011), and experts from the University of Queensland.

Public Consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 33 business days between 1 October 2014 and 14 November 2014. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species Information

Description

The curlew sandpiper is a small, slim sandpiper 18–23 cm long and weighing 57 g, with a wingspan of 38–41 cm. It has a long decurved black bill with a slender tip; the legs and neck are also long. The head is small and round, and the iris is dark brown. The legs and feet are black or black-grey. When at rest, the wing-tips project beyond the tip of the tail. It has a square white patch across the lower rump and uppertail-coverts, a prominent flight character in all plumages. The sexes are similar, but females have a slightly larger and longer bill and a slightly paler underbelly in breeding plumage (Higgins & Davies, 1996).

In breeding plumage, the head, neck and underbody to rear belly are a rich chestnut-red with narrow black bars on the belly and flanks. There are black streaks on the crown, a dusky loreal stripe, and white around the base of the bill. When the plumage is fresh, the head, neck and underbody are often mottled by white tips to the feathers. The feathers on the mantle and scapulars are black with large chestnut spots and greyish-white tips (Higgins & Davies, 1996).

The non-breeding plumage looks very different, with pale brownish grey upperparts and predominantly white underparts (with a brownish-grey wash and fine dark streaks on the foreneck and breast). The cap, ear-coverts, hindneck and sides of neck are pale brownish-grey with fine dark streaks, grading to off-white on the lower face, with white on the chin and throat. There is a narrow dark loreal stripe and white supercilium from the bill to above the rear ear-coverts. (Higgins & Davies, 1996).

Distribution

Australian distribution

In Australia, curlew sandpipers occur around the coasts and are also widespread inland, though erratic in their appearance across much of the interior. There are records from all states during the non-breeding period, and also during the breeding season when many non-breeding birds remain in Australia rather than migrating north.

In Queensland, scattered records occur in the Gulf of Carpentaria, with widespread records along the coast south of Cairns. There are sparsely scattered records inland. In NSW, they are widespread east of the Great Divide, especially in coastal regions. They are occasionally recorded in the Tablelands and are widespread in the Riverina and south-west NSW, with scattered records elsewhere. In Victoria, they were widespread in coastal bays and inlets; despite recent declines these are still their Victorian strongholds; they are widespread in near-coastal wetlands, and they occur intermittently on inland wetlands (e.g. in the Kerang area, Mildura, and western districts). In Tasmania, they were recorded on King Island and the Furneaux Group. They mostly occur in south-eastern Tasmania, but also at several sites in north-west Tasmania, with occasional records in low numbers on the west coast. In South Australia, curlew sandpipers occur in widespread coastal and sub-coastal areas east of Streaky Bay. Important sites include ICI and Price Saltfields, and the Coorong. Occasionally they occur in inland areas south of the Murray River and elsewhere. In Western Australia, they are widespread around coastal and sub-coastal plains from Cape Arid to south-west Kimberley. They occur in large numbers, in thousands to tens of thousands, at Port Hedland Saltworks, Eighty-mile Beach, Roebuck Bay and Lake Macleod. They are rarely recorded in the north-west Kimberley, around Wyndham and Lake Argyle, and occasionally they occur inland, in areas south of 26° S. In the Northern Territory, they mostly occur around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove Peninsula, Groote Eylandt and Sir Edward Pellew Island. They have been recorded inland from Victoria River Downs and around Alice Springs (Higgins & Davies, 1996).

Global distribution

The global population size of the curlew sandpiper has been estimated to be 1,350,000 (Delany & Scott, 2002; Bamford et al., 2008), however, these estimates are out of date. The global extent of occurrence is estimated at 100 000–1 000 000 km² (BirdLife International, 2014). Approximately 13% of the global population occurs in the East Asian-Australasian Flyway (180

000 individuals) (Bamford et al., 2008), however, these estimates are out of date and the true estimate is probably much lower.

The breeding range of the curlew sandpiper is restricted to the Russian Arctic from Chosha Bay east to Kolyuchiskaya Bay, on the Chukchi Peninsula, and also the New Siberian Islands (Lappo et al., 2012). It is a passage migrant through Europe, north Africa, Kazakhstan, west and south-central Siberia, Ussuriland, China, Taiwan, Japan, the Philippines and Papua New Guinea.

During the non-breeding period, they occur throughout Africa, south of southern Mauritania and Ethiopia, along the valley of the Nile River and in Madagascar. They also occur in Asia, from the coastal Arabian Peninsula to Pakistan and India, through Indonesia and Malaysia, south-east Asia and Indochina to south China and Australasia (Higgins & Davies, 1996).

Relevant Biology/Ecology

Life history

A generation time of 7.6 years (BirdLife International, 2014) is derived from an age at first breeding of 2.0 years, an annual survival of adults of 79% and a maximum longevity of 14.8 years, all extrapolated from congeners (Garnett et al., 2011). Estimates of apparent and true survival rate respectively for curlew sandpipers in Victoria are 73.1% and 80.5% (Rogers and Gosbell 2006). Rogers and Gosbell (2005) demonstrated that long-term decline in Victorian curlew sandpipers, although influenced by consecutive years of low breeding success, has been driven by reduced adult survival. Minton et al. (2006) confirmed that curlew sandpipers do not begin northwards migration and breeding until 2 years old.

Data extracted from the Australian Bird and Bat Banding Scheme (ABBBS) reports a longevity record of 18 years, 1.9 months (Australian Government, 2014).

Breeding

This species does not breed in Australia.

In Siberia, nesting occurs during June and July (Hayman et al., 1986). The nest is a cup positioned on the margins of marshes or pools, on the slopes of hummock tundra, or on dry patches in *Polygonum* tundra (BirdLife International, 2014). Curlew sandpipers usually have a clutch size of four eggs (Johnsgard, 1981).

General habitat

In Australia, curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies, 1996).

"*The Shorebird Community occurring on the relict tidal delta sands at Taren Point*" is listed as an Endangered Ecological Community in NSW (NSW DECC, 2005). The curlew sandpiper is one of 20 shorebird species that make up this community.

Feeding habitat

Curlew sandpipers forage on mudflats and nearby shallow water. In non-tidal wetlands, they usually wade, mostly in water 15–30 mm, but up to 60 mm deep. They forage at the edges of shallow pools and drains of intertidal mudflats and sandy shores. At high tide, they sometimes forage among low sparse emergent vegetation, such as saltmarsh, and sometimes forage in flooded paddocks or inundated saltflats. Occasionally they forage on wet mats of algae or waterweed, or on banks of beachcast seagrass or seaweed. They rarely forage on exposed

reefs (Higgins & Davies, 1996). In Roebuck Bay, northern Western Australia, they tend to follow the receding tide to forage near the water edge (Rogers 1999, 2005) but they also feed on part of the mudflats that have been exposed for a longer period, foraging in small groups (Tulp & de Goeij, 1994).

Roosting habitat

Curlew sandpipers roost in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins & Davies, 1996). They have also been recorded roosting in mangroves in Inverloch, Victoria (Minton & Whitelaw, 2000).

Feeding

This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds. Outside Australia, they also forage on shrimp, crabs and small fish. Curlew sandpipers usually forage in water, near the shore or on bare wet mud at the edge of wetlands. On wet mud they forage by pecking and probing. They probe in shallow water, and jab at the edge of the water where a film of water remains on the sand. They glean from mud and less commonly from the surface of water, or in drier areas above the edge of the water. For a 'jab' less than half the length of the bill is inserted into the substrate; a probe is performed with a slightly open bill inserted to its full length. Curlew sandpipers may wade up to the belly, often with their heads submerged while probing. They often forage in mixed flocks (Dann, 1999a), including with red-necked stints (*Calidris ruficollis*).

The diet of the curlew sandpiper includes the following taxa (Barker & Vestjens, 1989; Higgins & Davies, 1996; Dann, 1999a):

Plants (*Ruppia* spp. seeds), Annelid worms: *Ceratonereis eurythraeensis*, *Nereis caudate*, Molluscs: Kelliidae, Gastropods: Rissoidae, Cerithiidae, Fossaridae, *Polinices* sp., *Salinator fragilis*, Hydrococcidae, Hydrobiidae, *Assiminea brazieri*, *A. tasmanica*, Crustaceans: *Cymadusa* sp., *Paracorophium* sp., Brachyurans; Sentinel Crab (*Macrophthalmus latifrons*), Insects: Diptera (Stratiomyidae, Chironomidae), adults, larvae and pupae, larvae (of Coleoptera, Dytiscidae and Scarabaeidae), Lepidoptera

Curlew sandpipers have been recorded consuming grit. In tidal waters, on the outgoing tide, the birds move onto the most recently exposed parts of the tidal flats until low tide when they disperse widely (Rogers 1999). On the rising tide, the flocks remain in areas close to the water's edge until these areas are covered and then retreat in stages rather than moving continuously as they do on the outgoing tide. Occasionally, individuals feed at high tide near the roost, along stretches of sandy beach where piles of decomposing vegetation are scattered in the high-tide zone. Supratidal feeding mainly occurs during the pre-migratory fattening periods (February-April) (Dann, 1999b). In other studies supratidal foraging has been recorded throughout the austral summer, and has been found to occur more on neap tides when tidal flat exposure is reduced (Rogers et al. 2013).

Migration patterns

Curlew sandpipers are migratory. Overlapping breeding grounds occur in Siberia, and populations move south to widely different non-breeding areas which generally occur south of 35° N. Most birds migrate south, probably overland across Siberia and China, and south Asia. The northern migration occurs much further east, mainly along the south-east and east coasts of China, where staging occurs, then continuing overland to breeding areas (Higgins & Davies, 1996).

Departure from breeding grounds

Males depart breeding grounds during early July, followed by females in July and early August, then juveniles in August, with juveniles usually arriving in the non-breeding range later than adults. Southwards migration is poorly known but flag resightings indicate that the main passage is initially overland, and that some birds migrate well to the west of the direct great circle route from the breeding grounds to south-eastern Australia (Minton et al., 2006). They cross Russia during July till late October, and pass through Mongolia, with a few records from inland Asia. They reach the Asian coast on a broad front between India and China in August. Adults pass through the Inner Gulf of Thailand during August, with a second influx, probably mainly juveniles, in late October and early November. Thousands pass over the west coast of Malaysia and arrive in Singapore in July and August but the migratory destination of these birds is unclear. Small numbers pass through Myanmar and Hong Kong during August-October. The relatively low numbers of curlew sandpipers, and of resightings of Australian-flagged birds on the coast of Indonesia, Borneo, the Philippines and Papua New Guinea, suggest that curlew sandpipers migrating to Australia migrate in a direct flight from staging areas on the east Asian coast. They are regular in small numbers on passage through southern Papua New Guinea, and in the Port Moresby district they arrive as early as late August. Adults are capable of flying non-stop to Australia from Hong Kong and Singapore. They reach the northern shores of Australia in late August and early September (Higgins & Davies, 1996; Minton, 1996; Minton et al., 2006).

Non-breeding season

Substantial numbers of Curlew Sandpipers remain in northern Australia throughout the non-breeding season (e.g. Rogers et al. 2008). Others stopover in northern Australia before continuing migration to south-east Australia, the first birds arriving in late August, but the majority not until September. Some birds are also thought to move through the Gulf of Carpentaria to east and south-east Australia, with records from coastal Queensland and NSW. Some, occasionally hundreds, pass through north-east South Australia during late August to early December, and small numbers occur regularly in south-west NSW from early August. Some birds also move from north-west Australia, south to southern Western Australia, sometimes arriving in coastal south-western Western Australia as early as August, with small numbers also passing through Eyre, south-eastern Western Australia, mainly during August-November. Birds may return to the same non-breeding sites each year (Higgins & Davies, 1996; Minton, 1996).

Return to breeding grounds

The return north begins in March, the northern route being further to the east than the southern route. Sightings of colour-marked birds, and influx at inland sites in south-eastern Australia in April, suggest some passage occurs through inland areas, and at least some birds from south-eastern Australia move to north-west Australia before leaving the mainland. Curlew sandpipers leave coastal sites in east Queensland between mid-January and mid-April, with a possible passage along the north-east coast. They migrate north on a broad front, with fewer occurring in north-west Australia than on the southern migration. Young birds stay in non-breeding areas during breeding season (Higgins & Davies, 1996). Recoveries and flag resightings indicate that a large proportion of the Australian population migrate through southern China (including Hong Kong and Taiwan), Vietnam and Thailand in the last few days of March and through April. Migration is however on a broad front and smaller numbers of birds pass through Papua New Guinea in early April to mid-May, and Bali and Sumatra during March-April. Small numbers pass through Brunei, during mid-February to May, with large numbers passing through the Philippines during March-April. The birds depart Singapore during early March, passing through Malaysia during March-April. They move through the Inner Gulf of Thailand during late March-May and depart Myanmar during May. By May the majority of recoveries and flag resightings occur on or near the Asian coast, notably on the northern coast of Bohai Bay, with other major concentrations in the Yangtze Estuary and the northern base of the Shandong Peninsula. A few pass through the Republic of Korea, Japan and Sakhalin during April-May. They first arrive in Chukotka region, Russia, during late in May or early June (Higgins & Davies, 1996; Minton, 1996; Minton et al. 2006, Hong-Yan et al. 2011).

Descriptions of migratory pathways and important sites

Birds banded in Australia have been recovered in the upper Yenisey River and Daursky Nature Reserve, Russia, south India, Tanggu near Tianjin, many in Hong Kong, in China, Pu-tai, Chiayi and Cheng-his-li, Tainan City, Taiwan, south Vietnam, Gulf of Thailand and Java (Higgins & Davies, 1996; Minton & Jessop, 1999a, b, Minton et al., 2006). Long distance recoveries include birds banded in Victoria being recovered in Russia, at Yakutia, Verkhoyanskiy District, 11,812 km north of the banding site on the northern extremity of the breeding range and well to the west, on the Taimyr Peninsula, over 13,000 km from its banding location (Minton, 1996), and in China and Hong Kong (Minton, 1991).

The distribution of important sites is well known in the non-breeding period, with internationally important sites in Australia (22), Malaysia (2), Indonesia (1) and Thailand (1) (Bamford et al., 2008). In Australia, 9 sites are known to be important during migration, all in the southward period (Bamford et al., 2008). On northward migration Barter (2002) estimated that only 10% of the population use the Yellow Sea, most occurring in western Bohai Wan. However the discovery of very large numbers staging in Bohai Wan (Hong-Yan et al., 2011) suggests that the Yellow Sea is of more importance to the species than initially realised.

Threats

Threats in Australia, especially eastern and southern Australia, include ongoing human disturbance, habitat loss and degradation from pollution, changes to the water regime and invasive plants (Rogers et al., 2006; Australian Government, 2009; Garnett et al., 2011).

In the non-breeding grounds of Australia, some populations of this species occurs in highly populated areas that are vulnerable to habitat alteration. It is necessary to maintain undisturbed feeding and roosting habitat along the south-east coast and at sites on the north-west coasts used during migration for the species to survive at current population levels (Lane, 1987). Coastal development, land reclamation, construction of barrages and stabilisation of water levels can destroy feeding habitat. Pollution around settled areas may have reduced the availability of food.

Curlew sandpipers are threatened by wetland degradation in East Asia where it stages on migration (Bamford et al., 2008). Specifically this species is threatened at Bohai Bay which is being developed at a rapid rate (Murray et al., 2014). Threats at migratory staging sites include environmental pollution, reduced river flows, sea level rise, human disturbance and reclamation for tidal power plants and barrages, industrial use and urban expansion (Garnett et al., 2011; Iwamura et al., 2013).

How judged by the Committee in relation to the EPBC Act Criteria and Regulations

| Criterion 1. Population size reduction (reduction in total numbers) | | | |
|---|--|--|---|
| Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4 | | | |
| | Critically Endangered Very severe reduction | Endangered Severe reduction | Vulnerable Substantial reduction |
| A1 | ≥ 90% | ≥ 70% | ≥ 50% |
| A2, A3, A4 | ≥ 80% | ≥ 50% | ≥ 30% |

| | | | |
|----|---|-----|--|
| A1 | Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased. | (a) | direct observation [<i>except A3</i>] |
| A2 | Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible. | (b) | an index of abundance appropriate to the taxon |
| A3 | Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) <i>cannot be used for A3</i>] | (c) | a decline in area of occupancy, extent of occurrence and/or quality of habitat |
| A4 | An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. | (d) | actual or potential levels of exploitation |
| | | (e) | the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites |

based on any of the following:

Evidence:

Eligible under Criterion 1 A2(a) for listing as Critically Endangered.

The global population has been estimated at 1 850 000 individuals, of which about 180 000 are found in the East Asian – Australasian Flyway (Bamford et al., 2008), however, these are old data. In Australia, 115 000 individuals were thought to visit during the non-breeding period (Bamford et al., 2008), but numbers have subsequently declined (Garnett et al., 2011).

Numbers declined on Eighty-Mile Beach, WA, by c. 59% between 2000 and 2008 (Rogers et al., 2009), at the Coorong, SA, by 79% between the 1980s and 2004 (Wainwright and Christie, 2008), at sites across Queensland by 6.3% per year between 1998 and 2008 (Fuller et al., 2009), at Corner Inlet in Victoria by 3.4% per year between 1982 and 2011 (Minton et al., 2012), at Gulf St Vincent, SA, by 71% between 1981 and 2004 (Close, 2008), and by 82% across 49 Australia sites between 1983 and 2007 (BirdLife Australia *in litt.* 2011). Models suggest that this decline is due to reduced adult survival rates (Rogers and Gosbell, 2006).

Numbers in south east Tasmania have decreased by 100% in the period 1973 – 2014, with no curlew sandpipers recorded during coordinated summer counts in 2008, and 2010 – 2014 inclusive (Woehler pers. comm., 2014).

Numbers declined less severely elsewhere in the flyway. There were no clear trends in Japan between 1978 and 2008 (Amano et al., 2010), but as discussed above, Japan is not a major part of the migration route of this species.

A subsequent and more detailed assessment by a University of Queensland team (partly funded by the Department under an Australian Research Council collaborative grant), puts the species into the critically endangered category (Fuller, pers. comm., 2014). Time series data from directly observed summer counts at a large number of sites across Australia indicate a severe population decline of 75.9% over 20 years (7.5% per year; Fuller, pers. comm., 2014). This equates to a decline of 49.1% over a 10 year period, and 80.8% over 23 years, which is three generations for this species (Garnett et al., 2011).

In large part, the observed decline in curlew sandpiper numbers across Australia stems from ongoing loss of intertidal mudflat habitat at key migration staging sites in the Yellow Sea (Murray et al., 2014). As such, qualification under criterion A2 rather than A1 is warranted. However, threats are occurring locally in Australia, such as coastal development and recreational activities causing disturbance, also impact the species.

The Committee considers that the species has undergone a very severe reduction in numbers over three generation lengths (23 years for this assessment), equivalent to at least 80.8 percent and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it eligible for listing as critically endangered.

| Criterion 2. Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy | | | |
|---|--|----------------------------------|-------------------------------|
| | Critically Endangered Very restricted | Endangered Restricted | Vulnerable Limited |
| B1. Extent of occurrence (EOO) | < 100 km ² | < 5,000 km ² | < 20,000 km ² |
| B2. Area of occupancy (AOO) | < 10 km ² | < 500 km ² | < 2,000 km ² |
| AND at least 2 of the following 3 conditions: | | | |
| (a) Severely fragmented OR Number of locations | = 1 | ≤ 5 | ≤ 10 |
| (b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals | | | |
| (c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (number of mature individuals) | | | |

Evidence:

Not eligible

The extent of occurrence in Australia is estimated to be 7 600 000 km² (stable) and area occupied 6 800 km² (stable; Garnett et al., 2011). Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 3. Small population size and decline | | | |
|---|--|---|--|
| | Critically Endangered Very low | Endangered Low | Vulnerable Limited |
| Estimated number of mature individuals | < 250 | < 2,500 | < 10,000 |
| AND either (C1) or (C2) is true | | | |
| C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future | Very high rate 25% in 3 years or 1 generation (whichever is longer) | High rate 20% in 5 years or 2 generation (whichever is longer) | Substantial rate 10% in 10 years or 3 generations (whichever is longer) |
| C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions: | | | |
| (a) (i) Number of mature individuals in each subpopulation | ≤ 50 | ≤ 250 | ≤ 1,000 |
| (a) (ii) % of mature individuals in one subpopulation = | 90 – 100% | 95 – 100% | 100% |
| (b) Extreme fluctuations in the number of mature individuals | | | |

Evidence:

Not eligible

The number of mature individuals in Australia is estimated to be 115 000 with a decreasing trend (Bamford et al., 2008; Garnett et al., 2011), however, these estimates are out of date and

likely to be an overestimate. Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 4. Very small population | | | |
|---|--|--------------------------------|---------------------------|
| | Critically Endangered Extremely low | Endangered Very Low | Vulnerable Low |
| Number of mature individuals | < 50 | < 250 | < 1,000 |

Evidence:

Not eligible

The number of mature individuals in Australia is estimated to be 115 000 with a decreasing trend (Bamford et al., 2008; Garnett et al., 2011), however, these estimates are out of date and likely to be an overestimate.

The total number of mature individuals is 115 000 which is not considered extremely low, very low or low. Therefore, the species has not been demonstrated to have met this required element of this criterion.

| Criterion 5. Quantitative Analysis | | | |
|---|---|---|--|
| | Critically Endangered Immediate future | Endangered Near future | Vulnerable Medium-term future |
| Indicating the probability of extinction in the wild to be: | ≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.) | ≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.) | ≥ 10% in 100 years |

Evidence:

Not eligible

Population viability analysis has not been undertaken

Conservation Actions

Recovery Plan

There should not be a recovery plan for this species, as approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Significant management and research is being undertaken at international, state and local levels.

Primary Conservation Objectives

International objectives

1. Achieve a stable or increasing population.
2. Maintain and enhance important habitat.
3. Disturbance at key roosting and feeding sites reduced.

Australian objectives

1. Achieve a stable or increasing population.

2. Maintain and enhance important habitat.
3. Disturbance at key roosting and feeding sites reduced.
4. Raise awareness of curlew sandpiper within the local community.

Conservation and Management Actions

1. Work with governments along the East Asian – Australasian Flyway to prevent destruction of key migratory staging sites.
2. Support initiatives to protect and manage key staging sites of curlew sandpiper.
3. Maintain and improve protection of roosting and feeding sites in Australia.
4. Incorporate requirements for curlew sandpiper into coastal planning and management.
5. Manage important sites to identify, control and reduce the spread of invasive species.
6. Manage disturbance at important sites when curlew sandpipers are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary beach closures.
7. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Monitoring priorities

1. Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia.

Information and research priorities

1. More precisely assess curlew sandpiper population size, distribution and ecological requirements particularly across northern Australia.
2. Improve knowledge about dependence of curlew sandpiper on key migratory staging sites, and wintering sites to the north of Australia.
3. Improve knowledge about threatening processes including the impacts of disturbance.

Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Critically Endangered category:
Calidris ferruginea
- (ii) The Committee recommends that there should not be a recovery plan for this species.

Threatened Species Scientific Committee

4/3/2015

References cited in the advice

Amano, T., Székely, T., Koyama, K., Amano, H., & Sutherland, W.J. (2010). A framework for monitoring the status of populations: an example from wader populations in the East Asian-Australasian flyway. *Biological Conservation* 143, 2238-2247.

- Australian Government (2006). Wildlife Conservation Plan for Migratory Shorebirds. [Online]. Canberra, ACT: Department of the Environment and Heritage. Available from: <http://www.environment.gov.au/biodiversity/migratory/publications/shorebird-plan.html>.
- Australian Government (2009). Draft significant impact guidelines for 36 migratory shorebirds. Draft EPBC Act Policy Statement 3.21. Canberra, ACT: Department of the Environment and Heritage.
- Australian Government (2014). Australian Bird & Bat Banding Scheme Database, accessed 25 July 2014. Department of the Environment, Canberra.
- Bamford, M., Watkins, D., Bancroft, W., Tischler, G., & Wahl, J. (2008). Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites. [Online]. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts, Wetlands International-Oceania. Available from: <http://www.environment.gov.au/biodiversity/migratory/publications/shorebirds-east-asia.html>.
- Barker, R.D. & Vestjens, W.J.M. (1989). The Food of Australian Birds. 1 Non-Passerines. Lyneham, ACT: CSIRO.
- Barter, M. (2002). Shorebirds of the Yellow Sea: Importance, Threats and Conservation Status. Wetlands International Global Series 9, International Wader Studies 12, Canberra, Australia
- BirdLife International (2014) Species factsheet: *Calidris ferruginea*. Downloaded from <http://www.birdlife.org> on 23/06/2014. Recommended citation for factsheets for more than one species: BirdLife International (2014) IUCN Red List for birds. Downloaded from <http://www.birdlife.org> on 23/06/2014.
- Christidis, L. & Boles, W.E. (2008). Systematics and Taxonomy of Australian Birds. Collingwood, Victoria: CSIRO Publishing.
- Close, D.H. (2008). Changes in wader numbers in the Gulf St Vincent, South Australia, 1979-2008. *Stilt* 54, 24-27.
- Dann, P. (1999a). Foraging behaviour and diets of Red-necked Stints and Curlew Sandpipers in south-eastern Australia. *Wildlife Research*. 27:61-68.
- Dann, P. (1999b). Feeding periods and supratidal feeding of Red-necked Stints and Curlew Sandpipers in Western Port, Victoria. *Emu*. 99:218-222.
- Delany, S. & Scott, D. (2002). Waterbird Population Estimates – Third Edition. Wetlands International Global Series No. 12, Wageningen, The Netherlands.
- Fuller, R. (2014). Personal communication by email, 14 July 2014. University of Queensland.
- Fuller, R.A., Wilson, H.B., Kendall, B.E., & Possingham, H.P. (2009). Monitoring shorebirds using counts by the Queensland Wader Study Group. Report to the Queensland Wader Study Group and the Department of Environment and Resource Management, Melbourne.
- Garnett, S.T., Szabo, J.K., & Dutton, G. (2011). *The Action Plan for Australian Birds 2010*. Birds Australia, CSIRO Publishing, Melbourne.
- Hayman, P., Marchant, J., & Prater, T. (1986). *Shorebirds. An identification guide to the waders of the world*. London & Sydney: Croom Helm.

- Higgins, P.J. & Davies, S.J.J.F., (eds) (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons*. Melbourne, Victoria: Oxford University Press.
- Hong-Yan Y, Chen B, Barter M, Piersma T, Zhou C, Li F-S & Zhang Z-W (2011). Impacts of tidal land reclamation in Bohai Bay, China: ongoing losses of critical Yellow Sea waterbird staging and wintering sites. *Bird Conservation International*, 21:241-259
- Iwamura ,T., Possingham, H.P., Chadès, I., Minton, C., Murray, N.J., Rogers, D.I., Trembl, E.A. & Fuller, R.A. (2013). Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. *Proceedings of the Royal Society B*, 281: 20130325.
- Johnsgard, P.A. (1981). *The Plovers, Sandpipers and Snipes of the World*. Lincoln: Nebraska Press.
- Lane, B.A. (1987). *Shorebirds in Australia*. Sydney, NSW: Reed.
- Lappo, E.G., Tomkovich, P.S., Syroechkovskiy, E. (2012). *Atlas of Breeding Waders in the Russian Arctic*. Moscow: Institute of Geography, Russian Academy of Sciences.
- McCarthy, E.M. (2006). *Handbook of Avian Hybrids of the World*. New York: Oxford University Press.
- Minton, C. (1991). Victorian Wader Study Group Highlights. *Stilt*. 18:10.
- Minton, C. (1996). Analysis of overseas movements of Red-necked Stints and Curlew Sandpipers. *Victorian Wader Study Group Bulletin*. 20:39-43.
- Minton, C., & Jessop, R. (1999a). Sightings of leg-flagged waders from Victoria, Australia. Report number 7. *Stilt*. 35:43-51.
- Minton, C., & Jessop, R. (1999b). Sightings of waders and terns leg-flagged in north-western Australia. Report number 6. *Stilt*. 35:52-58.
- Minton, C.D.T., Jessop, R.E., Collins, P.C. and Wilson, J.R. (2006). The migratory movements of Curlew Sandpipers which visit Australia. *International Wader Studies* 19: 171-183.
- Minton, C.T.D., Dann, P., Ewing, P.C., Jessop, R., Anton, P., & Clemens, R. (2012). Trends of shorebirds in Corner Inlet, Victoria, 1982-2011. *Stilt* 61:3-18.
- Minton, C., & Whitelaw, J. (2000). Waders roosting on mangroves. *Stilt*. 37:23-24.
- Murray, N.J., Clemens, R.S., Phinn, S.R., Possingham, H.P., & Fuller, R.A. (2014). Tracking the rapid loss of tidal wetlands in the Yellow Sea. *Frontiers in Ecology and the Environment*.
- NSW Department of Environment and Climate Change (DECC) (2005). Taren Point Shorebirds - profile. [Online]. NSW DECC. Available from: <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10800>.
- Rogers, D.I. 1999. What determines shorebird feeding distribution in Roebuck Bay? Chapter 9 (Pp 145-179) in M. Pepping, T. Piersma, G. Pearson and M. Lavaleye (Eds). Intertidal sediments and benthic animals of roebuck Bay, Western Australia. NIOZ Report 1999-3, Texel.
- Rogers, D.I. 2005. The distribution of shorebirds along Eighty-mile Beach. Chapter 10 in G.P. Pearson, T. Piersma, M. Lavaleye and R. Hickey (Eds). The long mud: Benthos and

shorebirds of the foreshore of Eighty-mile Beach, Western Australia. NIOZ-Report 2005-2.

- Rogers, D., Hassell, C., Oldland, J., Clemens, R., Boyle, A., Rogers, K. (2009). Monitoring Yellow Sea migrants in Australia (MYSMA): north-western Australian shorebird surveys and workshops, December 2008.
- Rogers, D.I., Piersma, T., & Hassell, C.J. (2006). Roost availability may constrain shorebird distribution: exploring the energetic costs of roosting and disturbance around a tropical bay. *Biological Conservation* 133, 225-235.
- Rogers, K.G., & Gosbell, K. (2006). Demographic models for Red-necked Stint and Curlew Sandpiper in Victoria. *Stilt* 50, 203-214.
- Rogers, D.I., Loyn, R.H., & Greer, D. (2013). Factors influencing shorebird use of tidal flats adjacent to the Western Treatment Plant. Arthur Rylah Institute Technical Report No 250.
- Tulp, I., & de Goeij, P. (1994). Evaluating wader habitat in Roebuck Bay (north-western Australia) as a springboard for northbound migration in waders, with a focus on Great Knots. *Emu*. 94:78-95.
- Wainwright, P., & Christie, M. (2008). Wader surveys at the Coorong and S.E. Coastal Lakes, South Australia. *Stilt* 54, 31-47.
- Woehler, E. (2014). Personal communication by email, 5 November 2014. Birds Tasmania.