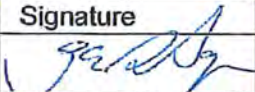


GLNG Gas Transmission Pipeline


Consolidated Pre-Clearance Survey Report for Marine Crossing Early Works

Document Number: 3380-GLNG-4-1.3-0127


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Appendices

Appendix A

Site Flora Species List

Appendix B

Ground Truthed Regional Ecosystems

Appendix C

Recorded Threatened Species

Abbreviations

APIA	Australian Pipeline Industry Association
APPEA	Australian Petroleum Production and Exploration Association
ASSMP	Acid Sulphate Soil Management Plan
AVMP	Aquatic Values Management Plan
CAMBA	China-Australia Migratory Bird Agreement
CEMP	Construction Environmental Management Plan
CG	Coordinator General
CICSDA	Callide Infrastructure Corridor State Development Area
cm	Centimetre
CSG	Coal Seam Gas
DECC	Department of Conservation and Climate Change
DEHP	Department of Environment and Heritage Protection
DERM	Department of Environment and Resource Management
DEWHA	Department of Water, Heritage and the Arts
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
E	Endangered
EA	Environmental Authority
EHSMS	Santos Environment, Health, Safety & Management System
EIS	Environmental Impact Statement
EO	Environment Officer
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESCP	Erosion and Sediment Control Plan
FHP	Fauna Handling Plan
GSDA	Gladstone State Development Area
GIS	Geographical Information System
GLNG	Gladstone Liquefied Natural Gas
GTP	Gas Transmission Pipeline
GTP ROW	Gas Transmission Pipeline Right of Way
ha	Hectares
HDD	Horizontal Directional Drilling
HERBRECS	Queensland Herbarium database
JAMBA	Japan-Australia Migratory Bird Agreement
LNG	Liquefied Natural Gas
LRMP	Landscape Rehabilitation Management Plan
LZ	Land Zone
m	Metres
Mi	Migratory
Mm	Millimetres

MNES	Matters of National Environmental Significance
NC Act	<i>Nature Conservation Act 1992</i>
NT	Near Threatened
OHS	Occupational Health and Safety
PEM	The Proponent Pipeline Environment Manager
Proponent	Santos GLNG Pty Ltd, PETRONAS Australia Pty Ltd, Total E&P Australia and KOGAS
PWMP	Pest and Weed Management Plan
QLD	Queensland
QPIF	Queensland Primary Industries and Fisheries
QPWS	Queensland Parks and Wildlife Service
RE	Regional Ecosystem
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROW	Right of Way
SEIS	Supplementary Environmental Impact Statement
SEQ	South East Queensland
SEVT	Semi-evergreen Vine Thicket
SMP	Species Management Plan
SOCI	Species of Conservation Interest Logbook
SSMP	Significant Species and Ecological Communities Management Plan
TEC	Threatened Ecological Communities
The Project	The GLNG GTP Project
V	Vulnerable
VM Act	<i>Vegetation Management Act 1999</i>

Definitions

In this pre-clearance survey report, the following definitions apply:

Glossary

Term	Meaning
Ancillary work areas	All areas outside of the Marine Crossing Early Works footprint required to develop and operate the GTP. This includes laydown sites, stockpile areas, construction areas, camps, low hazard dams and pump areas, and access tracks (permanent and temporary)
Approximately	Used throughout the document as a way to quantify impacts, particularly when working with decimal places. Use of this term should not be interpreted that the impacts are greater than those provided. For the purposes of this document, quantities have been rounded up and therefore actual impacts are slightly less than indicated in the SSMP
Bioregion	A geographic area characterised by a combination of physical and biological characteristics, for example, terrain, climate and ecological communities
Breeding places	An animal breeding place is a place being used by a protected animal to incubate or rear the animal's offspring if: <ul style="list-style-type: none"> The animal is preparing, or has prepared, the place for incubating or rearing the animal's offspring The animal is breeding, or is about to breed, and is physically occupying the place; or the animal and the animal's offspring are physically occupying the place, even if the occupation is only periodical The animal has used the place to incubate or rear the animal's offspring and is of a species generally known to return to the space place to incubate or rear offspring in each breeding season for the animal
Depauperate	Severely diminished
Directly adjacent to the ROW	Within 100 m of the ROW
Disturbance	Any activity that has an impact on the environment. This may include clearance of trees, movement of soil, blasting of rock, construction of man-made structures, and also extends to human activities resulting in noise, light, pollution or rubbish
Disturbance limit	Proposed extent of potential habitat to be cleared within the Marine Crossing Early Works footprint, Ancillary work areas and the associated Access Road areas
Ecological community	An assemblage of native species that: <ol style="list-style-type: none"> inhabits a particular area in nature meets the additional criteria specified in the regulations (if any) made for the purposes of this definition <p>Ecological communities include all the species of plants, animals and micro-organisms that naturally occur together in a particular area or environmental domain in nature in assemblages which can change over time</p>
Endangered (EPBC Act)	When a native species that is not critically endangered and is facing a very high-risk of extinction in the wild in the near future as determined in accordance with the prescribed criteria
Gilgai	Gentle mounds and depressions associated with swelling and cracking clay soils on alluvial floodplains
Habitat	An area providing the physical and biological requirements for a species
High value regrowth	High-value regrowth vegetation is mature native vegetation that hasn't been cleared since 31 December 1989
In close proximity to the Marine Crossing Early Works footprint	Generally relates to fauna species and refers to species or habitats identified within 100 m of the Marine Crossing Early Works footprint or seen flying overhead of the Marine Crossing Early Works footprint (due to the mobile nature of fauna, it can be difficult to quantify specific distances)
Insectivorous	An animal which subsists on insects

Term	Meaning
Known habitat	Habitats in which the species or a breeding place has been positively identified during the pre-clearing surveys or in habitat contiguous or intersecting a 5 km radius buffer around each known point record of the species (eg Queensland Museum, Wetland Info etc). Known habitat also refers to sites already known to exist by relevant scientific/government agencies or other consultants working in the area
Microhabitat	A small, specialized habitat that provides a unique habitat for certain species. Microhabitats may include rocky outcrops, piles of woody debris, leaf litter
Migratory species	Those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations
Nocturnal	Active by night
Population	Of a species or ecological community relating to an occurrence of the species or community in a particular area
Pre-clearing survey	An ecological survey undertaken by an approved ecologist in accordance with relevant Commonwealth Survey guidelines and/or industry practices
Regional Ecosystems (REs)	Vegetation communities that are consistently associated with a particular combination of geology, land form and soil in a bioregion
Remnant vegetation	Remnant woody vegetation is defined as vegetation where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy
Roost habitat	Where a bat spends its day
Sensitive area	An area known or potentially providing habitat for threatened species
Targeted survey	A survey specifically targeting a key ecological feature, including habitat features such as hollow-bearing trees, burrows and nests
Threatened ecological community	An ecological community listed EPBC Act as Critically Endangered, Endangered or Vulnerable
Threatened species	A plant or animal assigned a conservation status (Vulnerable, Endangered or Critically Endangered) under the EPBC Act
Translocation	The term translocation for the purposes of this management plan will follow the guidelines for translocation of threatened plants in Australia (Vallee <i>et al</i> 2004) which includes the following: seed collection and propagation; propagation via cuttings or tissue culture; direct seeding; transplantation of seedlings or mature plants; and the transfer of soil, leaf litter or brush
Unavoidable impacts	Impacts as a result of the construction activities within the Marine Crossing Early Works footprint and Ancillary work areas on core, essential (known and potential) and general habitat for threatened fauna, including migratory species. Unavoidable impacts also include direct impacts on threatened flora populations and threatened ecological communities
Vulnerable (EPBC Act)	A native species that is not critically endangered or endangered and is facing a high-risk of extinction in the wild in the medium term future as determined in accordance with the prescribed criteria

1 Introduction

1.1 Background and purpose

GLNG Operations, a joint venture between Santos GLNG Pty Ltd (Santos), PAPL (Downstream) Pty Ltd (PETRONAS), Total GLNG Australia (TOTAL) and KGLNG Liquefaction Pty Ltd (KOGAS) propose to construct a high pressure Gas Transmission Pipeline (GTP) to transport coal seam gas (CSG) from the CSG fields at Roma and Fairview to a proposed liquefied natural gas (LNG) facility on Curtis Island. The GTP forms one component of the Gladstone LNG (GLNG) Project (the Project), which includes the following:

- Exploration and production of CSG in the Surat and Bowen Basin gas fields
- Construction and operation of an approximate 420 km GTP from the CSG fields in Roma and Fairview to the LNG Facility on Curtis Island (Santos GLNG GTP)
- Construction and operation of a gas liquefaction and export facility on Curtis Island and associated infrastructure

On 16 July 2007, the Coordinator-General declared the GLNG Project to be a 'significant project' for which an Environmental Impact Statement (EIS) is required in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971* (Qld).

On 31 March 2008 and 14 April 2008, the Australian Government Minister for the Environment, Heritage and the Arts determined that the five referrals relating to the project, being CSG fields, the GTP, LNG terminal, marine environment and bridge to Curtis Island, were each a 'controlled action' pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EIS process was finalised on the 28 May 2010, GLNG became Australia's first major coal seam gas to LNG project to receive its environmental approval from the Qld Coordinator-General. On 22 October 2010, the Project received its environmental approval from the Commonwealth Environment Minister under the EPBC Act.

The EPBC Act controlled action approval for the GLNG GTP Project (EPBC No. 2008/4096) contained conditions relating to the commissioning of detailed pre-clearance surveys:

Pre-clearance surveys

5. *Before the clearance of native vegetation in the pipeline ROW, the proponent must:*
 - a. *undertake pre-clearance surveys for the presence of listed threatened species and migratory species, their habitat and listed ecological communities.*
 - b. *alternatively, where recent surveys have already been undertaken and those surveys meet the Department's requirements for surveys for the relevant MNES, the proponent may elect to development management plans based on those surveys in accordance with the requirements of Condition B.*
6. *Pre-clearance surveys must:*
 - a. *for each listed species, be undertaken in accordance with the Department's survey guidelines in effect at the time of the survey. This information can*

be obtained from <http://www.environment.gov.au/epbc/guidelines-policies.html#threatened>

- b. *be undertaken by a suitable qualified ecologist approved by the Department in writing*
 - c. *document the survey methodology, results and significant findings in relation to MNES*
 - d. *apply best practice site assessment and ecological survey methods appropriate for each listed threatened species, migratory species, their habitat and listed ecological communities*
7. *Pre-clearance survey reports (which document the methods used and the results obtained) must be published by the proponent and provided to the Department on request*
8. *If a listed threatened species or migratory species or their habitat, or a listed ecological community is encountered during the surveys undertaken as required by condition 5 and is not specified in the Table 1 or 2 at condition 11 and 12, the proponent must submit a separate management plan for each species or ecological community to manage the unexpected impacts of clearing. In relation to each listed species or ecological community, each plan must address:*
- a. *the relevant characteristics describing each ecological community*
 - b. *a map of the location of species, species' habitat, or ecological community in proximity to the ROW*
 - c. *measures that will be employed to avoid impact on the species, species' habitat, or ecological community*
 - d. *a quantification of the unavoidable impact (in hectares and/or individual specimens)*
 - e. *where impacts are unavoidable and a disturbance limit is not specified for the listed species or ecological community under condition 11, propose offsets to compensate for the impact on the population of the species' habitat, or the ecological community*
 - f. *current legal status (under the EPBC Act)*
 - g. *known distribution*
- For listed species, each plan must also include:*
- a. *known species' populations and their relationships within the region*
 - b. *biology and reproduction*
 - c. *preferred habitat and microhabitat including associations with geology, soils, landscape features and associations with other native fauna and/or flora or ecological communities*
 - d. *anticipated threats to MNES from pipeline construction, operation and decommissioning*

- e. *management practices and methods to minimise impacts such as:*
- i. *site rehabilitation timeframes, standards and methods*
 - ii. *use of sequential clearing to direct fauna away from impact zones*
 - iii. *re-establishment of native vegetation in linear infrastructure corridors*
 - iv. *handling practices for flora specimens*
 - v. *translocation and/or propagation practices and monitoring for translocation/propagation success*
 - vi. *monitoring methods including for rehabilitation success and recovery*
- f. *reference to relevant conservation advice, recovery plans, or other policies, practices, standards or guidelines relevant to MNES published or approved from time to time by the Department*

Note: Management plans should include sufficient detail to inform pipeline construction, management and decommissioning to minimise adverse impacts on MNES throughout the life of the project.

The location covered by this pre-clearance survey report is the Marine Crossing Early Works area (refer Figure 1.1 and Figure 1.2).

1.2 Pre-clearance surveys

This Consolidated Pre-Clearance Survey Report includes the relevant information from the series of Pre-clearance Survey Reports for the Marine Crossing Early Works area of the GLNG GTP Project that have been prepared by RPS and Footprints Environmental Consulting (RPS 2012), (FEC 2012a), (FEC 2012b) and (FEC 2012c). The reports included:

- GLNG GTP Marine Crossing – Flora Pre-clearance for Crossing Pads and Access Tracks (RPS 2012)
- GLNG GTP ROW Pre-clearing Threatened Species Surveys, Water Mouse Assessment Report (FER 2012a)
- GLNG GTP ROW Threatened Terrestrial Fauna Species, Pre-clearing Surveys Assessment Report (FER 2012b)
- GLNG GTP ROW Kangaroo Island Wetland Complex, Migratory Bird Surveys Baseline Assessment Report (FER 2012c)

Section 2 outlines the methodology, and Section 3 outlines the results of these pre-clearance surveys.

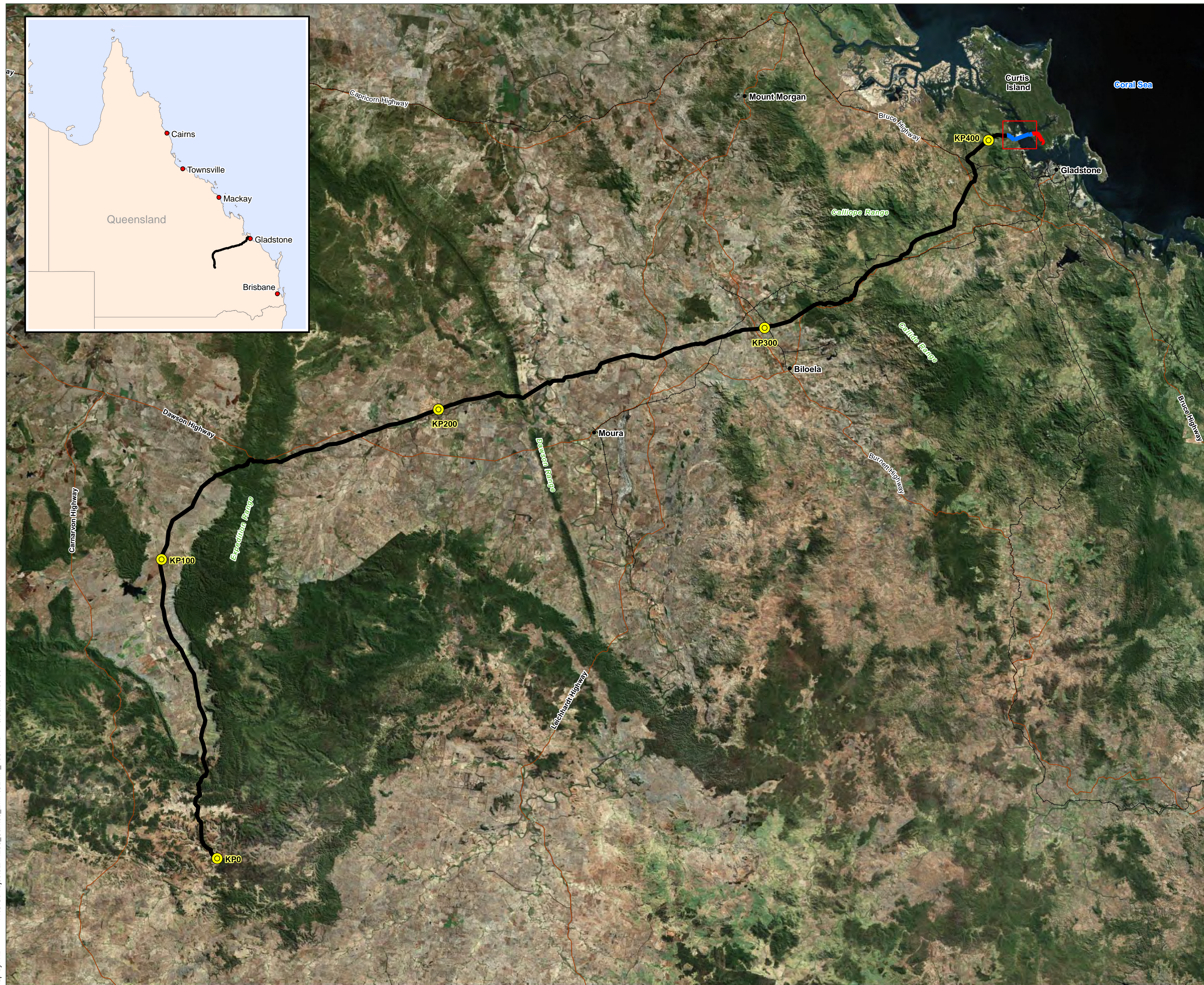
1.3 Site description

The study area is located within Lot 43 on DS290 and Lot 401 on DT4026. The study area includes a work pad and access track located on the mainland, to the north of Gladstone (refer to Figure 1.1 and Figure 1.2).

The study area occurs within a grazing property, with stands of remnant vegetation occurring. Existing infrastructure on the site includes numerous fences and access tracks. A small orchard also occurs on the site.

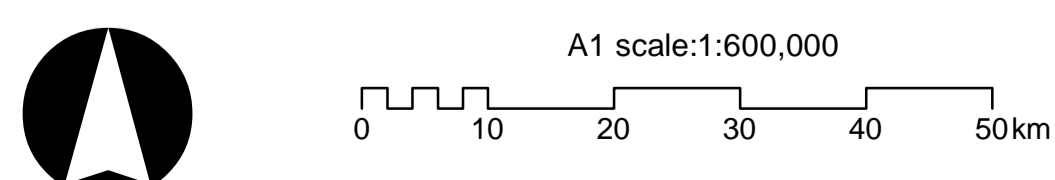
**Pre-Clearance Survey Report for
Marine Crossing Early Works**

- Marine Crossing GTP EM Project Footprint (Figure 1.2) Extent
- Gas Transmission Pipeline (GTP)
 - Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
- Kilometre Post Distance Marker (km)
- Major Road
- Rail










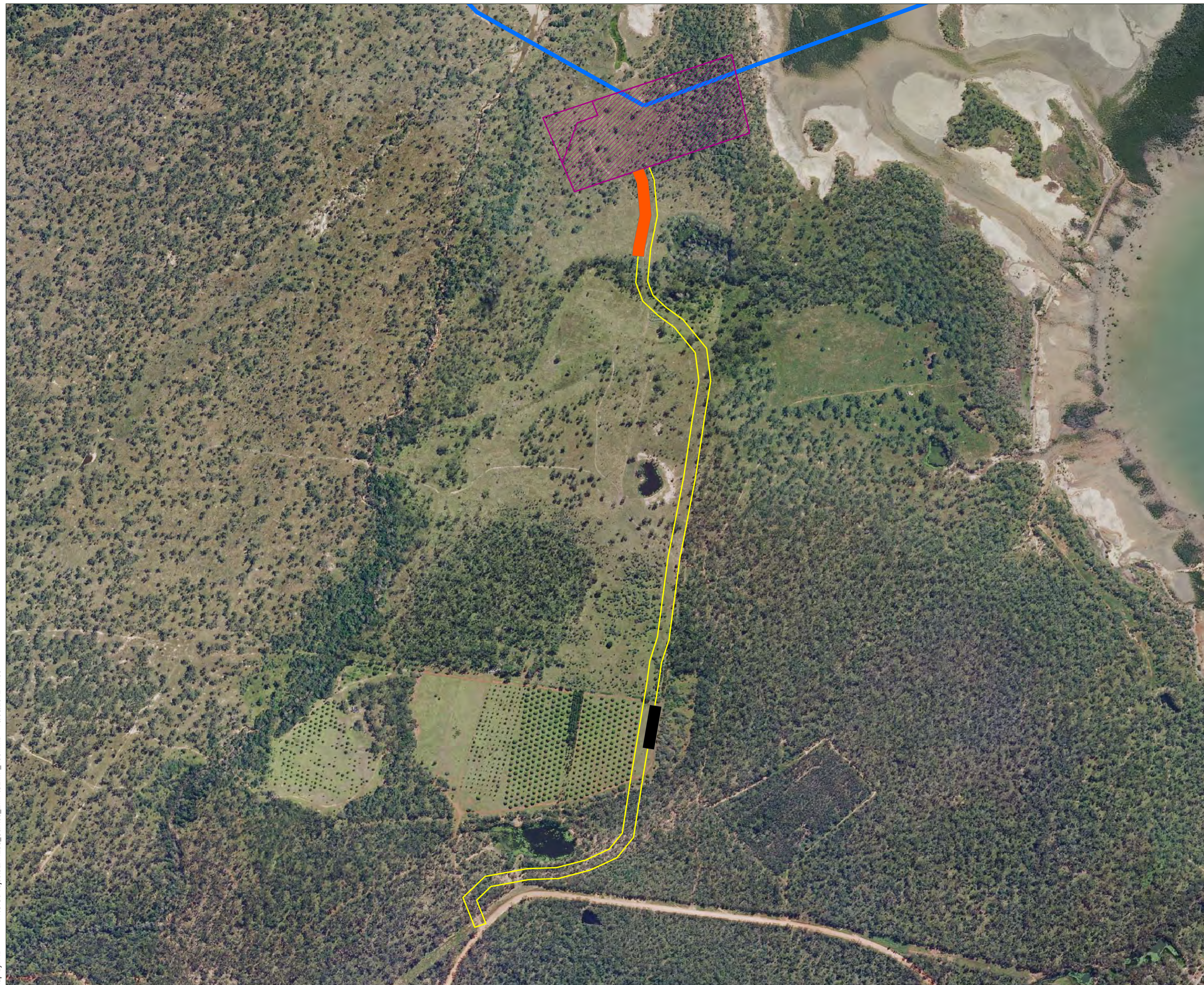
Source:
Gas Transmission Pipeline (GTP): Santos, Apr 2012.
Aerial: BING, Feb 2011.

**Locality Plan
Figure 1.1**



**Pre-Clearance Survey Report for
Marine Crossing Early Works**

- Gas Transmission Pipeline (GTP)
-  Mainland GTP
 -  Marine Crossing GTP
 -  Curtis Island GTP
 -  Proposed Access Road (25m width)
 -  Construction Site Pads
 -  Acid Sulfate Soils Treatment Area
 -  Washdown Facility



Source:
Gas Transmission Pipeline (GTP): Santos, Apr 2012.
Aerial: Santos, Feb 2011.
Indicative Project Footprint: Aurecon, GLNG May 2012.

**Proposed Access Track and
Tunnel Pads
Figure 1.2**

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Map by: RB

The study area occurs on the boundary between two bioregions, South-east Queensland, and the Brigalow Belt.

2 Survey methodology

2.1 Introduction

This consolidated report compiles the results of flora, Water mouse, fauna and migratory bird assessment of the previous pre-clearance surveys undertaken for the GTP ROW alignment as well as for the specific area of interest (mainland construction site pad and access road).

2.2 Flora survey methodology

2.2.1 Desktop assessment

Relevant environmental documents, databases, maps and legislation (Federal, State and Local) were reviewed to identify any potential ecological constraints (RPS 2012). Reviews included:

- EPBC Act Protected Matters Search Tool, SEWPaC, created 16 April 2012
- Wildlife Online records, Department of Environment and Resource Management (DERM), created 16 April 2012
- Environmentally Sensitive Areas mapping, DERM, created 18 April 2012
- Areas of Ecological Significance mapping, DERM, created 16 April 2012
- Referable Areas mapping, DERM, created 16 April 2012
- Vegetation Management Act 1999 (VM Act) Regional Ecosystem and Remnant Map (Version 6.1), accessed 16 April 2012
- VM Act Essential Habitat Map (Version 3.1), accessed 16 April 2012
- VM Act High Value Regrowth Vegetation Map (Version 2.1), accessed 16 April 2012
- EPBC Protected Matters Search Tool and Wildlife Online searches were undertaken for a central point within the site (coordinates -23.75472 latitude and 151.15944 longitude) and a 5 km buffer area around that point
- All other searches regarding the area of interest for this report were undertaken for Lot 401 on DT4026

2.2.2 Field assessment

There are currently no broad flora survey guidelines prepared by SEWPaC (RPS 2012). However, as part of the desktop assessment, the Species Profile and Threats Database (SPRATS) was reviewed for threatened species potentially occurring in the study area. This enabled the field assessment to specifically target the habitat of any threatened species, as well as utilising the recommended survey methods for those species. The field survey included Quaternary and Tertiary vegetation surveys on the work pad areas, along the access track and within surrounding vegetation communities, as per Queensland Herbarium vegetation survey guidelines (Nelder et. al. 2005).

Random meanders were also conducted to search for threatened species and weed species, as well as generate a site flora species list (RPS 2012). All field surveys were undertaken by qualified ecologists approved by SEWPaC.

Ecological condition was assessed at each tertiary site in accordance with the Condition Assessment Framework for Terrestrial Biodiversity in Queensland (Version 2.1) (Eyre *et al* 2011), referred to as the BioCondition assessment methodology. This methodology has been adopted by DERM to assess vegetation condition across Queensland. BioCondition assessment involves quantitatively assessing key attributes or surrogates of biodiversity values and ecosystem function within a vegetation community to produce a numeric condition score (RPS 2012). This score is compared with a benchmark score of the same vegetation community, where available. In this instance, raw BioCondition data can be used to inform future site rehabilitation works (RPS 2012).

2.3 Fauna survey methodology

2.3.1 Desktop assessments

Desk-based assessments were undertaken (refer Section 2.3.2) to ascertain the existing level of available information pertaining to the study site and surrounds in order to provide a level of background field data sufficient to draw informed, valid assumptions and conclusions about the:

- Location, extent and values of the habitats supported within the study site that are known/considered likely to support threatened fauna
- The general patterns of usage of the study area and the habitats supported therein by threatened fauna
- Known or likely occurrence and distribution of threatened fauna and the ecological communities that are known to support these species (FER 2012b)

2.3.2 Literature and data

Important information sources included, but were not limited to the following (FER 2012b):

- National, State and regional fauna/flora databases, ie Environment Australia, Queensland Museum and Herbarium and WildNet
- Curtis Coast Regional Coastal Management Plan (2003)
- Google Earth aerial photography (July 2011)
- Aerial photography supplied by GLNG (2008)
- Regional assessments which have relevance to the ecological values of the study site, ie Covacevich *et al* 1997; Deer 1996; McDonald *et al* 1991; Young *et al* 1999; McFarland *et al* 1999; and Woinarski & Catterall 2004
- Commonwealth survey methodology guidelines for threatened species groups as follows:
 - *Microbats*
 - *Birds*
 - *Mammals*
 - *Reptiles*
 - *Frogs*
- Gladstone Liquefied Natural Gas EIS (Santos 2010a)
- Gladstone Liquefied Natural Gas Transmission Pipeline, Technical Note – Narrows Crossing. Unpublished Technical Note on the construction of the underground pipeline (Santos 2010)

- Gladstone Liquefied Natural Gas Project Review of Shorebird Impacts within the Kangaroo Island Wetlands and the Narrows Crossing area (Footprints Environmental Consultants 2010)
- Australia Pacific LNG Project EIS (Australia Pacific LNG 2010)
- The EPBC Act Significant Impact Guidelines for the Vulnerable Water Mouse (*Xeromys myoides*), Nationally Threatened Species and Ecological Communities Background Paper to EPBC Act Policy Statement 3.20 (2009a)
- Queensland Curtis LNG Project Narrows Pipeline Crossing Review of Regional Shorebird data and Discussions of Impacts (Sandpiper et al 2010)
- Commonwealth, Queensland Wader Study Group and Shorebirds 2020 survey methodology guidelines
- The EPBC Act Significant Impact Guidelines for the 36 migratory shorebird species Migratory species, Significant impact guidelines for EPBC Act policy statement 3.21
- Gladstone Liquefied Natural Gas Transmission Pipeline, Technical Note – Narrows Crossing. Unpublished Technical Note on the construction of the underground pipeline (Santos 2010)
- National recovery plan for the water mouse (false water rat) *Xeromys myoides*. (DERM 2009b)
- Queensland Curtis LNG Project EIS (Queensland Curtis LNG 2010)
- Recent surveys undertaken for other LNG proponents for which reports are publically available eg APLNG pre-clearance survey report (Worley Parsons 2011)

The current certified mapping data was reviewed (Version 6.0b) to provide an indication of the bioregional analysis of REs in the study area (FER 2012b). In addition, aerial photography supplied by GLNG (flown 2008) and Google Earth imagery (2011) was reviewed (FER 2012b).

2.3.3 Survey site location and selection

Survey sites were selected on the basis that they contained suitable habitat values likely to support the threatened fauna species targeted for the assessment. Each survey site was chosen to provide good geographical spread and representation of vegetation communities and landscapes across the study site (FER 2012b).

The fauna survey program included a summer seasonal field investigation at 12 primary terrestrial survey sites (FER 2012b). The location of each survey site is depicted in Figure 2.1. Survey Site 01 was located on the construction site pad considered in this report.

2.3.4 Survey methods

Survey methodologies used in pre-clearing assessments were based on the individual significant species survey guidelines recommended by the Federal Government (FER 2012b). The survey guidelines stipulate a variety of methods for targeted surveying for threatened species which can be summarised by the following:

- Pitfall trapping – reptiles, eg Brigalow scaly-foot (*Paradelma orientalis*)
- Cage trapping – mammals, eg Northern quoll (*Dasyurus hallucatus*)
- Diurnal bird census – birds, eg Squatter pigeon (*Geophaps scripta scripta*)

**Pre-Clearance Survey Report for
Marine Crossing Early Works**

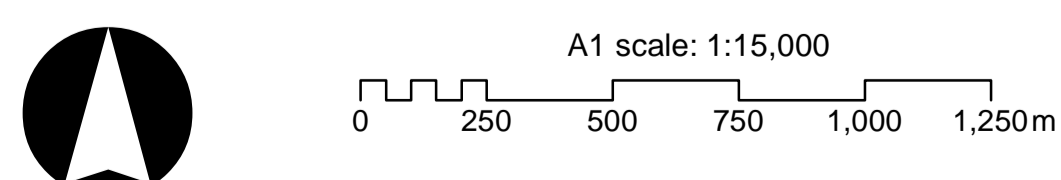


- Gas Transmission Pipeline (GTP)
- Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
 - + GTP Marine Crossing Reference Point
 - ▨ Construction Site Pads
 - Access Road
 - Watercourse Crossing Ancillary Areas
- Pre-clearing Terrestrial Fauna Survey Sites
- Curtis Island Survey Site 1
 - Survey Site 01
 - Survey Site 02
 - Water Mouse Survey Sites

Source:
 Gas Transmission Pipeline (GTP): Santos, Apr 2012.
 Aerial: Santos, Feb 2011.
 Indicative Project Footprint: Aurecon, GLNG May 2012.
 Footprints Environmental Consultants, 2012a, GLNG GTP ROW Pre-Clearing Threatened Species Surveys, Water Mouse Assessment Report.
 Footprints Environmental Consultants, 2012b, GLNG GTP ROW Pre-Clearing Threatened Terrestrial Fauna Pre-clearing Surveys Assessment Report.
 Extra Works Areas: GLNG, Jul 2012.

**Location of Pre-Clearing
Terrestrial Fauna Survey Sites
Figure 2.1**

Map by: RB P:\GIS\Projects\214208_Santos_EMP\SEMP_201.mxd 10/09/2012 11:16



GLNG No: XXXX-XX-XXXX
 Coordinate system: GCS_GDA_1994

- Active diurnal and nocturnal ground searching – reptiles and frogs, eg Collared delma (*Delma torquata*), Tusked frog (*Adelotus brevis*)
- Anabat detection – microchiropteran bats, eg Coastal sheathtail bat (*Taphozous australis*)
- Harp trapping - microchiropteran bats, eg Large-eared pied bat (*Chalinolobus dwyeri*)
- Call playback – nocturnal birds, eg Powerful owl (*Ninox strenua*)
- Area searches – large mammals and birds, eg Koala (*Phascolarctos cinereus*) and Glossy black cockatoo (*Calyptorhynchus lathami*)
- Remote detection trigger cameras – mammals, eg Northern quoll (*Dasyurus hallucatus*)
- Mapping of hollow bearing trees within and adjacent to the GTP ROW

For the assessment of the study site as a whole, the monitoring program consisted of two survey approaches.

The first, the primary survey program, was designed to apply systematic, standardised and replicable sets of survey methodologies at representative locations within primary habitat/vegetation types considered known or likely to support targeted threatened species (FER 2012b). A description of the relevant primary methodologies is presented below.

This approach provides a basis for direct comparison of survey results both spatially and temporally in order to assist in identifying the comparative values of each habitat type and areas of the study site (FER 2012b).

The secondary, or opportunistic approach, was comprised of a wide range of survey techniques and effort that, by their nature, were either:

- Not applicable to the systematic survey site approach (as not spatially/temporally replicable)
- Were undertaken opportunistically to augment the standardised survey site-based approach, especially with respect to the assessment of threatened species

A description of the relevant secondary methodologies is presented below.

All study methodologies employed for these assessments conform to, if not exceeds, current recommended methodologies (eg McFarland *et al* 1999, Commonwealth survey guidelines for threatened species) (FER 2012b).

Primary survey program methodologies

The primary survey approach comprised a range of standardised techniques with systematic application at each survey site. The methods applied are discussed below.

Cage/Elliot Type B trapping

Mid-sized ground mammals were surveyed using medium sized cage traps and Elliot type B traps. At each survey site, 10 traps were set along a transect which optimised sampling coverage of each sub-habitat type at that location. Traps were opened for three consecutive nights at each survey site, providing a minimum total trapping effort of 30 trap nights per site (ie number of traps open multiplied by the number of nights). Traps were baited with salami,

peanut butter-oats mix and half a pilchard. Fish oil was sprayed around the entrance to each trap. Baits were replaced as required (FER 2012b).

Pitfall trapping

Pitfall traps were employed to survey for reptiles and frogs. Each trap line consisted of five, 20 litre plastic buckets sunk into the ground approximately five metres apart and connected by a drift fence line (30 cm high, embossed, polyethylene dampcourse). Traps were opened for a minimum of three consecutive nights providing a total trapping effort of 15 trap nights per site (FER 2012b).

Diurnal bird surveys

Diurnal birds were surveyed using timed (20 minutes per session), area search methods which were comprised of early morning censuses (FER 2012b). The total minimum census time varied for each of the targeted species depending on the recommended survey methodology. Census surveys were undertaken within three hours of sunrise and sunset. Birds were identified from either direct observations and/or their call vocalisations (FER 2012b).

Diurnal herpetofauna ground searches

Dedicated active daytime ground searches were conducted for a minimum period of one-person hour at each site and at other selected locations where suitable habitat for target species was supported (FER 2012b). Surveys were conducted on each of the survey days to locate active/inactive reptiles and inactive frogs. Total search effort for each of the targeted species was dictated by the recommended survey methodology applicable.

This method involved:

- Rolling logs and rocks
- Raking soil at the base of trees and shrubs
- Searching under decorticated/exfoliating bark on logs and standing dead or live trees
- Examination under debris

Additionally, as part of the active searches, upper sections of trees were scanned with binoculars searching for basking or active arboreal/scansorial reptiles (FER 2012b). Ground search sessions were conducted prior to 1,100 hours.

Nocturnal ground searches

Spotlighting searches were undertaken on foot using 30-watt hand-held spotlights and headlamps. Searches were conducted for 60 minutes per site and replicated as dictated by survey requirements for the threatened species of interest (FER 2012b).

During each nocturnal spotlighting session, approximately one person hour was dedicated to arboreal searches with the remaining time spent on ground searches for nocturnal herpetofauna and ground mammals (ie bandicoots). Arboreal surveys targeted mammals (ie possums and gliders), nocturnal birds (ie owls and nightjars), reptiles (ie snakes and geckos) and flying mammals (ie flying foxes and fruit bats) (FER 2012b).

Insectivorous bat surveys

The survey program for insectivorous bat fauna was undertaken using electronic bat detectors and harp traps, as dictated by the relevant threatened species survey guidelines. Anabat detection involved both remote and active detection techniques with an Anabat II detector, used to record the ultrasonic signals of active bats (FER 2012b). Remote detection (ie equipment programmed for unattended, fixed point, overnight detection of microbat calls) was conducted over four survey nights. Active Anabat detection was employed during nocturnal spotlighting surveys.

Ultrasonic bat calls and locality details were recorded during the survey and subsequently analysed by Greg Ford for species identification (FER 2012b).

Harp trapping was undertaken at seven sites (four on the mainland and three on Curtis Island) within areas of the GTP ROW that supported suitable habitat for the target species, with the level of effort dictated by the relevant survey guidelines (FER 2012b).

Hair tube surveys

Hair tubes (a cylindrical tube with a mesh-sealed bait container at one end, with double sided sticky tape attached to the top side of the entrance to the tube) were specifically employed to survey for Northern quoll at those sites that supported potentially suitable habitat, or were in close proximity to areas that may support northern quoll (FER 2012b).

Remote trigger cameras

Remote trigger cameras were deployed for 14 nights and days. These cameras were deployed to survey specifically for Northern quoll (FER 2012b). Incidental observations of other fauna were noted where relevant.

Secondary survey program methodologies

The additional, secondary methodologies described below were employed at a range of areas/sites outside of the primary survey sites.

Targeted area searches

A series of rapid biodiversity assessments and target species surveys were undertaken in a range of representative and/or distinctive habitat types throughout the study site. Areas surveyed excluded those areas subject to the primary survey program as previously discussed (FER 2012b).

For diurnal activities, each survey area, nominally comprised of up to one or two hectares, was surveyed for up to one person hour. At each selected survey area, a combination of active diurnal ground searches, primarily for reptiles, and bird surveys were undertaken (FER 2012b). For nocturnal assessments, an area of approximately two hectares was surveyed for a minimum of one survey person hour where spotlighting searches on foot were undertaken using 30-watt spotlights and headlamps.

Targeted area searches were also undertaken for specific species, such as glossy black cockatoo, in specific habitat types, such as stands of *Casuarina littoralis* and *C. torulosa* which are known glossy black food trees. Searches for *Casuarina orts* (characteristically chewed seed pods) were undertaken in such habitat types (FER 2012b).

Call playback surveys

Nocturnal call playback surveys for powerful owl were undertaken at potentially suitable locations throughout the study site.

The procedure included broadcasting, through a vehicle's stereo system, powerful owl calls for a duration of approximately three to five minutes (FER 2012b). Several minutes of listening for responses and visual scanning of the immediate surrounds with a hand-held spotlight followed the call playback.

Call recordings for nocturnal mammals and birds were sourced from Stewart (2000).

Driving spotlight transects

Driving spotlight searches (driver plus one observer with a 100-watt spotlight) were undertaken from a 4WD along the road/track network within the study site primarily to survey for larger arboreal and ground mammals (eg owls, koalas, echidnas, macropods, possums, foxes, cats and dogs).

Inferential evidence

Inferential evidence of fauna occurrence was sought and found throughout the study site.

This included:

- Visual inspections of trees for trunk scratches/rubbings
- Searches for both predator and non-predator scats (eg northern quoll and yakka skink latrine sites)
- Fauna tracks
- Other signs of fauna occurrence (eg shed skins, nests, etc)

Only definitive evidence was used to record a species occurrence on the study site. Scats or pellets found were identified in the field (using Triggs 1999).

Hollow bearing tree mapping

As an additional element to the survey program, the location of any trees bearing hollows, within approximately 60 m of the centreline of the ROW alignment (at the time of commissioning by GLNG), were marked by GPS (FER 2012b).

2.3.5 Threatened species, survey methodology and effort

General threatened species

The following table details the threatened species considered for the assessment of the overall ROW, the applicable survey methods as dictated by the Commonwealth threatened species survey guidelines and the level of effort required (FER 2012b).

Table 2.1 Threatened species, survey methods and efforts matrix

Zoological name	Common name	Methods	Effort
Frogs			
<i>Adelotus brevis</i>	Tusked frog	Pits and Searches	5 pits, 3 nights
<i>Cyclorana verrucosa</i>	Rough frog	Pits and Searches	5 pits, 3 nights

Zoological name	Common name	Methods	Effort
Reptiles			
<i>Delma torquata</i>	Collared delma	Pits and Searches (Nocturnal)	5 pits/3 nights
<i>Paradelma orientalis</i>	Brigalow scaly-foot	Pits and Searches (Nocturnal)	5 pits/3 nights
<i>Strophorus taenicauda</i>	Golden-tailed gecko	Pits and Searches (Nocturnal)	5 pits/3 nights
<i>Egernia rugosa</i>	Yakka skink	Searches, Elliott's	3 days/nights
<i>Furina dunmalli</i>	Dunmall's snake	Searches	3 days/nights
<i>Denisonia maculata</i>	Ornamental snake	N/A	
<i>Eelseya albagula</i>	White-throated snapping turtle	N/A	
<i>Rheodytes leukops</i>	Fitzroy River turtle	N/A	
Birds			
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	Area Searches	As required by habitat suitability/presence
<i>Ephippiorhynchus asiaticus</i>	Black-necked stork	Area Searches	As required by habitat suitability/presence
<i>Erythrotriorchis radiatus</i>	Red goshawk	Census/Searches	80 hours over 10 days
<i>Geophaps scripta scripta</i>	Squatter pigeon	Census/Searches	15 hours/area, 10 hours flushing
<i>Ninox strenua</i>	Powerful owl	Call playback	8 hours over 4 days
<i>Turnix melanogaster</i>	Black-breasted button quail	Census/Searches	15 hours over 3 days
<i>Esacus magnirostris</i>	Beach stone-curlew	Census/Searches	
Bats			
<i>Chalinolobus dwyeri</i>	Large-eared pied bat	Harp/Anabat	16 trap nights, min 4 nights <50 ha
<i>Chalinolobus picatus</i>	Little pied bat	Anabat	Active and Passive Anabat <50 ha
<i>Nyctophilus corbeni</i>	Greater long-eared bat	Harp/Anabat	
<i>Taphozous australis</i>	Coastal sheath-tail bat	Anabat	Active and Passive Anabat
Mammals			
<i>Dasyurus hallucatus</i>	Northern quoll	Camera Cages/Elliotts Hair Tube	14 nights, 10 traps/3 nights, 20 tubes/14 nights
<i>Ornithorhynchus anatinus</i>	Platypus	N/A	
<i>Phascolarctos cinereus</i>	Koala	Area Search/ Spotlighting	
<i>Tachyglossus aculeatus</i>	Echidna	Area Search/ Spotlighting	

Source: (FEC 2012b)

Of importance, the assessment for Water mouse (*Xeromys myoides*) was conducted separately due to the very specific methodology and time constrained survey methods required to survey for this species. Details are provided below.

Finally, surveys for Ornamental snake were not undertaken as there was no suitable habitat, ie gilgai formations on grey cracking clays with/without Brigalow, supported within the study site (FER 2012b).

Water mouse

A total of five survey sites were selected to survey the Water mouse. These sites are detailed in Figure 2.1, with Water Mouse Survey Site 1 and Water Mouse Survey Site 1-1 located in the proximity of the construction site pad considered for this report.

The design of the survey program for the water mouse was developed and conducted in accordance with the habitat requirements for the species and the survey guidelines as detailed in the 'EPBC Act Significant Impact Guidelines For The Vulnerable Water Mouse (*Xeromys myoides*), Nationally Threatened Species And Ecological Communities Background Paper To EPBC Act Policy Statement 3.20' (Commonwealth of Australia 2009).

These guidelines recommend a combination of three survey techniques which include (FER 2012a):

- Habitat assessment eg record notable vegetation/habitat features
- Daytime searches for nests and other signs eg nest mounds, tracks, middens
- Nocturnal Elliot trapping

The survey guidelines can be downloaded in their entirety from the following web address: www.environment.gov.au/epbc/publications/pubs/xeromys-myoides.doc

2.3.6 Migratory species, survey methodology and effort

General migratory species methodology

Table 2.2 details the migratory species considered for this assessment and the methods used to survey for these species. Where species specific survey methodologies are not available for reference, the generic Commonwealth threatened species survey guidelines for the general faunal group are used as a default.

Table 2.2 Migratory species and survey methods matrix

Zoological name	Common name	Methods	Effort
<i>Monarcha melanopsis</i>	Black-faced monarch	Timed Census and/or Area Searches in suitable habitats	Minimum 3 x 20 minute morning census
<i>Ardea ibis</i>	Cattle egret		
<i>Apus pacificus</i>	Fork-tailed swift		
<i>Ardea alba</i>	Great egret		
<i>Merops ornatus</i>	Rainbow bee-eater		
<i>Monarcha trivirgatus</i>	Spectacled monarch		
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle		
<i>Hirundapus caudacutus</i>	White-throated needletail		

Source: (FEC 2012b)

Migratory bird surveys

Survey areas

A detailed habitat assessment was conducted, which involved accessing (by boat) and traversing (by foot) the Kangaroo Island wetland complex and Laird Point areas. From this assessment, it was ascertained that there were several areas within the habitats supported within these areas that were utilised by marine migratory birds (FER 2012c).

Survey timing

The design of the survey program for the marine migratory birds was developed and conducted in accordance with the habitat requirements for the species and the survey guidelines as detailed in the '*EPBC Act Significant Impact Guidelines for the 36 migratory shorebird species Migratory species, Significant impact guidelines for EPBC Act policy statement 3.2.1*' (Commonwealth of Australia 2009).

These guidelines recommend a combination of both seasonal event replication, ie winter and summer surveys, and survey replication, ie three survey counts over three days per survey event (FER 2012c). Optimal timing for survey events is between June and August for winter surveys and from November to February for summer events. In addition, survey replication was also required for both high and low tide events to collect data on the habitat usage under both high tide, for roosting, and low tide conditions, for foraging, by marine migratory birds.

Footprints Environmental Consultants' undertook the summer surveys from December to March.

Survey events were conducted and timed to coincide when:

- The majority of migratory birds were present in the area, ie during the northern hemisphere non-breeding season (mid-August to mid-April) so as to obtain data on the total population of migratory birds using the site during the Austral summer
- During the northern hemisphere breeding season (mid-April to mid-August) to obtain data on non-breeding, non-migrating immature populations of migratory birds at the site

Surveys for roosting shorebirds were conducted as close to the high tide each day, within a maximum of up to two hours either side of high tide.

Surveys for foraging shorebirds were conducted as close to bottom of the tidal cycle within a maximum of no more than two hours either side of low tide.

Monthly survey events were scheduled to be undertaken during each monthly Spring tide event to increase the likelihood of complete data capture of the birds that utilise the roost habitats.

Survey coverage

During each survey event, identified discrete roost/foraging areas were scanned with a 60 m by 80 m spotting scope, set up at a distance sufficiently far away from each roost/foraging area so as not to disturb the birds. The entire area of each discrete roost/foraging site was assessed (FER 2012c).

In addition, the entire claypan (high tide) and mudflat (low tide) areas were scanned with the scope.

Total counts of all migratory bird species observed were recorded. Where large numbers of birds were observed two counts were completed.

For high tide surveys, access to the roost sites was facilitated by boat to both Laird Point and Kangaroo Island (via Friend Point) and then traversing the claypan areas on foot.

Data collection

The following data points were collected during each survey event.

- Habitat characteristics, including;
 - *Landform type*
 - *Hydrology*
 - *Terrestrial and aquatic vegetation characteristics*
 - *Intertidal substrate characteristics*
 - *Invasive species*
 - *Current disturbance regime (eg human disturbance)*
 - *Presence of suitable nocturnal roost sites*
- Date, time of day
- Tide height
- Weather conditions including temperature, precipitation, wind speed and direction
- Total number of birds present across all species
- Total number of species observed
- Total number of birds of each species present

In addition, the type of activity undertaken by the birds and spatial data of the area used by shorebirds for feeding to enable mapping of foraging habitat was recorded (FER 2012c).

3 Pre-clearance survey results - flora

3.1 Vegetation communities

Five remnant and regrowth vegetation communities were mapped on the mainland study area and subsequently assessed on the ground (Figure 3.1). The following sections provide an overview of the vegetation communities occurring on site, while a detailed site flora species list is included in Appendix A.

3.1.1 *Eucalyptus crebra* and *Eucalyptus exserta* woodland

Description

This vegetation community occurs in three small pockets across the mainland study area, within the northeast corner of the launch pad, and adjacent to the southern and central portions of the access track (Figure 3.1) (RPS 2012). It is characterised by a tall canopy, with an average height of 15 m and canopy cover of approximately 70%. The canopy is dominated by Queensland peppermint (*Eucalyptus exserta*) and Narrow-leaved ironbark (*Eucalyptus crebra*). The secondary canopy comprises similar species, with the addition of Quinine tree (*Petalostigma pubescens*) Crows ssh (*Flindersia australis*), Long-fruited bloodwood (*Corymbia clarksoniana*), Moreton Bay ash (*Corymbia tessellaris*) and Hickory wattle (*Acacia disparrima*).

A short shrub layer is present, at an average height of 2.5 m and with a cover of approximately 45%. Species include: Hickory wattle (*Acacia disparrima*), Coffee bush (*Breynia oblongifolia*), Cockatoo apple (*Planchonia careya*) and Quinine tree. Lantana (*Lantana camara*) also occurs throughout the shrub layer, a declared weed (RPS 2012).

Vegetation ground cover averages 45% within this community (RPS 2012). The ground cover comprises between 20% and 40% native grass, including Black spear grass (*Heteropogon contortus*), Forest bluegrass (*Bothriochloa bladhi*) and Wiry panic (*Entolasia stricta*). Native herbs and forbs comprise approximately 5% of the ground cover, and include Sticky stylo (*Stylosanthes viscosa*), Rough saw sedge (*Gahnia aspera*) and Lomandra (*Lomandra longifolia*). Approximately 20% of the ground cover is comprised of weed species, including Guinea grass (*Megathyrsus maximus*), Red Natal grass (*Melinis repens*) and Paddy's lucerne (*Sida rhombifolia*). Snakeweed (*Stachytarpheta jamaicensis*) was also recorded within this community (RPS 2012).

Classification

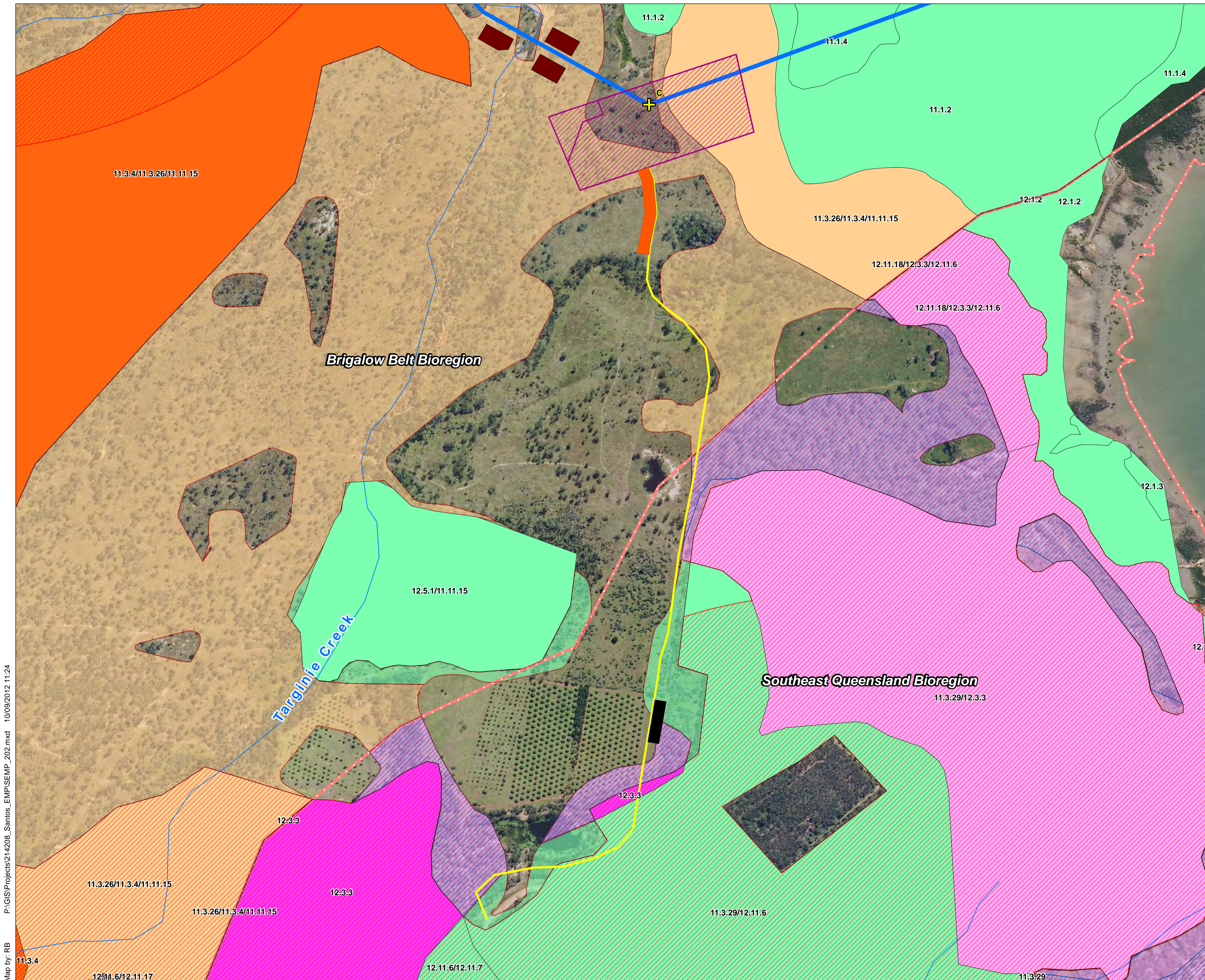
This vegetation community is analogous with RE 11.11.15, which is listed as 'Least Concern' under the VM Act and has a biodiversity status of 'No Concern at Present'. The vegetation community is not considered to be a Threatened Ecological Community (TEC), as listed under the EPBC Act.

3.1.2 *Eucalyptus tereticornis* woodland

Description

This vegetation community occurs across the launch pad on the mainland, as well as adjacent to the access track, in association with alluvial soils (Figure 3.1) (RPS 2012). The canopy is dominated by Queensland blue gum (*Eucalyptus tereticornis*), with White gum (*Eucalyptus platyphylla*) and Narrow-leaved ironbark also occurring. The secondary canopy is comprised of Silver-leaved paperbark (*Melaleuca dealbata*) and Hickory wattle. Occasional Broad-leaved paperbark (*Melaleuca quinquenervia*) also occurs (RPS 2012).

**Pre-Clearance Survey Report for
Marine Crossing Early Works**



- Gas Transmission Pipeline (GTP)
 - Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
- + GTP Marine Crossing Reference Point
- ▨ Construction Site Pads
- ▨ Acid Sulfate Soils Treatment Area
- ▨ Washdown Facility (Indicative)
- Access Road
- ▨ Watercourse Crossing Ancillary Areas
- Regional Ecosystem - Biodiversity Status
 - ▨ Endangered - dominant
 - ▨ Endangered - sub-dominant
 - ▨ Of Concern - dominant
 - ▨ Of Concern - sub-dominant
 - ▨ Not of Concern
- High Value Regrowth Vegetation
 - ▨ Endangered Regional Ecosystem
 - ▨ Of Concern Regional Ecosystem
 - ▨ Least Concern Regional Ecosystem
- ▨ EPBC Threatened Species/
Ecological Community
- ▨ Regional Ecosystem where
VM and BD status differ
- Essential Habitat
(Essential Habitat centred near ROW Point B
is for the Coast sheath-tail bat and Essential
Habitat near Access Road is for the Koala and
Coastal sheath-tail bat)
- ▨ Essential Regrowth Habitat
- ▨ Bioregion
- Watercourse

Source:
 Gas Transmission Pipeline (GTP): Santos, Apr 2012.
 Aerial: Santos, Feb 2011.
 Regional Ecosystems: Version 6.1, The State of Queensland
 (Department of Environment and Resource Management),
 Sep 2011.
 High Value Regrowth Vegetation: Version 2.1, The State of
 Queensland (Department of Environment and
 Resource Management), Sep 2011.
 EPBC Threatened Species and Ecological Community:
 Department of the Environment, Water, Heritage
 and the Arts, 2010.
 Bioregions: Department of Environment and Resource
 Management, 2011.
 Extra Works Areas: GLNG, Jul 2012.

**Vegetation Communities
Figure 3.1**

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Map by: RB

A sparse shrub layer occurs within this community, comprising Myrtle tree (*Psydrax oleifolia*), Narrow-leaved ironbark, Coffee bush and Cocky apple. The shrub layer ranges in height from approximately 1.5 m to 4 m. Lantana (*Lantana camara*) also occurs throughout the shrub layer.

The vegetated ground cover averages 85% within this community (RPS 2012). The ground cover comprises approximately 50% native grass, including: Black spear grass, Forest bluegrass, Hairy panic (*Panicum effusum*), Purple lovegrass (*Eragrostis lacunaria*), Slender chloris (*Chloris divaricata*), Barbed-wire grass (*Cymbopogon refractus*) and Dark wiregrass (*Aristida calycina*). Native herbs and forbs comprise approximately 10 % of the ground cover and include: Tropical speedwell (*Evolvulus alsinoides*), Umbrella sedge (*Cyperus exaltatus*), Swamp rice grass (*Leersia hexandra*), Common Finger-rush (*Fimbristylis ferruginea*) and *Dianella* sp.

Approximately 25% of the ground cover is comprised of weed species, including Red Natal grass (*Melinis repens*) and Cobblers pegs (*Bidens pilosa*).

Classification

This vegetation community is analogous with RE 11.3.4, which is listed as 'Of Concern' under the VM Act, and also has a biodiversity status 'Of Concern'. The community is not considered to be a Threatened Ecological Community (TEC), as listed under the EPBC Act.

3.1.3 *Corymbia clarksoniana* woodland

Description

There are large areas of this vegetation community adjacent to the access track (Figure 3.1) (RPS 2012). The canopy is dominated by Long-fruited bloodwood (*Corymbia clarksoniana*), with Queensland blue gum also occurring. The secondary canopy is comprised of similar species, with the addition of Quinine tree, Creek sandpaper fig (*Ficus opposita*) and Poison peach (*Trema tomentosa*).

A sparse shrub layer is present, comprising Red kamala (*Mallotus philippensis*), Wild orange (*Capparis mitchellii*), Cocky apple and Tuckerroo (*Cupaniopsis anacardioides*). Planted species including Chilli (*Capsicum* sp.), Guava (*Psidium guajava*) and Paw-paw (*Carica papaya*) also occur in this community.

Ground covers are consistent with *Eucalyptus exserta* and *Eucalyptus crebra* Woodland and are dominated by Black spear grass and Wiry panic (*Entolasia stricta*) (RPS 2012).

Weeds occurring in this community include Snakeweed and Rubber vine (*Cryptostegia grandiflora*). Rubber vine is considered a declared weed under the LP Act.

Classification

This vegetation community is analogous with RE 12.11.14, which is listed as 'Of Concern' under the VM Act and has a biodiversity status 'Of Concern'. The community is not considered to be a Threatened Ecological Community (TEC), as listed under the EPBC Act.

3.1.4 Ephemeral wetland

A small ephemeral wetland occurs to the north of the mainland pad (Figure 3.1). This wetland is in poor condition, as it is highly eroded and regularly accessed by feral pigs. Consequently, fringing vegetation around this wetland is highly disturbed. Wetland species found here include: Flat sedge (*Cyperus* sp.), Bullrush (*Schoenoplectus* sp.) and Water chestnut (*Eleocharis dulcis*).

3.1.5 Grazed grasslands

This vegetation community occurs across the western portion of the mainland launch pad, and well as adjacent to the access track (refer Figure 3.1). It is comprised of ground covers that have been regularly grazed, including Black spear grass, Satin top (*Bothriochloa erianthoides*), Sida (*Sida filiformis*), Queensland bluegrass (*Dichanthium sericeum*), Slender chloris (*Chloris divaricata*) and Gomphrena weed (*Gomphrena celosioides*).

3.2 Threatened ecological communities

The field results verified that neither of these communities occurred in the work pad area or along the access tracks.

3.3 Regional Ecosystems and high value regrowth vegetation

3.3.1 DERM mapping

Portions of the site are mapped as comprising remnant vegetation and high value regrowth vegetation. A total of five dominant REs are mapped as occurring within the study area (refer Table 3.1).

Table 3.1 REs mapped as occurring within the study area

RE code	Status ¹		Common name
	VMA	BD2	
12.3.3	E	E	<i>Eucalyptus tereticornis</i> woodland to open forest on alluvial plains
11.3.4	OC	OC	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains
11.3.26	LC	NC	<i>Eucalyptus moluccana</i> or <i>E. microcarpa</i> woodland to open forest on margins of alluvial plains
11.11.15	LC	NC	<i>Eucalyptus crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains

Table notes: 1 – E=Endangered, V=Vulnerable, OC=Of Concern; LC = Least Concern (VMA), NC = No concern at present (BD). 2 – BD = Biodiversity Status

3.3.2 Ground-truthed mapping

Ground-truthing showed that three REs occur on the mainland but the RE classification are slightly different to those that were mapped (refer Table 3.2) (RPS 2012). In addition, the extent of RE's differs from the mapped extent.

These REs occur in both remnant and regrowth condition across the study area. Refer to Appendix B for refined RE mapping, based on VM Act status.

Table 3.2 REs identified within the study area

RE code	Status ¹		Description
	VMA	BD2	
11.3.4	OC	OC	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains
12.11.14	OC	OC	<i>Eucalyptus crebra</i> , <i>E. tereticornis</i> woodland on metamorphics +/- interbedded volcanics
11.11.15	LC	NC	<i>Eucalyptus crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains

Table notes: 1 – E=Endangered, V=Vulnerable, OC=Of Concern; LC = Least Concern (VMA), NC = No concern at present (BD). 2 – BD = Biodiversity Status

3.4 Threatened species

Ground truthing did not confirm the presence of any threatened flora species on the site (RPS 2012). However, a total of 15 threatened flora species listed under the EPBC Act and/or the NCA potentially occur within a 5km buffer of the site. These species and their likelihood of occurrence within the study area were assessed according to the presence/absence of suitable habitat on the site (refer Table 3.3).

Table 3.3 Threatened flora species with potential to occur within the study area

Species	Common name	Status ¹		Habitat	Likelihood of occurrence
		VMA	BD2		
<i>Actephila sessilifolia</i>	Scrub daphne	NT	-	Dry rainforest and vine thickets north from Yarrol (Monto district, south of Gladstone)	Unlikely. Suitable habitat does not occur within the study area
<i>Bosistoa selwynii</i>	Heart-leaved bosistoa	-	V	Wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude between Richmond River, NSW, and Mt Larcom near Gladstone, Queensland	Unlikely. Suitable habitat does not occur within the study area
<i>Bosistoa transversa</i>	Three-leaved bosistoa	-	V	Wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude between Richmond River, NSW, and Mt Larcom near Gladstone, Queensland	Unlikely. Suitable habitat does not occur within the study area
<i>Bulbophyllum globuliforme</i>	Miniature moss orchid	R	V	This small epiphytic species grows only on Hoop pines (<i>Araucaria cunninghamii</i>), colonising the upper branches of mature trees in upland subtropical rainforest. It is found in the McPherson Range of north-east NSW and south-east Queensland; in the Maleny and Noosa areas of the Wide Bay district of Queensland and in the Calliope Range inland from Gladstone, Queensland. The species was also collected in 2005 near Hidden Valley, south of Ingham in north Queensland	Unlikely. Suitable habitat (Hoop Pine) does not occur within the study area
<i>Cupaniopsis shirleyana</i>	Wedge-leaf tuckeroo	V	V	Dry rainforest and scrubby urbanised areas on moderate to very steep slopes, scree-slope gullies and rocky stream channels at elevations of 60 to 550 m above sea level, in the Carina area (Brisbane) and Maryborough district north to Mt Larcom near Gladstone	Unlikely. Suitable habitat does not occur within the study area

Species	Common name	Status ¹		Habitat	Likelihood of occurrence
		VMA	BD2		
<i>Cycas megacarpa</i>	-	E	E	Occurs in Spotted gum (<i>Corymbia citriodora</i>) and Narrow-leaved ironbark (<i>Eucalyptus crebra</i>) woodland and open forest with a grassy understorey. It usually grows on hill tops and steep slopes	While suitable habitat to support this species occurs within the study area, this species was not observed. It is considered unlikely that the proposed activities will impact upon this species
<i>Cycas ophiolitica</i>	Marlborough blue	E	E	Found in rocky, sloping and open eucalypt-forest with little vegetative surround. Plants occur along hilly outcrops and in lower regions near creek systems	Habitat on site is not considered suitable to support this species, due to the topography of the study area
<i>Graptophyllum excelsum</i>	Scarlet fuchsia	NT	-	Occurs from just north of Cairns to just south of Gladstone. Versatile plant, hardy and adapts to garden situations as far south as Melbourne, resistant to light frosts. Grows in a wide range of habitats despite its natural habitat on rocky hillsides of limestone origin. It appreciates mostly full sun for better flowering and ample moisture for good growth. Waterlogging is not tolerated	Suitable habitat for this species occurs in portions of the site, associated with land zone 11, however this species was not observed. This species is unlikely to occur within land zone 3, given that this area is prone to waterlogging. It is unlikely that the proposed activities will impact upon this species
<i>Hernandia bivalvis</i>	Cudgerie	NT	-	Dry rainforest, occurring sporadically in Qld from near Brisbane to Proserpine on the central coast	Unlikely. Suitable habitat does not occur within the study area
<i>Macropteranthes fitzalanii</i>		NT	-	Typically found in the intertidal zone at the water's edge at a mean distance from sea level of 15 m	Suitable habitat does not occur on the mainland. Suitable habitat occurs on the Curtis Island site, however it was not identified
<i>Macropteranthes leiocaulis</i>		NT	-	Found in softwood scrub communities	Unlikely. Suitable habitat does not occur within the study area

Species	Common name	Status ¹		Habitat	Likelihood of occurrence
		VMA	BD2		
<i>Parsonsia larcomensis</i>	Mt Larcom silk pod	V	V	Found in open heathland and shrubland at or near the summits of mountain peaks, in shallow loamy soils on cliffs or among outcrops of acid volcanic rocks and serpentine soils at 350 to 750 m above sea level. Also recorded from riverine rainforest habitat at one location. At Mt Wheeler, the Mt Larcom Silk pod is associated with Red ironbark (<i>Eucalyptus fibrosa</i>), <i>Xanthorrhoea</i> spp. and <i>Pimelea leptospermoides</i>	Unlikely. Suitable habitat does not occur within the study area
<i>Samadera bidwillii</i>	Quassia	V	V	Quassia commonly occurs in lowland rainforest or on rainforest margins but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils. Commonly associated tree species include: Spotted gum (<i>Corymbia citriodora</i>), Grey gum (<i>Eucalyptus propinqua</i>), White mahogany (<i>E. acmenoides</i>), Forest red gum (<i>E. tereticornis</i>), Pink bloodwood (<i>E. intermedia</i>), Ironbark (<i>E. siderophloia</i>), Gum topped box (<i>E. moluccana</i>), Gympie Messmate (<i>E. cloeziana</i>), and Broad-leaved ironbark (<i>E. fibrosa</i>)	Unlikely. Suitable habitat does not occur within the study area
<i>Taeniophyllum muelleri</i>	Minute orchid, Ribbon-root orchid	-	V	Grows on outer branches and branchlets of rainforest trees that occur mainly on streambanks; coast and coastal ranges, from sea level to 250 m alt., north from the Bellinger River in NSW	Unlikely. Suitable habitat does not occur within the study area
<i>Zieria actites</i>		E	-	No habitat descriptions found	This species was not observed within the study area

Table notes: 1 – E=Endangered, V=Vulnerable, OC=Of Concern; LC = Least Concern (VMA), NC = No concern at present (BD). 2 – BD = Biodiversity Status

3.5 Other significant species

Surveys for 'Type A' Restricted Species, as listed under the NC Act, were undertaken along the access tracks and within the pads. While Kurrajong (*Brachychiton populneus*) occurs within vegetation communities observed within the mainland property, they do not occur within proximity to the access track or pad (RPS 2012).

3.6 Significant weed species

Three declared weed species listed under the *Land Protection (Pest & Stock Route Management) Act 2002* (LPA) were recorded on the site (refer Table 3.4) (RPS 2012). In addition, a number of environmental weeds were also recorded on the site (Appendix A). While these introduced plants are not declared under the LP Act, they may still potentially display invasive behaviour in some ecosystems. Thus, their control is generally favoured by authorities from an ecological viewpoint.

Table 3.4 Land Protection (Pest & Stock Route Management) Act 2002- Declared species identified on site

RE code	Common name	LP Act Classification
<i>Cryptostegia grandiflora</i>	Rubber vine	2
<i>Lantana camara</i>	Lantana	2
<i>Opuntia stricta</i>	Prickly pear	2

3.7 Clearing of Regional Ecosystems and Environmentally Sensitive Areas

To facilitate construction of the proposed access tracks and work pad, approximately 11.1 ha of clearing is required (RPS 2012). Table 3.5 outlines the extent of remnant vegetation, regrowth vegetation, and non-remnant vegetation that will be disturbed.

RE's with a biodiversity status of 'Of Concern' are considered to be a Category C Environmentally Sensitive Area (ESA). In addition, areas of Essential Habitat are also considered to be a Category C ESA. A total of 4.072 ha of Category C ESA will be removed as part of construction works, comprising Of Concern RE, some of which is also considered to be Essential Habitat.

Table 3.5 Vegetation Clearing Calculations

RE code	Status ¹		Remnant (ha)	High Value Regrowth (ha)	Non-Remnant (ha)
	VMA	BD2			
11.3.4	OC	OC			N/A
12.11.14	OC	OC			N/A
11.11.15	LC	NC			N/A
N/A	-	-	N/A	N/A	4.074

Table notes: 1 – E=Endangered, V=Vulnerable, OC=Of Concern; LC = Least Concern (VMA), NC = No concern at present (BD). 2 – BD = Biodiversity Status

3.8 Bio-Condition

To guide rehabilitation efforts, Bio-Condition assessments were undertaken within each RE observed within the study area. Table 3.6 provides the raw data for each RE. Bio-Condition scores have not been provided, as benchmarks are not available for the RE's occurring within the study area.

Table 3.6 Bio-Condition Data

Bio-Condition Criteria	RE		
	11.3.4	12.11.14	11.11.15
Canopy Cover (%)	33	65	72
Shrub Cover (%)	15	20	45
Large Eucalyptus Trees	2.35	7	5
Tree Height (m)	18	24	15
Shrub Height (m)	4	3	2.5
Coarse Woody Debris (m/ha)	94	55	137
Weed Cover (%)	35	33	44
Species Richness - canopy	4	8	6.5
Species Richness - shrubs	2	3	4
Species Richness - grasses	5	3	5
Species Richness – herbs and forbs	3	2	4
Ground cover- native grasses (%)	53	40	45
Ground cover – organic litter (%)	11	15	7.5

4 Pre-clearance survey results - fauna

4.1 Survey timing

Preliminary investigations and survey site selection was conducted in October 2011. The fieldwork program for the survey was undertaken from mid December 2011 through to the end of March 2012.

The principal investigator was Andrew Veary (BSc (Hons)) with assistance in the field from Dr Kris Murray (PhD) and Elle Veary (BAppSc). Greg Ford (BAppSc, Grad Dip Resource Management) of Balance Environmental was commissioned by Footprints Environmental Consultants to undertake the Anabat microchiropteran bat call recording analysis and Barbara Triggs of Dead Finish, undertook the hair tube sample analysis.

4.2 Field survey conditions

Excellent rainfall was recorded in the preceding summer seasons and the good rainfall in the local district over several years had recharged the waterbodies and creeks in the local area and promoted good vegetative growth, particularly in relation to diversity and biomass of grasses. Very little rain was recorded in the weeks prior to commencement of the survey period. Periodic rainfall was recorded throughout the survey period.

Field conditions during the survey period (December 2011 to March 2012) were characterised by:

- Temperatures in the mid to high 30's °C, fine days with clear, warm night conditions
- Hot and overcast conditions with scattered showers and overcast, warm night conditions
- Hot, humid and heavily overcast conditions, with or without evening thunderstorms

Survey conditions were considered to be optimal for a detailed fauna survey under summer seasonal conditions.

4.3 Survey site descriptions

Descriptions of the key fauna habitat attributes of survey site 01 corresponding to the construction site pad of interest for this report are presented in Table 4.1 (FER 2012b).

Table 4.1 Survey site 01 description

Survey site and description	Key fauna habitat characteristics
Lowland mixed eucalypt woodland	Woodland on lowland sandy alluvial flats and a small rise, dominated by <i>Eucalyptus tereticornis</i> , with <i>E. platyphylla</i> and <i>E. crebra</i> present on alluvial sandy flats. <i>E. crebra</i> and <i>E. exerta</i> were dominant on the rocky rise, with <i>Corymbia clarksoniana</i> interspersed through the woodland. Hollows were uncommon, recorded in both trees and stags, recorded to approximately 10 cm. The shrub layer was sparse and patchy, dominated by <i>Acacia</i> sp.. Ground cover was dominated by native grasses including <i>Heteropogon contortus</i> , <i>Bothriochloa bladii</i> and <i>Cymbopogon refractus</i> . Ground timber was common, ranging from fallen sticks to a few, large hollow logs. There were no exposed rocks or stones on the alluvial flats, but some rock outcropping was evident on the rise. There was little evidence of cattle activity or fire at this site

4.4 Survey Methods and Application Locations

Table 4.2 provides a summary of the target threatened species at survey site 01 and which methods to survey for these species were applied.

Table 4.2 Threatened species, survey method application at Survey Site 01

Zoological name	Common name	Survey method summary
Reptiles		
<i>Delma torquata</i>	Collared delma	Pits and Searches (Nocturnal)
<i>Paradelma orientalis</i>	Brigalow scaly-foot	Pits and Searches (Nocturnal)
<i>Strophorus taenicauda</i>	Golden-tailed gecko	Pits and Searches (Nocturnal)
<i>Egernia rugosa</i>	Yakka skink	Searches, Elliots
<i>Furina dunmalli</i>	Dunmall's snake	Searches
Birds		
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	Area Searches
<i>Erythrotriorchis radiatus</i>	Red goshawk	Census/Searches
<i>Geophaps scripta scripta</i>	Squatter pigeon	Census/Searches
<i>Ninox strenua</i>	Powerful owl	Call playback/Spotlighting
<i>Esacus magnirostris</i>	Beach stone-curlew	Census/Searches
Bats		
<i>Chalinolobus dwyeri</i>	Large-eared pied bat	Harp and/or Anabat
<i>Chalinolobus picatus</i>	Little pied bat	Anabat
<i>Nyctophilus corbeni</i>	Greater long-eared bat	Harp and/or Anabat
<i>Taphozous australis</i>	Coastal sheath-tail bat	Anabat
Mammals		
<i>Dasyurus hallucatus</i>	Northern quoll	Camera/Hair Tube/Cage/Elliots
<i>Phascogale cinereus</i>	Koala	Area Search/Spotlighting
<i>Tachyglossus aculeatus</i>	Echidna	Area Search/Spotlighting

4.5 Recorded fauna assemblage

The records collated from the desktop review and the current surveys are provided in detail in the 'Threatened Vertebrate Fauna Species Assessment Report' (Footprints 2012b).

Hair tube sampling was used to target Northern quoll and was undertaken at those sites that supported potentially suitable habitat, or were in close proximity to areas that may support northern quoll. The sampling program provided 2,520 tube nights and recorded two species, northern brown bandicoot and brush-tailed possum.

Overall, the species diversity recorded for the project reflects the highly disturbed nature of the study site (FER 2012b). The results are within the range of expected results for the type and extent of fauna habitats on the study site. A high proportion of the species recorded from the survey program are highly adaptable taxa that do not have habitat, niche and/or dietary specialist requirements. A large proportion of this recorded fauna assemblage was comprised of species regarded as common and widespread throughout the wider region (FER 2012b).

4.6 Hollow bearing tree mapping

Mapping of hollow bearing trees was undertaken along the entire GTP ROW within the study site. A total of 1,410 trees were identified as supporting hollows (FER 2012b). A map for hollow bearing trees is presented in Figure 4.1.

4.7 Recorded threatened and migratory species

A total of 16 species were recorded as part of the pre-clearing surveys conducted on the entire, seven listed as threatened and nine listed under migratory provisions of the EPBC Act.

4.7.1 General threatened species and migratory species

Seven species were recorded that are listed under either the NC Act and/or the EPBC Act. These species are detailed in Table 4.3, which also presents the broad survey areas where these species were recorded. The specific locations where each species was recorded is presented in Figure 4.2. Full details of each species, including GPS records are presented in Table 4.3.

Of importance, there are no details of Koala records on Figure 4.2 as there were no actual sightings of Koalas during the pre-clearing surveys (FER 2012b). Identification and subsequent “presence” of Koala was made through identification of the characteristic scratches Koalas make on smooth barked eucalypt trees (FER 2012b). However, Queensland Parks and Wildlife Service (QPWS) has advised that Koalas have not been sighted within the mainland survey site in approximately 15 years.

Records for each species, with the exception of Squatter pigeon, were single individual observations. For Squatter pigeon, as these are flock/communal birds, there were typically several birds observed at each observation location point (FER 2012b). Details of all Squatter pigeon records are presented in Appendix A.

Nine migratory species were identified through the surveys and these are listed in Table 4.3 below. Four of these species are listed under international migratory bird agreements. All species recorded are considered to be common within suitable habitats in the local area (FER 2012b).

Table 4.3 Recorded Threatened and Migratory Species sites 1-6

Zoological Name	Common Name	Status		
		1	2	3
Birds – EVNT Species				
<i>Ephippiorhynchus asiaticus</i>	Black-necked stork	nt		
<i>Lophoictinia isura</i>	Square-tailed kite	nt		
<i>Esacus magnirostris</i>	Beach stone-curlew	V		
<i>Geophaps scripta scripta</i>	Squatter pigeon	V	V	
Mammals – EVNT Species				
<i>Tachyglossus aculeatus</i>	Short-beaked echidna	slc		
<i>Phascolarctos cinereus</i>	Koala	slc	V	
Birds – Migratory Species				
<i>Anseranas semipalmata</i>	Magpie goose		m	
<i>Egretta sacra</i>	Eastern reef egret			C

Zoological Name	Common Name	Status		
		1	2	3
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle		m	C
<i>Pandion cristatus</i>	Eastern osprey		m	
<i>Himantopus himantopus</i>	Black-winged stilt		m	
<i>Merops ornatus</i>	Rainbow bee-eater		m	J
<i>Eurystomus orientalis</i>	Dollarbird		m	
<i>Monarcha melanopsis</i>	Black-faced monarch		m	

4.7.2 Port Curtis area Water mouse records

Several recent surveys undertaken in the Port Curtis area have confirmed the presence of Water mouse. Locations where Water mouse has been confirmed are:

- APLNG Curtis Island LNG Facility Site – one record (Worley Parsons 2011)
- QCLNG GTP Targinie Creek – one record (GHD 2011)
- Yarwun Coal Terminal (proposed stockpile area) – two records (GHD 2012)

Investigations undertaken for the GLNG Curtis Island LNG Facility Site obtained no records of capture (BAMM 2011) and habitat assessments undertaken concluded that the marginal habitat present was unlikely to be suitable for Water mouse.

Field conditions and survey limitations

Field conditions during each survey period were characterised by warm to hot, humid days (FER 2012c). Nocturnal conditions were generally fine, warm and humid with light breezes. Survey conditions were considered to be good for undertaking Water mouse surveys.

Surveys undertaken during April 2012 were initially scheduled to be undertaken in late February/early March, however due to extensive and prolonged rainfall in the local area which significantly constrained access to the Friend Point survey sites, this survey was postponed.

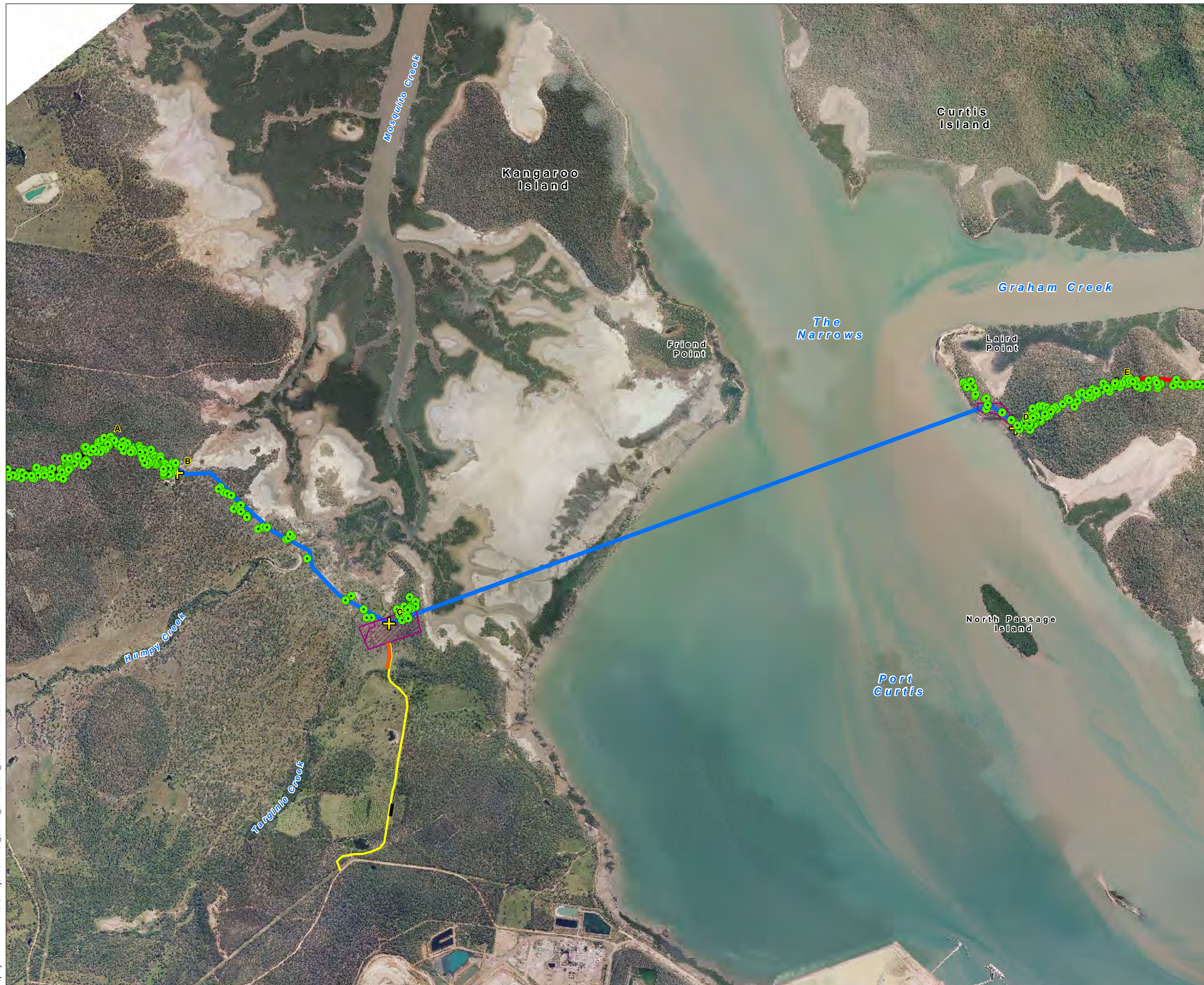
Survey Site 1

This site was located in the head waters of Mosquito Creek where the original GTP was proposed to traverse across the Kangaroo Island wetland complex. The site consisted of a mosaic of estuarine intertidal habitats and terrestrial supralittoral zone (FER 2012a). The intertidal area consisted of a thin veneer of bare mud flats with exposed bed rock and rock boulders between the supralittoral bank to the west and the creek. A vehicle access track was evident along the edge of the supralittoral zone. Some evidence of pigs was also observed. A very dense mangrove forest to approximately 4 m high lined Mosquito Creek and open, bare, very fine grained clay mud flats were located to the east. Mosquito Creek channel in this area was deeply incised and consisted of a deep creek channel with very steep, soft mud banks. The mangrove forests were inundated even on neap tidal cycles.

No evidence of Water mouse – mounds, prey middens, tracks, etc – were observed during diurnal searches (FER 2012a). Crab burrows were abundant in the area.

The vegetation community mosaic was comprised of REs 11.1.2 and 11.1.4 defined in the REDD (v6.0b) database as described in Section 4.4.

**Pre-Clearance Survey Report for
Marine Crossing Early Works**

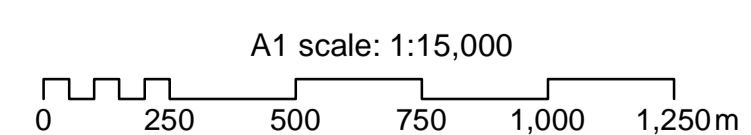
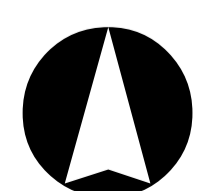


- Gas Transmission Pipeline (GTP)
- Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
 - + GTP Marine Crossing Reference Point
 - Construction Site Pads
 - Acid Sulfate Soils Treatment Area
 - Washdown Facility (Indicative)
 - Access Road
 - Hollow Bearing Trees

Source:
Gas Transmission Pipeline (GTP): Santos, Apr 2012.
Indicative Project Footprint: Aurecon, GLNG Apr 2012.
Aerial: Santos, Feb 2011.
GLNG Hollow Bearing Trees: GLNG, Jul 2012.

**Location of Hollow Bearing
Trees
Figure 4.1**

Map by: RB P:\GIS\Projects\214208_Santos_EMP\SEMP_203.mxd 10/09/2012 12:04



GLNG No: XXXX-XX-XXXX
Coordinate system: GCS_GDA_1994

**Pre-Clearance Survey Report for
Marine Crossing Early Works**

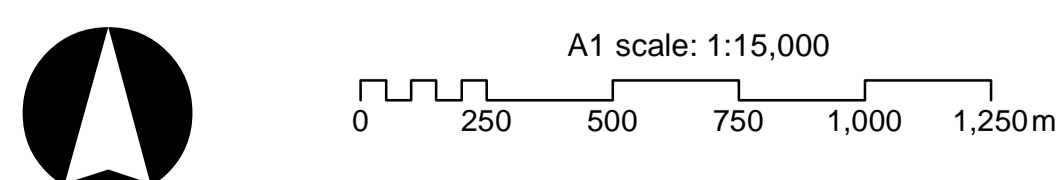


- Gas Transmission Pipeline (GTP)
- Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
 - + GTP Marine Crossing Reference Point
 - ▨ Construction Site Pads
 - Access Road
 - Watercourse Crossing Ancillary Areas
- Threatened Fauna Species
- Beach Stone-curlew
 - Little Tern
 - Powerful Owl
 - Raptor Nest possibly White-bellied Sea-eagle
 - Square-tailed Kite
 - Squatter Pigeon
 - Water Mouse

Source:
 Gas Transmission Pipeline (GTP): Santos, Apr 2012.
 Aerial: Santos, Feb 2011.
 Indicative Project Footprint: Aurecon, GLNG May 2012.
 Footprints Environmental Consultants, 2012a, GLNG GTP ROW Pre-Clearing Threatened Species Surveys, Water Mouse Assessment Report.
 Footprints Environmental Consultants, 2012b, GLNG GTP ROW Pre-Clearing Threatened Terrestrial Fauna Pre-clearing Surveys Assessment Report.
 Extra Works Areas: GLNG, Jul 2012.

**Location of Threatened
Fauna Species
Figure 4.2**

Map by: RB P:\GIS\Projects\214208_Santos_EMP\SEMP_200.mxd 10/09/2012 11:13



GLNG No: XXXX-XX-XXXX
 Coordinate system: GCS_GDA_1994

Table 4.4 Vegetation community mosaic REs

RE	Description
11.1.2a	Estuarine wetlands (eg mangroves). Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves such as <i>Avicennia marina</i> and/or <i>Ceriops tagal</i> . May have obvious salt crusts on the soil surface
11.1.4	Mangrove low forest on Quaternary estuarine deposits. Low open-shrubland to closed forest of mangrove species forming a variety of associations, depending on position in relation to salt water inundation. <i>Avicennia marina</i> is the most common dominant but also other trees such as <i>Aegiceras corniculatum</i> , <i>Rhizophora</i> spp. and <i>Ceriops tagal</i> dominate often in pure stands. There is often a shrub layer consisting of juvenile plants of the above species. Other species such as <i>Excoecaria agallocha</i> , <i>Bruguiera</i> spp., <i>Lumnitzera racemosa</i> and <i>Alchornea ilicifolia</i> may also occur. Occurs on intertidal flats which are often dissected by tidal streams. Soils are usually deep saline clays

Habitat Suitability Assessment: Very High – 1 water mouse captured – presence confirmed.



Photo 4.1 Photograph of Site 1 Mosquito Creek and Dense Mangrove Forest (Source: FER 2012a)



Photo 4.2 Photograph of Site 1 Mosquito Creek and Dense Mangrove Forest (Source: FER 2012a)



Photo 4.3 Photograph of Site 1 Mudflats with Exposed Bedrock and Boulders (Source: FER 2012a)



Photo 4.4 Photograph of Site 1 Mudflats with Exposed Bedrock and Boulders (Source: FER 2012a)



Photo 4.5 Photograph of Site 1 Supralittoral Zone and Terrestrial Habitats (Source: FER 2012a)



Photo 4.6 Photograph of Site 1 Supralittoral Zone and Terrestrial Habitats (Source: FER 2012a)

Survey Site 1-1

This site was located on and around Targinnie Creek, from the supralittoral zone into the estuarine habitats. This site consisted of a mosaic of estuarine intertidal habitats and a highly disturbed terrestrial supralittoral zone. Grazing related impacts within the supralittoral zone, adjacent terrestrial and estuarine habitats were evident. Extensive soil erosion from stock access and feral pig activity was observed. The intertidal area was characterised by a mosaic of Salt couch grass (*Sporobolus virginicus*) flats, mangrove forests and bare, very fine grained mud flats. The mangrove forest was to approximately 3 m high. The creek channel in this area was wide and relatively shallow with very steep, near vertical marine clay soft mud banks. The mangrove forests appeared to be only inundated on spring tidal cycles.

No evidence of Water mouse – eg mounds, prey middens, tracks, etc – was observed during diurnal searches (FER 2012a). Crab burrows were abundant in the area.

The vegetation community mosaic was comprised of REs 11.1.1, 11.1.2a and 11.1.4 defined in the REDD (v6.0b) database as described in Table 4.5.

Table 4.5 Vegetation community mosaic REs 11.1.1, 11.1.2a, 11.1.4

RE	Description
11.1.1	<i>Sporobolus virginicus</i> grassland on Quaternary estuarine deposits. <i>Sporobolus</i> spp. usually dominates pure stands although a wide range of other species may be present as scattered individuals including <i>Fimbristylis ferruginea</i> , <i>Cyperus victoriensis</i> , <i>C. scariosus</i> , and sometimes <i>Eleocharis spiralis</i> , <i>Mnesithea rottboellioides</i> , <i>Marsilea mutica</i> , <i>Cynanchum carnosum</i> , <i>Ischaemum australe</i> , <i>Cyperus polystachyos</i> , <i>Ceratopteris thalictroides</i> and <i>Leptochloa fusca</i> . Occasional emergent stunted mangroves, usually <i>Avicennia marina</i> or <i>Ceriops tagal</i> , may occur as isolated individuals or along small channels. There may also be a minor presence of salt-tolerant forbs such as <i>Suaeda australis</i> , <i>S. arbusculooides</i> , <i>Sarcocornia quinqueflora</i> subsp. <i>Quinqueflora</i> or <i>Tecticornia australasica</i> . Occurs on supratidal flats which are often only inundated by highest spring tides. Often occurs on the landward side of intertidal flats; seaward margins irregularly inundated with tidal waters and dissected by small tidal channels. Formed from Quaternary estuarine sediments with deep grey or black and grey saline cracking clays with occasional mottling, minor gilgai occasionally present
11.1.2a	Estuarine wetlands (eg mangroves). Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves such as <i>Avicennia marina</i> and/or <i>Ceriops tagal</i> . May have obvious salt crusts on the soil surface
11.1.4	Mangrove low forest on Quaternary estuarine deposits. Low open-shrubland to closed forest of mangrove species forming a variety of associations, depending on position in relation to salt water inundation. <i>Avicennia marina</i> is the most common dominant but also other trees such as <i>Aegiceras corniculatum</i> , <i>Rhizophora</i> spp. and <i>Ceriops tagal</i> dominate often in pure stands. There is often a shrub layer consisting of juvenile plants of the above species. Other species such as <i>Excoecaria agallocha</i> , <i>Bruguiera</i> spp., <i>Lumnitzera racemosa</i> and <i>Alchornea ilicifolia</i> may also occur. Occurs on intertidal flats which are often dissected by tidal streams. Soils are usually deep saline clays

Habitat Suitability Assessment: Very High – located very near to where Water mouse presence has been confirmed.

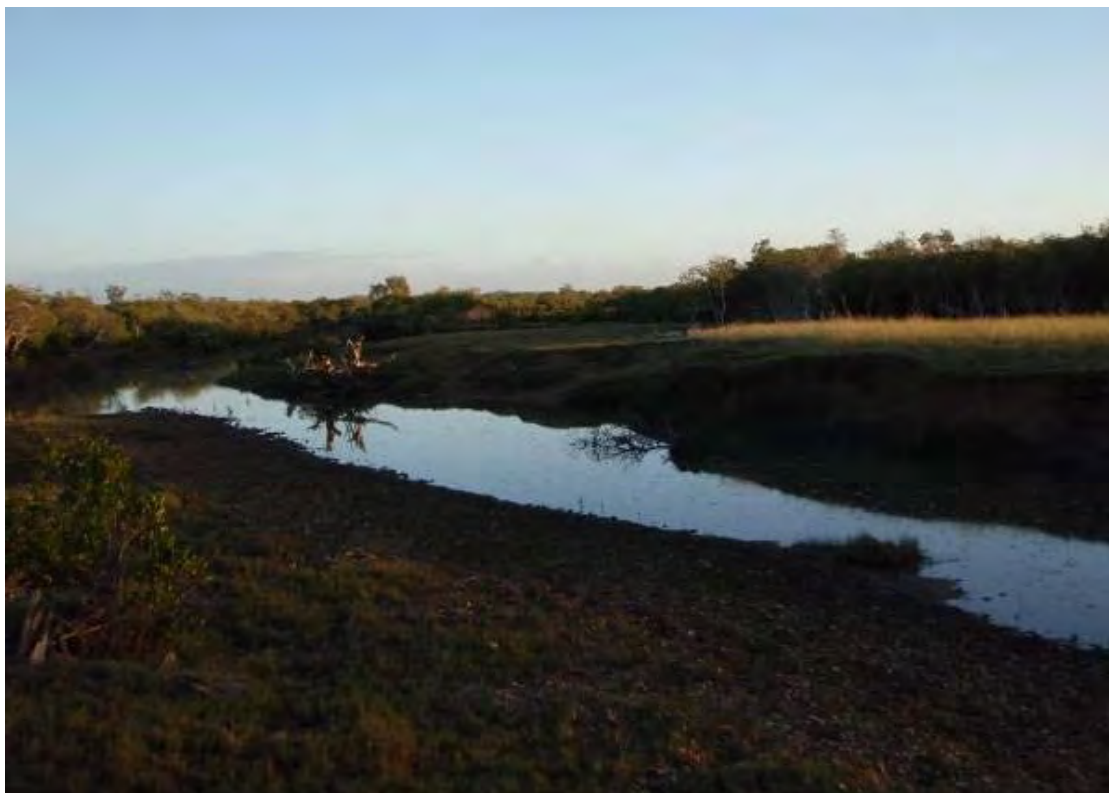


Photo 4.7 Photograph a of the Site 1-1 Creek Channel and Grasslands (Source: FER 2012a)



Photo 4.8 Photograph of the Site 1-1 Creek Channel and Grasslands (Source: FER 2012a)



Photo 4.9 Photograph of Site 1-1 Stream Channel and Mudflats (Source: FER 2012a)



Photo 4.10 Photograph of Site 1-1 Stream Channel and Mudflats (Source: FER 2012a)



Photo 4.11 Photograph of Site 1-1 Supralittoral Zone and Terrestrial Habitats (Source: FER 2012a)



Photo 4.12 Photographs of Site 1-1 Supralittoral Zone and Terrestrial Habitats (Source: FER 2012a)

Water mouse records

One male water mouse, shown in Photo 4.13 below, was capture at survey site 1 (refer Figure 2.1) on the night of 1 January, 2012 (FER 2012a).



Photo 4.13 Photograph of Water mouse captured at Site 1 (Source: FER 2012a)

4.7.3 Migratory birds records

Desktop review of shorebirds

Desktop review of the literature available for this assessment has identified the likely and/or known occurrence of 40 shorebird species within the habitats supported in the project area (FER 2012c). Of the 40 species identified, 17 are known to occur within habitats supported in the study area. A further 14 species are considered likely to occur in the study area, of which seven are considered highly likely and seven species likely. The remaining nine species are considered unlikely to occur due to the lack of suitable habitat preferred by these species.

The scoring of probability of a species occurrence within the study area is based on the:

- Information of species records within the project area
- Preferred habitat requirements known for each species
- The availability, extent and predicted value of those preferred habitats within the study area

Table 4.6 Shorebird Species for the Project Area, Ecological Profiles and Probability of Occurrence within the Study Area

Zoological name	Common name	Species profile	Probability of occurrence
<i>Rostratula australis</i>	Australian painted snipe	Occurs either singularly or in groups with movements unpredictable in response to local rain events (Geering <i>et al</i> 2007, Marchant and Higgins 1993). Occurs primarily in freshwater marshes (Marchant and Higgins 1993, Geering <i>et al</i> 2007). Roosts in dense swamp vegetation during day, forages at dawn, dusk and night (Marchant and Higgins 1993). Breeds in Australia in swamps with temporary water regimes with combination of shallow water, exposed wet mud and dense low fringing vegetation (Marchant and Higgins 1993, Geering <i>et al</i> 2007)	Highly Unlikely
<i>Burhinus grallarius</i>	Bush stone-curlew	Occurs in a wide range of open woodland habitats, rarely within intertidal/marine habitats (Marchant and Higgins 1993). A nocturnal species that shelters during the day in grass or under shady tree (Geering <i>et al</i> 2007)	Highly Likely
<i>Esacus magnirostris</i>	Beach stone-curlew	Exclusively a coastal species found in marine littoral habitats on all types of beaches - sandy, rocky, muddy, small large etc (Marchant and Higgins 1993). Primarily resident, though young are dispersive (Marchant and Higgins 1993). Birds breed at the back of sandy beaches, banks, coral ridges or on open coast (Marchant and Higgins 1993). Foraging occurs on intertidal mudflats, sandflats, sand banks and sand spits, open beaches and river mouths (Marchant and Higgins 1993). Roosts within mangroves or beneath trees behind beach foredunes (Geering <i>et al</i> 2007)	Known
<i>Haematopus fuliginosus</i>	Sooty oyster catcher	This species is strictly coastal marine, usually within 50 m of the shoreline, with a preference for rocky intertidal shorelines (Marchant and Higgins 1993). Breeding occurs mainly on offshore islands and rock stacks, occasionally on remote headlands, promontories and rocky outcrops (Marchant and Higgins 1993). Roosting occurs on offshore islands, isolated rock platforms, beaches, banks and spits (Marchant and Higgins 1993)	Unlikely
<i>Haematopus longirostris</i>	Australian pied oyster catcher	A sedentary coastal species which prefers intertidal mudflats and sand banks in large marine embayments and along open ocean sandy beaches (Marchant and Higgins 1993). Forages on exposed intertidal flats, rocks and rubble (Marchant and Higgins 1993). Roosts primarily on sandy beaches, spits, dunes and small islets within bays, lagoons and inlets (Marchant and Higgins 1993)	Known
<i>Cladorhynchus leucocephalus</i>	Banded stilt	Inhabits predominantly saline and hypersaline waters both coastal and inland (Marchant and Higgins 1993). Foraging occurs in shallow or deep waters and they roost/loaf on banks, bars, shores, islands, spits etc (Marchant and Higgins 1993). The species is a rare visitor to Qld, breeding primarily in WA and SA (Marchant and Higgins 1993)	Unlikely
<i>Himantopus himantopus</i>	Black-winged stilt	A wide ranging species in Australia that prefers shallow, open freshwater wetlands, but are also common in saline environments including saltmarsh and tidal lagoons (Marchant and Higgins 1993). Foraging occurs in shallow water margins of wetlands or in saturated mud, occasionally along margins of tidal estuaries (Marchant and Higgins 1993). Roosts on shallow water, banks, spits and sand flats in estuaries (Marchant and Higgins 1993)	Likely

Zoological name	Common name	Species profile	Probability of occurrence
<i>Recurvirostra novaehollandiae</i>	Red-necked avocet	Australian endemic species with a sparse distribution in Qld (Marchant and Higgins 1993). Preferred habitat shallow ephemeral saline wetlands, but ranges from fresh to hypersaline wetlands (Marchant and Higgins 1993). Usually breed at inland salt lakes on low islands/banks and forage in shallow water margins on soft mud (Marchant and Higgins 1993)	Likely
<i>Charadrius bicinctus</i>	Double-banded plover	Distribution in Qld primarily restricted to the south east. South of Rockhampton, birds are found within estuarine and fresh or saline terrestrial wetlands within the littoral zone including saltmarsh areas (Marchant and Higgins 1993). Birds roost in bare open earth areas, either adjacent to or hundreds of metres away from foraging areas which include open shallow waters, muddy flats, rocky/gravelly areas etc (Marchant and Higgins 1993)	Highly Likely
<i>Charadrius hiaticula</i>	Ringed plover	Breeding occurs in Canada, Greenland, Iceland and northern Europe. An accidental visitor to Australia (Marchant and Higgins 1993). In Australasia, has been recorded from moist tidal mud/sandflats, sheltered bays, and estuaries in littoral zone (Marchant and Higgins 1993)	Unlikely
<i>Charadrius leschenaultii</i>	Greater sand plover, Large sand plover	Non-breeding summer migrant. Mainly sandy or muddy beaches with large intertidal sandbanks or mudflats (Marchant and Higgins 1993). Typically roost on sand spits and banks, often on rocky points (Marchant and Higgins 1993)	Highly Likely
<i>Charadrius mongolus</i>	Lesser sand plover, Mongolian plover	Non-breeding summer migrant. Mainly sandy or muddy beaches with large intertidal sandbanks or mudflats (Marchant and Higgins 1993). Typically roost near feeding grounds on sand spits and banks, occasionally on rocky points and reefs (Marchant and Higgins 1993)	Known
<i>Charadrius ruficapillus</i>	Red-capped plover	Widespread, predominantly inland species in Australia which inhabits littoral, estuarine and terrestrial wetlands, with a preference for saline and brackish waters (Marchant and Higgins 1993). Foraging occurs on sand/mudflats, along marine/estuarine shorelines and amongst gravel and shell grit (Marchant and Higgins 1993)	Known
<i>Elsayornis melanops</i>	Black-fronted dotterel	Widespread throughout Australasia and the most widespread wader in Australia occurring in terrestrial freshwater wetlands, sometimes brackish and less often in saline wetlands (Marchant and Higgins 1993). Forage primarily along water margin in soft fine mud and roost alongside foraging areas (Marchant and Higgins 1993)	Likely
<i>Pluvialis fulva</i>	Pacific golden plover	Non-breeding summer migrant. Mainly sandy or muddy beaches with large intertidal sandbanks or mudflats, though also salt marsh, mangroves and estuarine mudflats (Lane 1987; Marchant and Higgins 1993)	Known
<i>Pluvialis squatarola</i>	Grey plover	Non-breeding summer migrant. Mainly marine shores, sandy or muddy beaches with large intertidal sandbanks or mudflats, though also salt marsh, mangroves and estuarine mudflats (Lane 1987; Marchant and Higgins 1993)	Likely

Zoological name	Common name	Species profile	Probability of occurrence
<i>Erythronyctes cinctus</i>	Red-kneed dotterel	Widespread throughout Australia occurring in terrestrial freshwater wetlands, rarely brackish and less often in saline wetlands (Marchant and Higgins 1993). Forage primarily along waters margin in soft fine mud and roost alongside foraging areas (Marchant and Higgins 1993)	Unlikely
<i>Vanellus miles</i>	Masked lapwing	Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Lane 1987). Often highly dispersive, with movements associated with seasonal changes in rainfall and availability of wetlands (Higgins and Davies 1996)	Known
<i>Actitis hypoleucos</i>	Common sandpiper	Non-breeding summer migrant. Wide range of coastal and inland habitats of varying salinities (Higgins and Davies 1996). Preferred coastal habitats include muddy intertidal zones of mangrove-lined estuaries, tidal rivers and creeks (Lane 1987). Also muddy margins or rocky shores of wetlands, though large coastal mudflats apparently not favoured (Higgins and Davies 1996). High tide roosts include rocks or roots/branches of mangroves (Lane 1987)	Highly Likely
<i>Arenaria interpres</i>	Ruddy turnstone	Non-breeding summer migrant predominately found in coastal areas on exposed rock/coral reefs, platforms, shelves, often with shallow tidal pools, also on sand and coral beaches and estuaries, harbours, bays and coastal lagoons (Higgins and Davies 1996). Roosts and loafs on beaches, among rocks, shells, rocky islets, mudflats and sandflats above tide line (Higgins and Davies 1996)	Highly Likely
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	Non-breeding summer migrant. Coastal and inland habitats, feeding for invertebrates in mud or shallow water along edges of shallow wetlands, lagoons, dams and sewage farms (Higgins and Davies 1996)	Known
<i>Calidris alba</i>	Sanderling	Non-breeding summer migrant to Australia, restricted to coastal areas, predominantly open sandy beaches exposed to open sea swell, exposed sandbars and spits etc (Higgins and Davies 1996). Birds roost on bare sand, behind beachcast kelp etc and behind coastal dunes, in southeast Qld, they have been recorded on tidal flats during storms (Higgins and Davies 1996). Foraging occurs along sandy beaches, exposed sand bars at the water edge in wave washed zone (Higgins and Davies 1996)	Likely
<i>Calidris canutus</i>	Red knot	Non-breeding migrant to Australia, restricted mainly to coastal regions, within sheltered coastal habitats supporting large intertidal mud/sand flats including bays, inlets, estuaries, harbours lagoons and also ocean beaches (Higgins and Davies 1996). Foraging occurs within the intertidal flats in shallow water, soft mud/sand, at the water edge, often as tide recedes, with roosting occurring in sheltered areas near foraging areas (Higgins and Davies 1996)	Likely
<i>Calidris ferruginea</i>	Curlew sandpiper	Non-breeding summer migrant. Occurs on both coastal and inland wetland habitats, though not as widespread as red-necked stint and sharp-tailed sandpiper (Higgins and Davies 1996). Prefers bare, wet, muddy surfaces and adjoining shallow water margins of fresh, saline, or brackish open water bodies and wetlands (Lane 1987; Higgins and Davies 1996)	Likely

Zoological name	Common name	Species profile	Probability of occurrence
<i>Calidris ruficollis</i>	Red-necked stint	Non-breeding summer migrant. Occurs in a wide variety of coastal and inland wetland habitats from salt lakes, freshwater swamps, intertidal mudflats and sandy ocean beaches (Lane 1987; Higgins and Davies 1996). More abundant coastally where it mainly feeds wet or drying mud near waterline on intertidal mudflats and roosts on sandy beaches (eg spits) (Lane 1987)	Known
<i>Calidris tenuirostris</i>	Great knot	Non-breeding migrant to Australia, restricted mainly to coastal regions, within sheltered coastal habitats supporting large intertidal mud/sand flats including bays, inlets, estuaries, harbours lagoons and also ocean beaches (Higgins and Davies 1996). Foraging occurs within the intertidal flats in shallow water, soft mud/sand, at the water edge, often as tide recedes, with roosting occurring in sheltered areas near foraging areas (Higgins and Davies 1996)	Known
<i>Gallinago hardwickii</i>	Latham's snipe, Japanese snipe	Non-breeding summer migrant in a variety of freshwater and brackish wetlands. Feeds on soft wet ground or in shallow water for invertebrates, seeds and vegetation (Higgins and Davies 1996; Todd 2000). Usually found close to dense ground cover (Garnett and Crowley 2000)	Highly Unlikely
<i>Gallinago megala</i>	Swinhoe's snipe	Non-breeding rare vagrant migrant to Australia, within primarily freshwater wetlands (Higgins and Davies 1996)	Highly Unlikely
<i>Gallinago stenura</i>	Pin-tailed snipe	Non-breeding rare vagrant migrant to Australia, within primarily freshwater wetlands (Higgins and Davies 1996)	Highly Unlikely
<i>Limicola falcinellus</i>	Broad-billed sandpiper	Non-breeding summer migrant in sheltered parts of the coast, favouring estuarine mudflats, occasionally on saltmarshes, shallow freshwater lagoons, large soft intertidal mudflats, +/- shell or sandbanks nearby. They favour mud among, or fringed by, mangroves, particularly on the seaward side and sometimes occur in estuaries edged by saltmarsh. Foraging occurs on exposed flats of soft mud or wet sand at edges of coastal and near-coastal wetlands. They forage in soft mud near mangroves and in shallow water on muddy edges of ponds. Roosting occurs on banks of sheltered sandy, shelly or shingly beaches (Higgins & Davies 1996)	Known
<i>Limosa lapponica</i>	Bar-tailed godwit	Non-breeding summer migrant. Exclusively coastal, inhabiting broad intertidal mud or sand flats (often with seagrass meadows) and feeding on soft wet mud and/or shallow waters (Higgins and Davies 1996). High tide roosts on sandy beaches, spits, muddy bars and islets in sheltered environments (Lane 1987; Higgins and Davies 1996)	Known
<i>Limosa limosa</i>	Black-tailed godwit	Non-breeding summer migrant. Mainly coastal, occurring on sheltered bays and estuaries and feeds in soft mud or shallow water on wide intertidal mudflats or sand flats (Higgins and Davies 1996). Also uses near coastal tidal and non-tidal wetlands (eg salt marsh and salt flats) that are shallow and sparsely vegetated (Higgins and Davies 1996)	Highly Likely
<i>Numenius madagascariensis</i>	Far eastern curlew	Non-breeding summer migrant. Intertidal mud or sand flats of sheltered coasts, estuaries and harbours (Higgins and Davies 1996). High tide roosts on sandy spits and beaches, though also amongst coastal vegetation such as salt marsh and mangroves (Lane 1987)	Known

Zoological name	Common name	Species profile	Probability of occurrence
<i>Numenius minutus</i>	Little curlew, Little whimbrel	Non-breeding summer migrant, occurring in fresh and saline wetland habitats, feeding mostly in dry grasslands and sedgeland but have been recorded from flooded claypans and flood plains inundated from spring/king tides (Higgins and Davies 1996)	Highly Likely
<i>Numenius phaeopus</i>	Whimbrel	Non-breeding summer migrant. Prefers mudflats within mangrove habitats, though also forage at low tide on open tidal mudflats, on sandy beaches, and along banks of tidal rivers and creeks (Lane 1987; Higgins and Davies 1996). Roost in mangrove trees, though also on muddy, sandy or rocky beaches (Higgins and Davies 1996)	Known
<i>Tringa brevipes</i>	Grey-tailed tattler	Non-breeding summer migrant. Exclusively coastal, occurring mainly in areas which support extensive mangal communities and intertidal mudflats (Higgins and Davies 1996). May prefer intertidal mudflats which support seagrass meadows (Thompson 1992). Roosts on rocks and beaches, though prefers mangroves when present (Lane 1987)	Known
<i>Tringa glareola</i>	Wood sandpiper	Non-breeding summer migrant to Australia with largest numbers recorded in the north west, sparsely scattered records through Qld. primarily within well vegetated shallow freshwater wetlands, more rarely in brackish wetlands, dry saltmarsh, but not on coastal flats (Lane 1987, Higgins and Davies 1996). Forages amongst dry/wet mud, vegetation within habitats and roosts on grassy hillocks and also in low trees (Higgins and Davies 1996)	Highly Unlikely
<i>Tringa nebularia</i>	Common greenshank	Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Lane 1987)	Known
<i>Tringa stagnatilis</i>	Marsh sandpiper	Non-breeding summer migrant occurring in coastal and inland permanent and ephemeral wetlands of varying salinity including swamps, estuaries, salt pans, saltmarshes, inundated floodplains and intertidal mudflats (Higgins and Davies 1996). Foraging occurs within shallow water at edge of wetland and roosts on tidal mudflats, meadow saltmarsh and inland swamps (Higgins and Davies 1996)	Known
<i>Xenus cinereus</i>	Terek sandpiper	Non-breeding summer migrant. Exclusively coastal, feeding on soft muddy substrates, especially near mangroves within sheltered estuaries, harbours and coastal lagoons (Higgins and Davies 1996). High tide roosts on beaches, though often prefers mangroves when present (Lane 1987)	Known

Source: (FEC 2012c)

Desktop review of marine migratory birds

Database review has highlighted the potential presence of an additional ten marine migratory bird species. These are listed in Table 4.7 below, with their conservation status and an assessment of the likelihood of occurrence within the study area.

Table 4.7 Database Records for Additional Marine Migratory Bird and Conservation Status for the Project Area

Zoological name	Common name	Status			Likelihood of occurrence
		1	2	3	
<i>Ardea alba</i>	Great egret		m	CJ	Possible, suitable habitat supported in area.
<i>Ardea ibis</i>	Cattle egret		m	CJ	Highly unlikely, unsuitable habitat
<i>Charadrius bicinctus</i>	Double-banded plover		m		Possible
<i>Charadrius ruficapillus</i>	Red-capped plover		m		Highly Likely
<i>Egretta sacra</i>	Eastern reef egret			C	Highly Likely
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle		m	C	Highly Likely
<i>Himantopus himantopus</i>	Black-winged stilt		m		Possible, marginal habitat
<i>Pandion cristatus</i>	Eastern osprey		m		Highly likely
<i>Rostratula australis</i>	Australian painted snipe	V	V	C	Unlikely, unsuitable habitat
<i>Sternula albifrons</i>	Little tern	E	E	CJR	Highly likely

Table Note: V = Vulnerable
E = Endangered
C = Bilateral agreements between Australia and China
CJR = Bilateral agreements between Australia and China, Japan, Republic of Korea
m = listed under marine and/or migratory provisions of EPBC Act

Study area vegetation descriptions

Furthermore, two major shorebird roost sites were identified on Kangaroo Island, one at the northern section of the island, the other at Friend Point. A major shorebird foraging area was also identified along the south-east facing shoreline of the island (refer Figure 4.3) (FER 2012c).

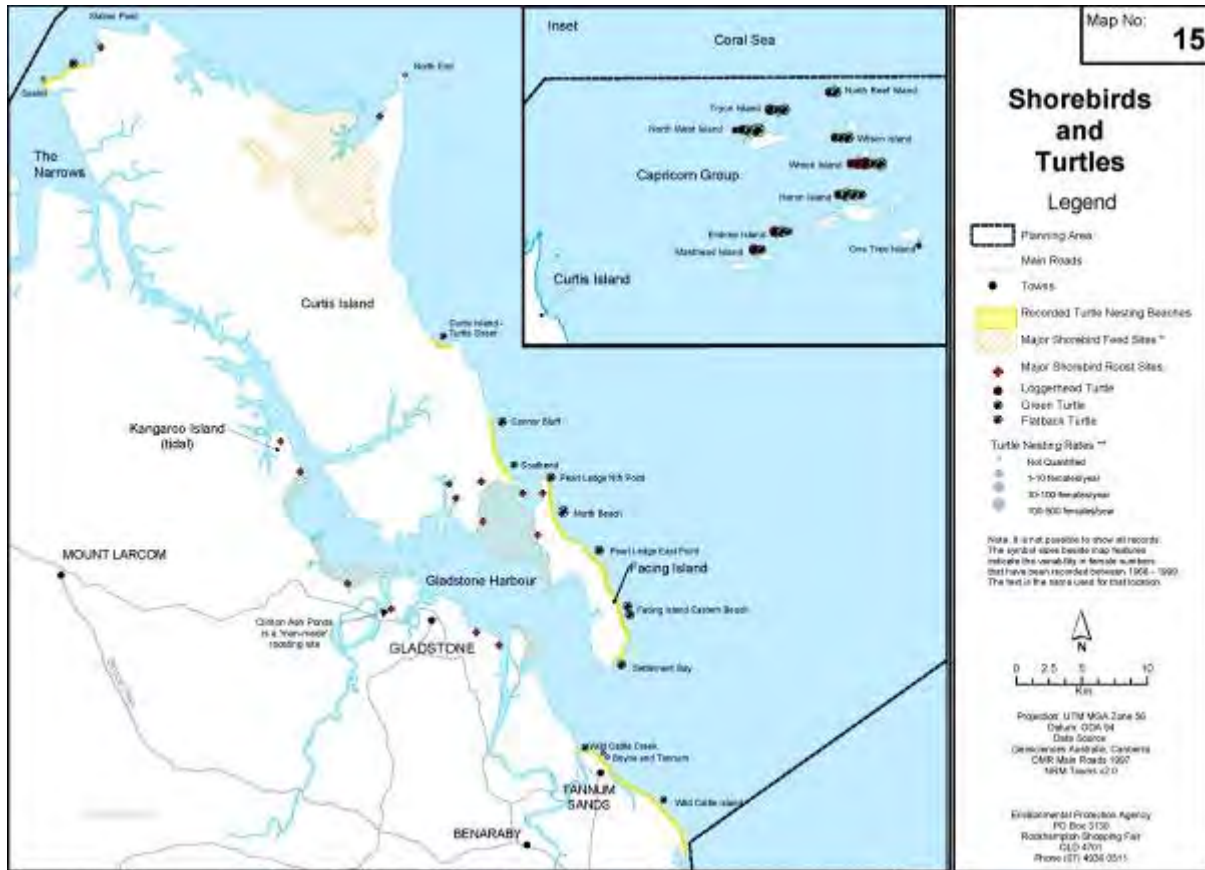


Figure 4.3 CCRCMP Map 15 – Shorebirds and Turtles

Survey site locations

As a result of the initial habitat assessments undertaken, a total of 14 roost areas and one intertidal foraging area were identified for undertaking survey counts (FER 2012c).

The roost areas consisted of three sites at Laird Point and 11 sites on Kangaroo Island.

One foraging area was identified immediately adjacent to the south-east of Kangaroo Island.

A map of all the identified roost areas and intertidal foraging areas on Kangaroo Island and at Laird Point are presented in Figure 4.4.

Conclusion for Kangaroo Island Wetland area

The Kangaroo Island wetland area supports high quality roosting habitat for shorebirds and marine migratory birds with records for 23 species recorded utilising habitats supported therein (FER 2012c).

**Pre-Clearance Survey Report for
Marine Crossing Early Works**

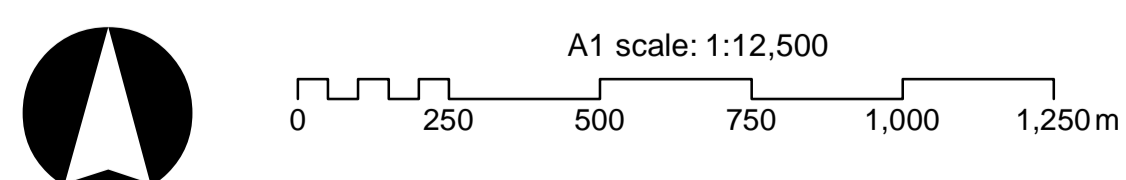


- Gas Transmission Pipeline (GTP)
- Mainland GTP
 - Marine Crossing GTP
 - Curtis Island GTP
- GTP Marine Crossing Reference Point
- +
- Construction Site Pads
-
- Acid Sulfate Soils Treatment Area
-
- Washdown Facility (Indicative)
-
- Access Road
-
- Watercourse Crossing Ancillary Areas
-
- Roost Sites
- ✱ Claypan Roost
 - ✱ Friend Point Roost
 - ✱ Kangaroo Island North Roost
 - ✱ Laird Point Roost
 - ✱ Low Tide Count Location
 - ✱ Narrows Roost
 - Major Shorebird Roost Site
 - Shorebird Area (Shorebirds 2020)

Source:
 Gas Transmission Pipeline (GTP): Santos, Apr 2012.
 Indicative Project Footprint: Aurecon, GLNG Apr 2012.
 High Tide Roosts: Santos GLNG Review of Shorebird Impacts within the Kangaroo Island Wetlands and the Narrows Crossing Area, Footprints Environmental Consultants, Oct 2010.
 Aerial: Santos, Feb 2011.
 Shorebird Sites, Shorebirds 2020, <http://www.shorebirds.org.au/March 2011>.
 Major Shorebird Roost Site:
 Shorebirds and Turtles, Shorebirds and Turtles, Curtis Coast Regional Coastal Management Plan, Department of Environment and Resource Management, 2003
 Extra Works Areas: GLNG, Jul 2012.

**Location of High Tide Roosts
and Low Tide Foraging Areas
Figure 4.4**

Map by: RB P:\GIS\Projects\214208_Santos_EMP\SEMP_204.mxd 10/09/2012 14:02



GLNG No: 3381-40-0454
 Coordinate system: GCS_GDA_1994

The data recorded from low tide foraging surveys of the intertidal mudflats indicates that these habitats possibly support only marginal foraging habitat, due to the low numbers of birds observed, *cf.* the records from roost surveys (average of 40 birds at low tide vs 208 birds at high tide). The reason for this is unclear, but is potentially due to the nature of the intertidal areas and the changes that have occurred following the dramatic increase in the amount of development within the Port Curtis area (FER 2012c). Anecdotal evidence suggests that this increase in development has been associated with a marked increase in the amount of fine sediment being deposited over the mudflats. Without reviewing data collected prior to the recent expansion of Port Curtis (if any), it is not possible to qualitatively assess this situation. An assessment of this nature was outside the scope of this investigation.

Assessment of study area significance

Review of the literature has concluded that whilst there were no internationally significant roost areas in the Curtis Coast area, additional regional surveys conducted in accordance with the determination criteria may confirm the presence of internationally significant populations of far eastern curlew and grey-tailed tattler.

With respect to national significance, the Port Curtis area satisfied both of the determination criteria (as proposed by Clemens *et al* 2008) and the three criteria proposed by the Department of Environment, Water, Health and the Arts (DEWHA) (2009a, b). Consequently, Port Curtis can be identified as a nationally significant area for shorebirds.

Of particular importance for this assessment is that Sandpiper *et al* (2010), through analysis of QWSG data and their own records, have determined that the Friend Point area satisfies the national, State and regional criteria, and as such can be identified as a roost area of national significance (FER 2012c). Of note, is that data analysis for the Laird Point area, where the proposed pipeline will “enter” Curtis Island, also meets the determination criteria for a national, State and regionally significant roost area. The assessment also concluded that the Friend Point roost site supported nationally significant populations of Far eastern curlew and Whimbrel and the Claypan roost site supported a nationally significant population of far eastern curlew (Sandpiper *et al* 2010).

Comparative analysis of data collected from 47 shorebird areas in the Curtis Coast region determined the following relative ranked values of the Friend Point roost within the Curtis Coast shorebird areas (Sandpiper *et al* 2010):

- 7th for National Criteria
- 1st for State Criteria
- 7th against Regional Criteria
- 6th for total population counts

The data collected from the current assessment was analysed against the summary of significance thresholds detailed in Sandpiper *et al* (2010). This summary is presented in Table 4.8 below. The data collected from the current assessment continues to provide evidence that the roosts supported within the Kangaroo Island wetland complex support nationally significant populations of Far eastern curlew.

From this analysis, it can be concluded that the Friend Point area continues to support high values at national, State and regional scales (FER 2012c).

Of particular note is that nationally significant roost counts were recorded at all Friend Point and Claypan roost sites on Kangaroo Island (FER 2012c).

Table 4.8 Summary Assessment of Target Species Significance Thresholds for the Curtis Coast Region

Target Species	Flyway Population Thresholds ²						Friend Point QWSG Counts ⁵				FEC Counts	Status of Friend Point Population
	Flyway Pop ¹	Australian Pop ¹	1% Internationally significant	0.25% ³	0.1% Nationally Significant	QWSG Gladstone Maximum Counts	Status of Curtis Coast Population based on Flyway Thresholds	Summer Max Count	Winter Max count	Friend ⁴ Point Summer Max Count	Kangaroo Island Complex Max Summer Count	
Far eastern curlew	38,000	28,000	380	95	38	515	Exceeds all population thresholds therefore of International, State and Regional significance	50	35	62	100	Summer counts exceed 0.1% population thresholds therefore population is of National Significance
Whimbrel	100,000	10,000	1,000	250	100	450	Exceeds the 0.1% population threshold therefore of National significance	13	22	299	67	Exceeds both 0.25% and 0.1% thresholds therefore population is of National Significance
Bar-tailed godwit	325,000	185,000	3,250	813	325	1,508	Exceeds the 0.1% population threshold therefore of National significance	155	19	74	122	Not of significance
Common greenshank	60,000	19,000	600	150	60	198	Exceeds the 0.1% population threshold. Therefore of National Significance	5	1	1	0	Not of significance

	Flyway Population Thresholds ²					Friend Point QWSG Counts ⁵			FEC Counts			
Red-necked stint	325,000	270,000	3,250	813	325	1,581	Not of International Significance, exceeds the 0.1% population threshold therefore population is of National significance	12	222	304	221	Not of significance

Source: References: 1 Geering *et al* (2007) and Bamford *et al* 2008; 2 -Australian population estimates from Bamford *et al* (2008) and Geering *et al* (2007). 3 – Staging criteria adopted by Bamford *et al* 2008. 4 -Rohweder and Charley (2009a, b) count data; 5 – Sandpiper *et al* 2010.

5 Recommendations

5.1 Kangaroo Island Wetland Complex

The capture of a Water mouse within habitats associated with Mosquito Creek confirms the presence of this vulnerable species, not only in areas within and adjacent to the GTP ROW, but within the estuarine and adjacent terrestrial habitats supported within Mosquito Creek and neighbouring terrestrial environs (FER 2012a).

The Kangaroo Island wetland mosaic is a very complex system of intertidal creeks, drainage channels, Mangrove forests, Salt couch grasslands, Samphire and extensive, fine grained mud flat communities.

The Water mouse is a highly mobile species that has been observed to travel up to 3 km a night. Home ranges for this species can vary from 0.53 Ha to 3.42 Ha (Gynther and Janetzki 2008, Van Dyck 1996). As this species is so mobile, it is considered that this species occurs throughout the Mosquito Creek estuarine environs and also may venture into the adjacent supralittoral and terrestrial habitats (FER 2012a).

Given the extent of the very high quality water mouse habitat supported within the Mosquito Creek complex and the high mobility of this species, it is considered that the water mouse occurs throughout the Mosquito Creek catchment area, and may also be present further to the east within habitats supported between Kangaroo Island and Friend Point (FER 2012a).

The current assessment has highlighted the deficiencies in knowledge for the shorebird and marine migratory birds that utilise habitats supported on Kangaroo Island. If the observed disappearance of shorebirds from Laird Point can be used as a measure to assess the effect of the GLNG GTP works to date, it is considered highly likely that a similar reduction in numbers of birds will be observed at the roosts within the Kangaroo Island wetland complex (FER 2012c).

It is strongly recommended that GLNG Operations continue to monitor the bird populations of Kangaroo Island to assess the level of impact to these birds, specifically as the tunnelling option passes close to roost areas and under the intertidal foraging mudflats.

The design of on-going monitoring programs should as a minimum, replicate the current survey effort, and be expanded to include additional areas outside of the direct zone of impact of the LNG development, including, for example, areas at the southern end of Port Curtis, eg Rodds Bay, and sites at the northern end of Curtis Island in the Port Alma region. Inclusion of these sites will provide a wider focus on the migratory birds of the area, and may provide data on where the birds move to once the development of the “bundled option” alignment reaches the claypan areas, which is imminent.

5.2 Feral species

During the surveys, it was noted that there was extensive evidence of introduced feral species, notably dog/dingo, fox, cat and pig. All these species have been identified as threatening processes for the decline of water mouse populations (Commonwealth of Australia 2009).

Assessment of the potential impacts of the GTP ROW and associated interactions with other threatening processes was outside of the scope of this assessment. Once the proposed alignment and construction methodology have been finalised we strongly recommend that consideration of associated feral animal impacts on Water mouse (and other species, eg migratory birds) and the Kangaroo Island wetland complex as a whole be addressed (FER 2012a).

5.3 Threatened and migratory species

The survey methodology identified the presence of seven species listed as threatened under the Commonwealth EPBC Act and/or the Queensland NC Act. Nine species listed under migratory provisions of the EBBC Act were also observed.

The diversity and abundance of the recorded fauna assemblage of the study site is considered to be quite low, providing records for 212 species *cf.* 422 species recorded in databases. The lack of diversity and abundance can be partially explained by comparing the habitats supported within the GTP ROW *cf.* the total diversity and area of habitats supported within the database search area. In addition, some habitats supported within the database search area are not supported within the GTP terrestrial ROW, for example marine environs, which account for 30 bird species (eg shorebirds) and six mammals (eg dugong).

Nonetheless, the assemblage recorded is considered to be quite depauperate, with a low diversity of species recorded and low total counts of individuals from each species. This is thought to be linked to a lack of habitat diversity within the GTP ROW and surrounds (FER 2012b).

The reason for this lack of habitat diversity can be linked to the highly disturbed condition of habitats supported within the study site, which are most likely attributable to a history of poor land management practises such as broad scale clearing, repetitive regrowth removal, over stocking, overgrazing and inappropriate fire management.

These results are thought to be caused by two primary factors:

- Much of the GTP ROW has been systematically cleared of native vegetation for pasture improvement and those areas that have not been totally cleared, have been thinned and exposed to overgrazing pressures
- Inappropriate fire regimes, with most areas being subjected to too frequent and too hot fire regimes as part of annual pastoral land management practices

These land management practises have not only affected the diversity and abundance of common wildlife, but have had an impact on threatened species which typically have very specific habitat niche requirements. Continual clearing and burning results in gross simplification of habitats, in terms of distribution, diversity and structure. These broad scale activities, leading to habitat simplification have been identified as key threatening processes to threatened species persistence and survival.

As a consequence, most of the habitats within and around the GTP ROW support only marginal habitat value to threatened species generally (FER 2012b). Specific areas, such as site 1, support high habitat values for Powerful owl as these areas support complex and diverse vegetation communities. Some of the listed reptile species may still persist within these areas as they still support complex vegetation communities with good structural diversity and ground habitat diversity. The remainder of the ROW has been so systematically altered for pastoral improvement, only those species that are sufficiently mobile and disturbance tolerant, eg Squatter pigeon, can persist in these areas.

5.3.1 Potential wider distribution of recorded threatened species

Although the presence of several threatened species has been identified in specific areas, it is considered that many of these species have a high potential of occurrence elsewhere within or adjacent to the ROW (FER 2012b). The potential for these species to occur in other areas has been identified through habitat assessments and knowledge of individual species requirements.

Squatter pigeon

This species is considered to be relatively common in central Queensland and is considered likely to occur anywhere within the GTP ROW where suitable habitat exists.

Powerful owl

Whilst not recorded on the mainland during the survey period, it is considered highly likely that Powerful owl also occurs within suitable habitats located in the mainland construction site pad as habitats within this area support attributes required for this species, ie complex woodland habitat structure, presence of trees supporting large hollows (>20 cm) and abundant prey species (eg possums, gliders). As such, management for this species should be included in these mainland sections.

Koala

Whilst not physically recorded during the surveys, characteristic scratch marks of Koala were observed; although, advice from QPWS cites that Koalas have not been sighted within the mainland survey site for approximately 15 years. The precautionary principle should be applied and management for this species should be included within the GTP ROW.

Beach stone-curlew

This species primarily occurs within estuarine intertidal areas. It is not considered likely to occur outside of the areas where it has been recorded.

Black-necked stork

Black-necked stork was observed near KP 408 foraging in a small farm dam. This species is highly mobile and has the capacity to occur within similar habitats throughout the GTP ROW.

Square-tailed kite

This species was recorded near KP 404 (refer to Figure 1.1). It is a highly mobile species and has the capacity to occur within woodlands, forests and timbered watercourses in the local area.

6 Conclusion

As part of the Project, GLNG Operations proposes to construct a high pressure GTP to transport coal seam gas from the CSG fields at Roma and Fairview to a proposed liquefied natural gas facility on Curtis Island. To facilitate the construction of access tracks and a work pad for the Marine Crossing Early Works area, approximately 11.1 ha of clearing is required. This report assesses the potential impact on the environment of the clearing of this study area through the findings of four baseline surveys prepared by RPS and Footprints Environmental Consulting. All four surveys are supported by desktop and field assessments. The results of each survey are summarised below.

The results of the Flora Pre-Clearance for the Construction Site Pad and Access Track survey indicate that (RPS 2012):

- A total of four REs were ground-truthed as occurring in the study area. Of these, two are listed as “Least Concern” / ‘Not of Concern at Present’, and two are listed as ‘Of Concern’
- Five remnant and regrowth vegetation communities were mapped on the study area and subsequently assessed on the ground
- Within a 5 km buffer of the site, there are two threatened ecological communities that potentially occur. However, no threatened ecological communities were observed on either site
- Within a 5 km buffer of the site, there are eleven threatened flora listed under the NC Act that have the potential to occur, and eight species listed under the EPBC Act that have the potential to occur. While two threatened flora species are considered as ‘possible occurrences’ on the site (based on habitat assessments), no threatened flora species were observed. The actual risk to all species is considered low. In addition, the proposed activity is considered unlikely to impact upon MNES listed under the EPBC Act
- Finally, numerous environmental weeds were observed, as well as three weeds listed under the LP Act. The listed weeds are categorised as Class 2, which requires that landholders control those species on their property

The results of the Fauna Pre-Clearance for Crossing Pads and Access Track Survey indicate that (FER 2012b):

- The key fauna habitat in the study area is Lowland Mixed Eucalypt Woodland
- The diversity and abundance of the recorded fauna assemblage of the study site is considered to be quite low. Overall, the species diversity recorded for the Project reflects the highly disturbed nature of the study site. The results are within the range of expected results for the type and extent of fauna habitats on the study site. A high proportion of the species recorded from the survey program are highly adaptable taxa that do not have habitat, niche and/or dietary specialist requirements. A large proportion of this recorded fauna assemblage was comprised of species regarded as common and widespread throughout the wider region
- A total of 16 species were recorded as part of the pre-clearing surveys, seven listed as threatened and nine listed under migratory provisions of the EPBC Act
- Of importance, there are no details of koala records as there were no actual sightings of Koalas during the pre-clearing surveys

The results of the Water mouse Pre-Clearance for Crossing Pads and Access Tracks Survey indicate that (FER 2012a):

- The presence of Water mouse in the Port Curtis is confirmed by both the desktop and field assessments
- Given the extent of the very high quality water mouse habitat supported within the surroundings of the study area and the high mobility of this species, it is considered that the water mouse occurs throughout the Mosquito Creek catchment area, and may also be present further to the east within habitats supported between Kangaroo Island and Friend Point

The results of Migratory Bird Pre-Clearance for Crossing Pads and Access Tracks Survey indicate that (FER 2012c):

- The Kangaroo Island wetland complex supports high quality roosting habitat for shorebirds and marine migratory birds with records for 23 species recorded utilising habitats supported therein
- Of particular note is that nationally significant roost counts were recorded at all Friend Point and Claypan roost sites on Kangaroo Island
- It is strongly recommended that GLNG continue to monitor the bird populations of Kangaroo Island to assess the level of impact to these birds, specifically as the tunnelling option passes close to roost areas and under the intertidal foraging mudflats

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Appendix A Site Flora Species List

Botanical Name	Common Name
Native Flora Species	
<i>Corymbia clarksoniana</i>	Long-fruited bloodwood
<i>Corymbia intermedia</i>	Pink bloodwood
<i>Corymbia tessellaris</i>	Carbeen
<i>Eucalyptus crebra</i>	Narrow-leaved ironbark
<i>Eucalyptus exserta</i>	Messmate
<i>Eucalyptus platyphylla</i>	Poplar gum
<i>Eucalyptus tereticornis</i>	Forest red gum
<i>Ficus opposita</i>	Sandpaper fig
<i>Flindersia australis</i>	Leopardwood
<i>Lophostemon suaveolens</i>	Swamp box
<i>Melaleuca dealbata</i>	Silver-leaved paperbark
<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark
<i>Rhizophora stylosa</i>	Red mangrove
<i>Acacia disparrima</i>	Hickory wattle
<i>Alstonia constricta</i>	Bitterbark
<i>Breynia oblongifolia</i>	Coffee Bush
<i>Capparis mitchellii</i>	Wild orange
<i>Cupaniopsis anacardioides</i>	Tuckaroo
<i>Dodenea lanceolata</i>	Hopbush
<i>Erythrina vespertilio</i>	Batwing coral tree
<i>Lantana camara</i>	Lantana
<i>Mallotus phillippensis</i>	Red Kamala
<i>Petalostigma pubescens</i>	Quinine tree
<i>Planchonia careya</i>	Cocky apple
<i>Psychodra oleifolia</i>	Native Australian Myrtle
<i>Viola banksii</i>	Ivy-leaf Violet
<i>Aristida calycina</i>	Dark wiregrass
<i>Bothriochloa bladhii</i>	Forest bluegrass
<i>Chloris divaricata</i>	Slender chloris
<i>Cymbopogon refractus</i>	Barbwire grass
<i>Cynodon dactylon</i>	Green couch
<i>Cyperus exaltatus</i>	Umbrella sedge
<i>Dianella</i> sp.	Dianella
<i>Dichanthium sericeum</i>	Qld Bluegrass
<i>Eleocharis dulcis</i>	Water chestnut
<i>Entolasa stricta</i>	Wiry panic
<i>Eragrostis</i> sp.	Love grass
<i>Eragrostis lacunaria</i>	Purple lovegrass
<i>Evolvulus alsinoides</i>	Tropical speedwell
<i>Fimbristylus dichotoma</i>	Forked Fimbristylis
<i>Fimbristylus ferruginea</i>	Common finger rush

Botanical Name	Common Name
<i>Gahnia aspera</i>	Rough saw-sedge
<i>Heteropogon contortus</i>	Black spear grass
<i>Imperata cylindrica</i>	Blady grass*
<i>Indigofera</i> sp.	-
<i>Juncus</i> sp.	Rush
<i>Leersia hexandra</i>	Swamp rice grass
<i>Lomandra longifolia</i>	Spiny-headed mat-rush
<i>Ludwigia octovalvis</i>	Water primrose
<i>Panicum effusum</i>	Hairy panic
<i>Paspalidium</i> sp.	Paspalidium
<i>Pterocaulon</i> sp.	-
<i>Phyllanthus virgatus</i>	-
<i>Schoenoplectus</i> sp.	Club rush
<i>Sida cordifolia</i> *	Country mallow
<i>Sporobolus caroli</i>	Fairy grass
<i>Sporobolus virginicus</i>	Marine couch
<i>Themeda triandra</i>	Kangaroo grass
Weed Species	
<i>Asclepias curassavica</i>	Red-head cotton bush
<i>Ageratum conyzoides</i>	Blue Billygoat Weed
<i>Bidens pilosa</i>	Cobblers pegs
<i>Capsicum</i> sp.	Chilli
<i>Carica papaya</i>	Pawpaw
<i>Crotalaria</i> sp.	Rattle pod
<i>Cryptostegia grandiflora</i>	Rubber vine
<i>Chloris virgata</i>	Feathertop Rhodes grass
<i>Emelia sonchifolia</i>	Emelia
<i>Glycine microphylla</i>	Glycine
<i>Gomphocarpus physocarpus</i>	Balloon cotton bush
<i>Gomphrena celosioides</i>	Gomphrena weed
<i>Macroptilium atropurpureum</i>	Siratro
<i>Macroptilium lathyroides</i>	Phasey bean
<i>Megathyrsus maximus</i>	Guinea grass
<i>Melinis repens</i>	Red natal grass
<i>Neonotonia wightii</i>	White glycine
<i>Opuntia stricta</i>	Prickly pear
<i>Passiflora suberosa</i>	Corky passionflower
<i>Passiflora subpeltata</i>	White passion flower
<i>Psidium guajava</i>	Guava
<i>Solanum hispidum</i>	Giant devil's fig
<i>Sida rhombifolia</i>	Arrowleaf sida
<i>Stachytarpheta jamaicensis</i>	Snakeweed

Botanical Name	Common Name
<i>Stylosanthes viscosa</i>	Sticky stylo
<i>Trema tomentosa</i>	Poison peach
<i>Urena lobata</i>	Urena burr
<i>Verbena bonariensis</i>	Purple top verbena

Sources: EPBC Act, NC Act & LPA Act. **Status:** E: Endangered, V: Vulnerable, LC: least concern. LPA Class 2: noxious weed - landholders are required by law to attempt to keep their land free of these species. *: Weed species. **: Tree species but occurring as a shrub on-site.

Appendix B

Ground-truthed Regional Ecosystems



Figure 3.3 - Ground-truthed Regional Ecosystems

Figure 3.3

Project: GLNG Marine Crossing Access Track and Pads








Client: GLNG

Compiled by: HR Date: 21/5/2012

Approved by: BD Date: 21/5/2012

Source: Aerial and construction layout provided by GLNG

Legend

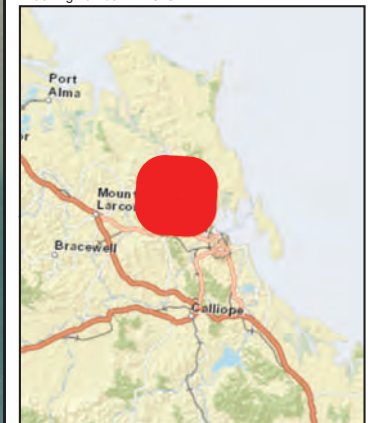
-  Proposed Access Track (25m width)
-  Proposed Work Pads remnant, Of Concern
-  remnant, Least Concern
-  regrowth, Least Concern
-  regrowth, Of Concern
-  non-remnant, Least Concern
-  non-rem, N/A

0 0.25 0.5 1 km

Datum: GDA94



Tracking number: 112920



Appendix C

Recorded Threatened Species

Table C.1 Recorded threatened species

ID	Latitude	Longitude	Species Identifier	Number of Animals
1	-23.7678574	151.1423764	Beach Stone-curlew 01	1
2	-23.75295614	151.1531316	Beach Stone-curlew 02	1
3	-23.74437911	151.1898306	Beach Stone-curlew 03	2
4	-23.7460559	151.1903764	Beach Stone-curlew 04	1
5	-23.74847735	151.1766783	Beach Stone-curlew 05	1
6	-23.76284117	151.1368096	Beach Stone-curlew 06	1
7	-23.75905691	151.1311757	Beach Stone-curlew 07	1
8	-23.77164988	151.133982	Beach Stone-curlew 08	1
9	-23.76062265	151.1329044	Beach Stone-curlew 09	1
10	-23.771403	151.13471	Black-necked Stork 01	1
11	-23.75290861	151.152936	Little Tern 01	1
12	-23.76184858	151.2092543	Powerful Owl 01	1
13	-23.7531516	151.0961982	Square-tailed Kite 01	1
14	-23.76815328	151.1369448	Squatter Pigeon 01	3
15	-23.77125291	151.1368593	Squatter Pigeon 02	3
16	-23.76700027	151.1368838	Squatter Pigeon 03	2
17	-23.75437142	151.1198601	Squatter Pigeon 04	1
18	-23.75948866	151.1182303	Squatter Pigeon 05	1
19	-23.75999987	151.12982	Squatter Pigeon 06	1
20	-23.75885457	151.0336872	Squatter Pigeon 07	2
21	-23.78625895	151.0510168	Squatter Pigeon 08	3
22	-23.76212871	151.1324283	Squatter Pigeon 09	6
23	-23.76717377	151.1345645	Squatter Pigeon 10	1
24	-23.76432183	151.1334124	Squatter Pigeon 11	2
25	-23.76090822	151.1304738	Squatter Pigeon 12	1
26	-23.77116297	151.1368659	Squatter Pigeon 13	2
27	-23.86795308	151.0310655	Squatter Pigeon 14	2
28	-23.86843555	151.0302437	Squatter Pigeon 15	4
29	-23.75858065	151.0487322	Squatter Pigeon 16	2
30	-23.75877159	151.0331373	Squatter Pigeon 17	1
31	-24.02536254	150.877083	Squatter Pigeon 18	2
32	-23.74814778	151.105226	Squatter Pigeon 19	1
33	-24.01463346	150.9340918	Squatter Pigeon 20	2
34	-23.76299598	151.135655	Squatter Pigeon 21	2
35	-24.01463907	150.9317273	Squatter Pigeon 22	1
36	-24.01318599	150.9448809	Squatter Pigeon 23	11
37	-24.0887009	150.8317516	Squatter Pigeon 24	2
38	-24.02924336	150.8698635	Squatter Pigeon 25	5

ID	Latitude	Longitude	Species Identifier	Number of Animals
39	-23.87923144	151.0168294	Squatter Pigeon 26	3
40	-24.05883249	150.8477346	Squatter Pigeon 27	4
41	-23.99675486	150.9738725	Squatter Pigeon 28	5
42	-24.07832469	150.8371269	Squatter Pigeon 29	1
43	-23.76296204	151.1356446	Squatter Pigeon 30	1
44	-24.07849191	150.8376353	Squatter Pigeon 31	1
45	-24.02918679	150.870008	Squatter Pigeon 32	1
46	-23.87835226	151.0154652	Squatter Pigeon 33	2
47	-23.74993111	151.1798696	Raptor Nest possibly White-bellied Sea-eagle	