Reconnaissance Flora & Vegetation Survey
Basic Vertebrate Fauna Survey
Lake MacLeod Solar Salt Project

Prepared for Lake MacLeod Pty Ltd
11 August 2025



Document Status						
Rev No.	Authors	Reviewer/s	Date	Approved for Issue		
				Name	Distributed To	Date
1	J.Waters	D.Brearley	12/06/25	D.Brearley	T.Mitchell	08/07/25
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EXECUTIVE SUMMARY

Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned to undertake a reconnaissance flora and vegetation survey and basic vertebrate fauna survey of six survey areas, herein referred to as the 'study area', at the Lake MacLeod Solar Salt Project located approximately 50 km north of Carnarvon in the Gascoyne Region of Western Australia. The field survey was completed by a Principal Botanist, Principal Ecologist and Ecologist from Onshore Environmental over six days in May 2025.

A total of 124 plant taxa from 41 families and 90 genera was recorded during the reconnaissance flora and vegetation survey. A total of 21 vegetation types were mapped and described within the six survey areas. Four flora species of conservation significance were recorded from the Borrow Pit 13 study area:

- *Indigofera* cf. *oraria* (Priority 1 and range extension);
- *Stenanthemum divaricatum* (Priority 3);
- *Olax aurantia* (range extension); and
- *Eriachne* aff. *obtusa* (species of interest).

Dominant vegetation types included Scrub of *Rhagodia preissii* subsp*. obovata, Rhagodia latifolia* subsp*. latifolia, Pimelea microcephala* and *Acacia sclerosperma* on sandplain, chenopod shrublands on calcrete outcrops and plains, and *Tecticornia* (samphire) low shrubland on localised areas of saltmarsh. Vegetation was generally in good to poor condition with degrading factors uncluding the presence of weed species, grazing by goats and sheep and close proximity to roads and infrastructure (edge effects).

A total of 21 vegetation types occurring on four broad landform types were mapped from the study area. None of these were aligned with Commonwealth or Western Australian listed Threatened Ecological Communities (TECs), or Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority Ecological Communities (PECs) documented from the Gascoyne Bioregion. Vegetation condition was predominantly rated as *good* to *poor* (71% of the study area) with the major disturbances including grazing by domestic stock and edge effects along cleared road and access track corridors, mining infrastructure and road maintenance activities.

A total of four fauna habitat types occurred within the study area: *Acacia* shrublands on sandplains and sand dunes, coastal hills and sand dunes, limestone plains and *Tecticornia* saltmarshes. A total of 67 fauna species were recorded from the field survey including 51 birds, nine mammals and seven reptiles. One species of conservation significance was recorded adjacent to the study area: Glossy Ibis (listed as Migratory under the EPBC Act). This species was recorded from a drainage channel 50 metres (m) outside the Water Dam 2 survey area. Three other conservation significant species were considered likely to occur within the survey areas:

- Gnaraloo Mulch Slider (*Lerista haroldi*, Priority 1);

- Fork-Tailed Swift (*Apus pacificus*, Migratory); and
- Osprey (*Pandion haliaetus*, Migratory).

The Gnaraloo Mulch Slider had previously been recorded from within the Borrow Pit 13 survey area and was likely to occur within the *Acacia* shrublands on sandplains and sand dunes habitat occurring at the Borrow Pit 13, Borrow Pit 10 and Borrow Pit 11 survey areas. The Fork-tailed Swift and Osprey were likely to fly over the study area. Large stick nests possibly utilised by Ospreys were observed adjacent to two of the survey areas.

A number of migratory shorebirds may occasionally utilise the *Tecticornia* saltmarsh habitat within the Water Dam 2 and Borrow Pit 10 and Borrow Pit 11 survey areas flowing rainfall events.

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1.0 INTRODUCTION

1.1 Preamble

Onshore Environmental was commissioned by Leichhardt to undertake a biological survey at the Lake MacLeod Solar Salt Project situated approximately 50km north of Carnarvon in the Gascoyne Region of Western Australia (Figure 1). Salt and gypsum produced at the site are shipped from the nearby Cape Cuvier Port (Figure 1).

In May 2025 a reconnaissance flora and vegetation survey and a basic vertebrate fauna survey was completed over six survey areas in order to provide information for a native vegetation clearing permit (NVCP). Ground disturbance is proposed at the site for road maintenance (two areas), construction of temporary borrow pits (three areas) and expansion of a water dam (one area) (Table 1, Figure 2).

Table 1 Summary of the six survey areas within the study area.

Study Area	Area (ha)
Borrow Pit 10	290.73
Borrow Pit 11	22.94
Borrow Pit 13	36.69
Road Maintenance 1	2.34
Road Maintenance 2	9.54
Water Dam 2	34.68

1.2 Survey Objective

A biological survey of the six survey areas was undertaken by Onshore Environmental in May 2025. The reconnaissance flora and vegetation assessment aimed to:

- Describe and map vegetation types and vegetation condition;
- Identify locations for conservation significant flora species; and
- Determine similarity of vegetation types with Commonwealth and Western Australian listed Threatened Ecological Communities (TECs) and Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority Ecological Communities (PECs).

The basic vertebrate fauna assessment aimed to:

- Describe and map fauna habitat types;
- Undertake targeted searches to determine the presence of conservation significant fauna species and/or suitable habitat for conservation significant fauna species likely to occur; and
- Undertake opportunistic and systematic sampling to record fauna species utilising the study area.

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Figure 1: Location of the study area



700000 750000 800000 850000

7400000 7350000 7300000 7250000 7200000

GNARALOO
MINILYA
CAPE CUVIER
LAKE MACLEOD
QUOBBA
North West Coastal Hwy
Leichhardt
Salt Operations
BOOLATHANA
Blowholes Rd
Carnarvon-Mullewa Rd
CARNARVON

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0 10 20 30 km

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Document Control	
Date:	4th June 2025
Status:	Final
Figure:	1
Sheet Size:	A4
File Reference:	LM_Figure1_location

Datum: GDA 2020
Projection: MGA Zone 50

Data sources: Data WA - Native Vegetation Extent (DPIRD-005), Roads (Simplified) (LGATE-195), Legislated Lands and Waters (DBCA-011), Geographic Names (GECNOMA) (LGATE-013), Geoscience Australia - Surface Hydrology Lines (Regional), Surface Hydrology Polygons (Regional)



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Figure 2: Location of the six survey areas, referred to as the study area

Legend

Study Areas

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Document Control	
Date:	4th June 2025
Status:	Final
Figure:	2
Sheet Size:	A4
File Reference:	LM_Figure1a_study_areas

Datum: GDA 2020
Projection: MGA Zone 50

Data sources: Data WA - Native Vegetation Extent (DPIRD-005), Roads (Simplified) (LGATE-195), Legislated Lands and Waters (DBCA-011), Geographic Names (GEONOMA) (LGATE-013), Geoscience Australia - Surface Hydrology Lines (Regional), Surface Hydrology Polygons (Regional)

2.0 REGIONAL CONTEXT

2.1 Climate

The climate of the Carnarvon area is arid to semi-arid with annual rainfall approximating 200 mm across the region. Summer temperatures are hot with the maximum summer temperature for Carnarvon averaging 32.6°C during February. Winter temperatures are mild with the minimum winter average dropping to 10.9°C during July (BOM 2025). Average rainfall for Carnarvon Airport is 220 mm with the highest totals generally occurring in winter (averaging >40 mm in June and July). Quobba Station, situated approximately 10 km west of the Water Dam 2 survey area has an average annual rainfall of 208 mm, however rainfall data is incomplete for 2025.

Monthly rainfall totals at Carnarvon Airport prior to the May 2025 field survey period were below average with 3.9 mm recorded in January and 10 mm recorded in May (BOM 2025, Figure 3). Seasonal conditions at the time of survey were very dry.

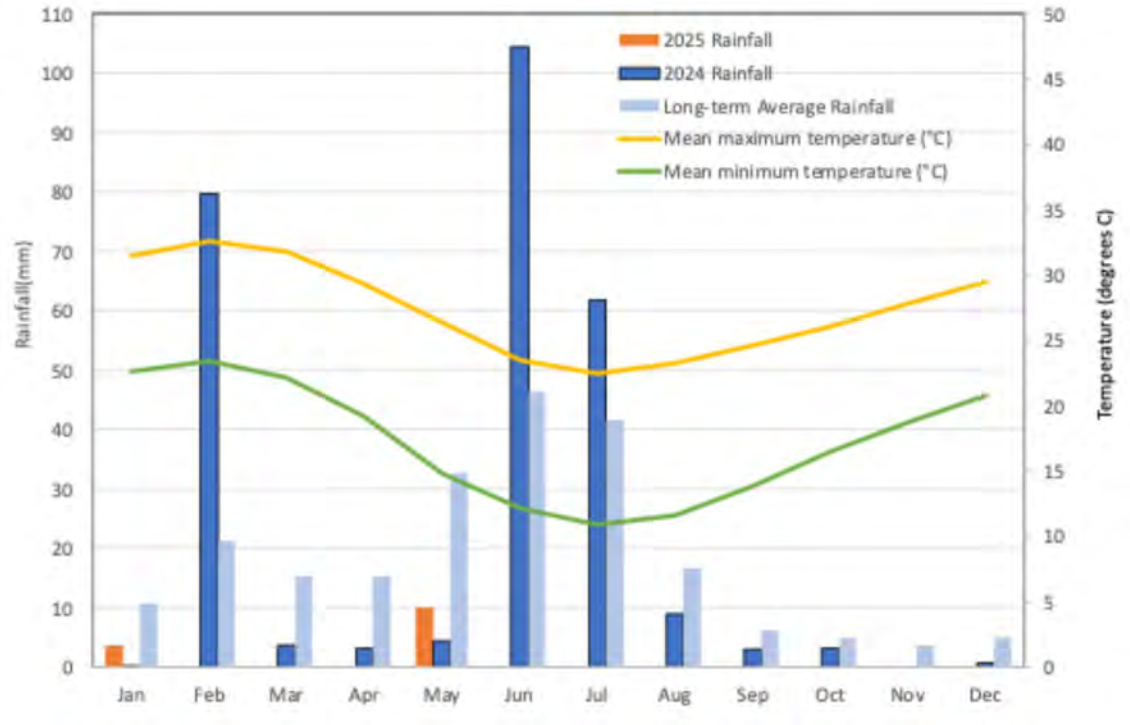


Figure 3 Rainfall and temperature data from the Carnarvon Airport Weather Station (Bureau of Meteorology 2025).

2.2 Biogeographic Regions

The Interim Biogeographic Regionalisation for Australia (IBRA) describes a system of 89 'biogeographic regions' (bioregions) and 419 subregions covering the entire Australian continent (IBRA7). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna. The study area occurs in the Wooramel subregion of the Carnarvon Bioregion.

The Carnarvon Bioregion covers 83,747 km^2 of gently undulating landscape supporting vegetation of *Acacia* shrublands and saltbush/bluebush (ACRIS Management Committee and Bastin 2008). The Wooramel subregion covers the alluvial plains of the Gascoyne, Minilya and Wooramel Rivers and includes Lake MacLeod and the Kennedy Range (Desmond and Chant 2001). Coastal areas of the bioregion are described as "saline alluvial plains with samphire and saltbush low shrublands'.

2.3 Geology and Soils

Geology of the Carnarvon Bioregion is characterised by quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata (Desmond and Chant 2001). Tille (2006) has completed soil-landscape mapping across the arid interior and range lands of Western Australia. The study area occurs within the Carnarvon Province consisting of sandplains, alluvial plains, stony plains, hills and mesas occurring on Cainozoic deposits over sedimentary rocks of the southern Carnarvon Basin (Tille 2006). The study area is situated on large alluvial deposits of the ancient deltas of the Lyndon, Minilya, Gascoyne and Wooramel Rivers. The Carnarvon Province is divided in to ten zones with the study area occurring within the Lake MacLeod Coastal Zone (5,450 km^2) which stretches between Carnarvon and Warroora Station. The zone is described as "Lake bed, saline flats and calcrete plains (with some sandplains and dunes) on marine shoreline and aeolian deposits and marine limestone of the Carnarvon Basin. Salt lakes soils with red deep sands and some calcareous loamy earths and red deep sandy duplexes. Bare salt-lake with halophytic shrublands, spinifex grasslands and acacia scrub."

2.4 Flora and Vegetation

The study area is located within the Carnarvon region, which is part of the Eremaean Botanical Province (Beard 1990). The original vegetation mapping was undertaken by Beard (1990) at a scale of 1:1,000,000 and was refined by Shepherd *et al.* (2002). There are three vegetation associations described from within the study area (Government of Western Australia 2019):

- Coastal Dunes 95: Hummock grasslands, shrub steppe; acacia and grevillea over *Triodia basedowii*;
- Coastal Dunes 328: Succulent steppe with scrub; waterwood and *Acacia sclerosperma* over saltbush samphire; and
- Coastal Dunes 329; Shrublands; dwarf waterwood (*Acacia coriacea*) shrubs on recent dunes.

While the Pre-European extent for each vegetation association is close to 100%, the proportion of each association occurring within formal or informal conservation reserves is generally low (Table 2).

Table 2 Pre-European extent of vegetation associations occurring within the study area (Government of Western Australia 2019).

Vegetation Association	System	Description	Pre-European Extent (ha)	% Remaining	% Current Extent in Class I-IV Reserves
95	Coastal Dunes	Hummock grasslands, shrub steppe; *Acacia* and *Grevillea* over *Triodia basedowii*	1,224,626.57	99.92	1.50
328	Coastal Dunes	Succulent steppe with scrub; waterwood & *Acacia sclerosperma* over saltbush & samphire	10,236.89	97.24	
329	Coastal Dunes	Shrublands; dwarf waterwood (*Acacia coriacea*) shrubs on recent dunes	27,383.07	96.17	

2.5 Land Systems

The Department of Agriculture (now the Department of Primary Industry and Regional Development) has conducted inventory and condition surveys of rangelands across Western Australia using an integrated survey method involving the land system approach to rangeland description evaluation. Local rangeland surveys cover the Gascoyne (Wilcox and McKinnon 1974) and Carnarvon Basins (Payne *et al.* 1987). Five land systems intersected the study area (Table 3, Figure 5) broadly associated with sandy plains (Brown and Cardabia land systems), coastal dunes (Coast land system) and saline plains (MacLeod and Warroora land systems).

Table 3 Land systems occurring within the study area.

Land System	Description
Brown	Sandy plains with sparse longitudinal dunes, supporting tall *Acacia* shrublands.
Cardabia	Undulating sandy plains with linear dunes, minor limestone plains and low rises, supporting mainly soft spinifex hummock grasslands with scattered acacias and other shrubs.
Coast	Large coastal dunes (some unvegetated) with narrow swales, limestone plains, wave-cut platforms and beaches, supporting diverse tall and low shrublands.
MacLeod	Broad saline plains, with sandy banks and low rises above saline slopes and bare mudflats; bare surfaces and low shrublands of samphire and saltbush.
Warroora	Flat to gently sloping saline alluvial plains, with minor areas of sand and limestone, supporting tall acacia shrublands and low shrublands of saltbush, bluebush and samphire.



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Figure 4: Beard (1981) vegetation associations represented within the study area

Legend

- Study Area

Beard Vegetation Associations

- COASTAL DUNES_328
- COASTAL DUNES_329
- COASTAL DUNES_95
- GASCOYNE MARSHES_125
- GASCOYNE MARSHES_205
- GASCOYNE MARSHES_308
- GASCOYNE MARSHES_325
- LAKE MACLEOD_125
- LAKE MACLEOD_325

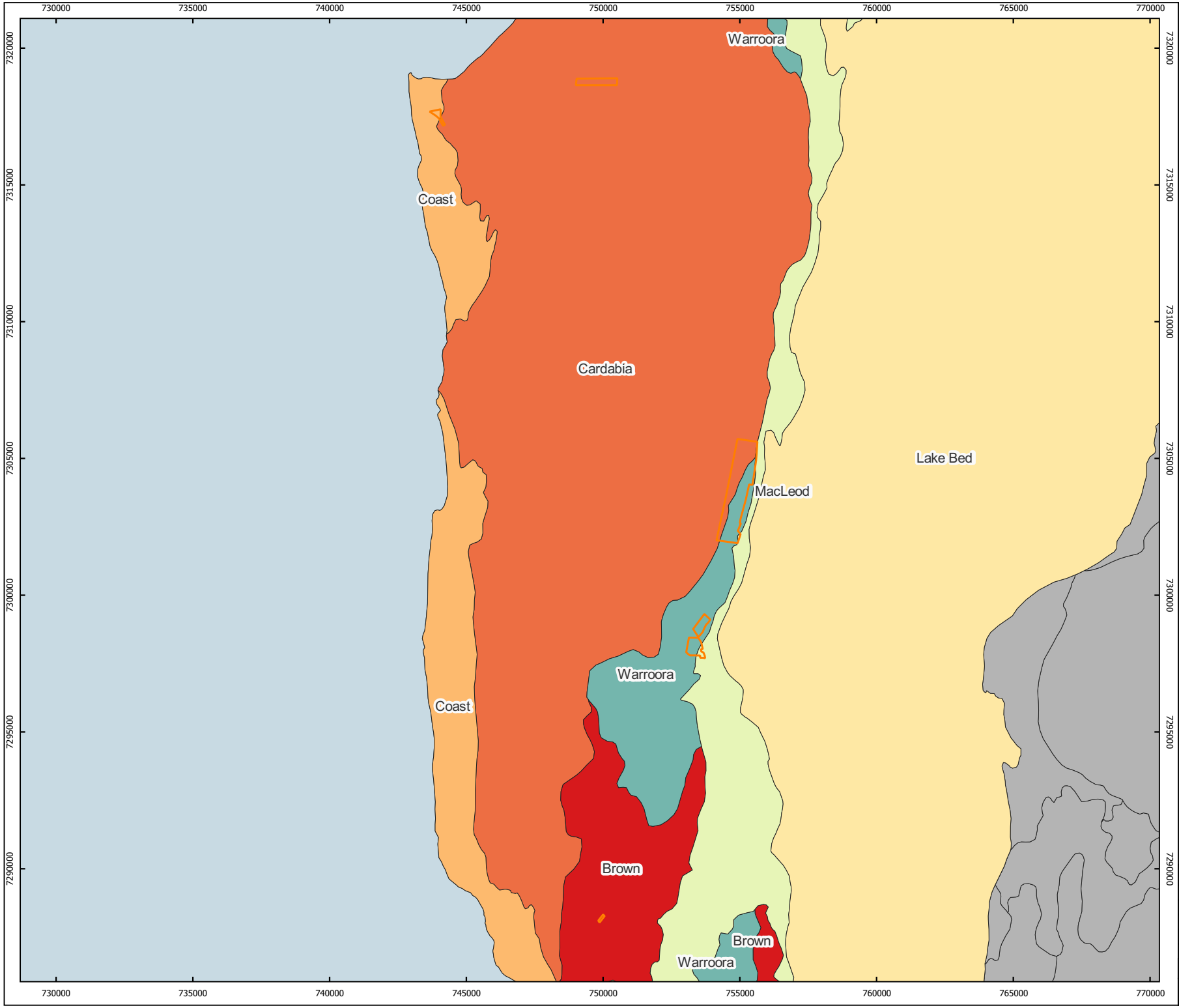
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Document Control	
Date:	4th June 2025
Status:	Final
Figure:	4
Sheet Size:	A4
File Reference:	LM_Figure4_beard

Datum: GDA 2020
Projection: MGA Zone 50

Data sources: Data WA - Pre_European_Vegetation_DPIRD_006



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Figure 5: Land Systems occurring within the study area

Legend

- Study Area

Land System

- Brown Land System
- Cardabia Land System
- Coast Land System
- Lake Bed Land System
- MacLeod Land System
- Warroora Land System

0 2 4 6 km

1:180,000

Document Control	
Date:	4th June 2025
Status:	Final
Figure:	5
Sheet Size:	A4
File Reference:	LM_Figure5_land_systems

Datum: GDA 2020
Projection: MGA Zone 50

Data sources: Data WA - Rangelands_DPIRD_063

3.0 METHODOLOGY

3.1 Legislation and Guidance Statements

The reconnaissance flora and vegetation survey and basic vertebrate fauna survey were carried out in a manner that was compliant with EPA requirements for environmental surveying and reporting in Western Australia:

- Statement of Environmental Principles, Factors and Objectives (EPA 2020a);
- Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020b);
- Environmental Factor Guideline Terrestrial Fauna (EPA 2016a);
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b); and
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016c).

3.2 Desktop Assessment

3.2.1 Literature Review

A review of all relevant publicly available literature for flora and fauna surveys in close proximity to the study area was undertaken, including a search of the Department of Water and Environmental Regulation's Index of Biodiversity Surveys for Assessment (DWER 2025). Results from these surveys are described in more detail in Section 4.1.1 and 4.1.2.

An evaluation of flora and fauna species, and vegetation and fauna habitats known from the locality included reviewing previous surveys that were publicly available to provide an understanding of dominant flora species and regional and local vegetation associations. The literature review consisted of the following:

- Beard (1990) Plant Life of Western Australia;
- Burbidge, McKenzie and Harvey (2000) A biogeographic survey of the southern Carnarvon Basin, Western Australia: background and methods.

At the local scale a number of previous surveys have been completed within close proximity to the study area. These surveys were reviewed to provide regional context, and to identify vegetation types, habitats and species of conservation significance with the potential to occur within the study area.

3.2.2 Database Searches

The desktop assessment included searches of several databases relating to conservation significant flora and fauna previously collected or described within, or in close proximity to, the study area. For this report the search was extended beyond the study area to place environmental values into a local and regional context. The following databases were searched:

- DBCA Threatened and Priority Fauna and Flora database search (50 km radial search) (DBCA 2025a);
- DBCA's TEC, PEC and Environmentally Sensitive Areas (ESAs) database (50 km radial search) (DBCA 2025b);
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database (10 km radial search) (DCCEEW 2025);
- Atlas of Living Australia (ALA) spatial database search of the study area boundary (ALA 2025); and
- International Union for Conservation of Nature (IUCN) database (IUCN 2025).

The results from the above database searches and the literature review were compiled to provide a list of conservation significant flora and fauna species that could potentially occur within or surrounding the study area.

3.2.3 Assessment of Likelihood of Occurrence in the Study Area

A list of conservation significant species occurring within a 50 km radius of the study area was compiled from the above database searches and literature review. The likelihood of each flora or fauna taxa occurring within the study area was assessed using a set of rankings and criteria (as described in Table 4). The criteria are based on presence of suitable landform (inferred from aerial imagery with contours overlayed, and from knowledge of the adjacent areas) and distance to known records.

Table 4 Ranking system used to assign the likelihood of conservation significant flora species occurring within the offset area.

Rank	Criteria
Recorded	The species has been recorded in the study area.
Likely to occur	The species has been recorded from a landform which is present within the study area, and previous records occur within a 10 km radius.
Possible to occur	The species has been recorded from a landform which is present within the study area, and previous records occur within a 10-20 km radius.
Unlikely to occur	The landform from which the species has previously been recorded is absent within the study area, and/or there are no previous records within a 20 km radius of the study area.

The likelihood of each conservation significant fauna species occurring within the study area was assessed based on habitat availability, the age, proximity and number of previous records, previous assessments and the regional occurrence of the species. Habitat availability and suitability was assessed based on aerial imagery and previous knowledge of the study area and surrounds.

3.2.4 Assessment of Conservation Significance

The conservation significance of flora, fauna and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

International Level:

- IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1); and
- International Conventions: Migratory taxa listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Commonwealth Level:

- EPBC Act: The DCCEEW lists Threatened species, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists species that are considered to be of conservation significance under one of six categories (Appendix 1).

State Level:

- Biodiversity Conservation (BC) Act: At a State level, native flora and fauna species are protected under the BC Act – Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations (Appendix 1); and
- DBCA Priority list: DBCA produces a list of Priority species that have not been assigned statutory protection under the BC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 1).

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.

3.3 Field Survey Methodology

3.3.1 Timing and Personnel

The field survey was completed by Principal Botanist Dr Jerome Bull, Principal Ecologist Ms Jessica Waters and Ecologist Mr Thomas Mott between the 13th and 18th May 2025.

3.3.2 Survey Methodology

The field survey involved opportunistic sampling using relevé sites to confirm vegetation type boundaries and provide site descriptions for points of interest. The study area was ground truthed at approximately 250 m intervals to describe and map vegetation types, fauna habitats, vegetation condition, and identify opportunistic records for conservation significant flora and fauna species. Specific survey techniques are described further below.

3.3.3 Vegetation Type and Habitat Mapping

The classification of vegetation types within the study area follows the height, life form and density classes of Aplin (see Appendix 2). This is largely a structural classification suitable for

broader scale mapping but takes all ecologically significant strata into account. Vegetation type mapping utilised high-resolution aerial photography at a scale of 1:5,000, with definition of vegetation polygons based on contrasting shading patterns. Ground-truthing of the study area was completed during the field survey to confirm vegetation polygons and boundaries. Where ground truthing revealed new vegetation types not observable from a prior analysis of aerial photography, these were described and demarcated accordingly. The field survey also provided vegetation descriptions for selected vegetation polygons to confirm dominant structural layers and associated plant taxa. Relevé points were overlaid on aerial photography and associated flora and vegetation data was used to update vegetation type descriptions for the individual polygons. Vegetation condition was determined using a recognised rating scale (based on Keighery 1994, see Appendix 3).

The fauna habitat mapping was based on vegetation type mapping completed during the survey and also utilised high-resolution aerial photography. Ground-truthing of the study area further aided in definition of fauna habitat boundaries.

3.3.4 Targeted Surveys for Conservation Significant Species

Ground truthing conducted across the study area provided an opportunity to record opportunistic locations for conservation significant species and undertake closer examination of specific landforms where conservation significant species would be expected to occur. Targeted searches for species of conservation significance were completed in areas where it was anticipated that significant flora or fauna might occur based on habitat preferences (according to the database searches) and from previous knowledge of the local flora, vegetation and habitats. Habitats likely to support conservation significant species were intensively targeted during the field survey due to their increased likelihood to support conservation significant species.

3.3.5 Vouchering

Voucher specimens were taken for flora taxa where the identification could not be confirmed in the field. Taxonomy was completed by Dr Jerome Bull, and use was made of the Western Australian Herbarium.

3.3.6 Motion Sensor Cameras and Audio Recorders

A total of ten motion sensor cameras with infrared illumination to 30 m (Browning Spec Ops Elite HP5 model) were placed within representative habitat areas and habitat features potentially supporting conservation significant fauna species. Cameras were generally positioned with a southerly aspect to avoid direct sun exposure onto the camera lens, facing the ground, and, where appropriate, directed towards logs, rock piles and other significant habitat features. Camera locations were baited with universal bait (a mixture of sardines, fish oil, rolled oats and peanut paste) to attract a variety of fauna species. The ten camera traps were deployed for five days (Table 5, Figures 6a-6f).

Additionally, a Song Meter Micro 2 recorder was deployed at two locations within the study area to record bird calls. The recorder was programmed to record for three hours at sunrise and sunset.

Table 5 Locations for camera traps and audio recorders within the study area.

Sample Type	Deployed	Retrieved	No. Days	Easting	Northing
Audio recorder	13/5/2025	16/5/2025	3 days	749384	7318776
Audio recorder	16/5/2025	18/5/2025	2 days	755497	7305231
Camera	13/5/2025	18/5/2025	5 days	744014	7317582
Camera	13/5/2025	18/5/2025	5 days	753369	7298245
Camera	13/5/2025	18/5/2025	5 days	749901	7318739
Camera	13/5/2025	18/5/2025	5 days	749876	7288215
Camera	13/5/2025	18/5/2025	5 days	755567	7305261
Camera	13/5/2025	18/5/2025	5 days	754592	7302911
Camera	13/5/2025	18/5/2025	5 days	749371	7318808
Camera	13/5/2025	18/5/2025	5 days	753094	7297935
Camera	13/5/2025	18/5/2025	5 days	755320	7304038
Camera	13/5/2025	18/5/2025	5 days	753498	7298589



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6a: Samping locations within the study area

Legend

- Study Area

Sample Sites

- Camera
- Fauna Observations
- Flora Observations
- Track File

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6b: Samping locations within the study area

Legend

- Study Area

Sample Sites

- Audio recorder
- Camera
- Fauna Observations
- Flora Observations
- Track File

0 0.5 1 km

1:25,000

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Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50



LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6c: Samping locations within the study area

Legend

- Study Area

Sample Sites

- Audio recorder
- Camera
- Fauna Observations
- Flora Observations
- Track File

0 100 200 300 m

1:10,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50



LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6d: Samping locations within the study area

Legend

- Study Area

Sample Sites

- Camera
- Fauna Observations
- Flora Observations
- Track File

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50



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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6e: Samping locations within the study area

Legend

- Study Area

Sample Sites

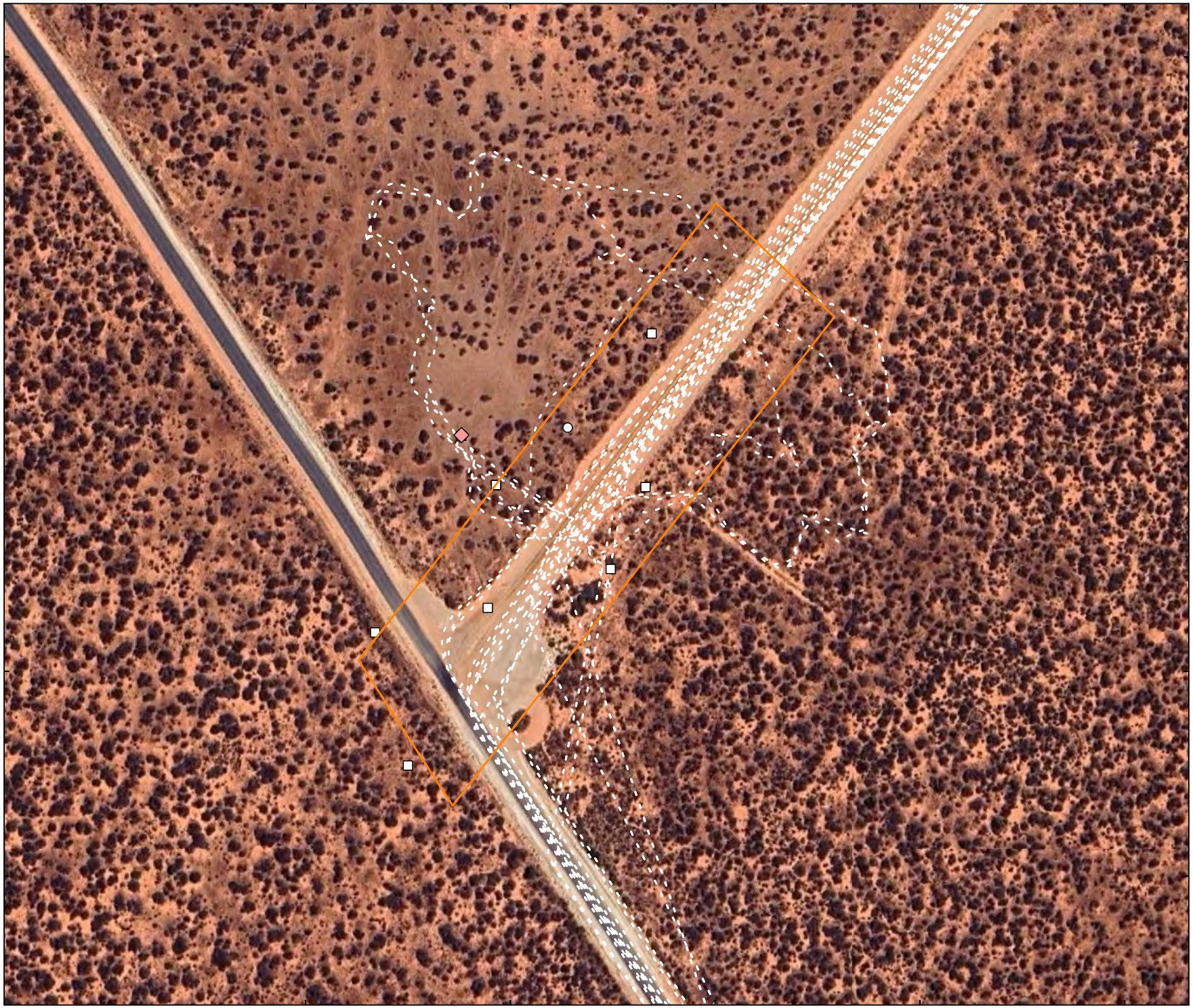
- Camera
- Fauna Observations
- Flora Observations
- Track File

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 6f: Samping locations within the study area

Legend

- Study Area

Sample Sites

- Camera
- Fauna Observations
- Flora Observations
- Track File

0 50 100 m

1:2,500

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	6
Sheet Size:	A4
File Reference:	LM_Figure5_sampling

Datum: GDA 2020
Projection: MGA Zone 50

3.3.7 Survey Constraints

The EPA Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2016b) list seven potential limitations that field surveys may encounter. These limitations are addressed in Table 6.

Table 6 Relevance of limitations, as identified by EPA (2016a), to the flora and vegetation survey.

Constraint	Relevance
Availability of contextual information at a regional and local scale	NOT A LIMITATION The study area occurs within the Wooramel subregion. There are a number of publicly available flora and vegetation survey reports completed within the area and these provide an excellent local database.
Proportion of flora recorded and/or collected, any identification issues	**LIMITATION** The targeted flora survey was undertaken during May 2025 within the recommended survey period for the Eremaean Botanical Province. However the survey was conducted under dry seasonal conditions and as a result, much of the annual and ephemeral flora component was absent, reducing the proportion of total flora recorded.
Survey timing, rainfall, season of survey	**LIMITATION** The field survey was completed within the period recommended by the EPA however dry seasonal conditions likely resulting in reduced numbers of annual and ephemeral flora taxa being identified.
Disturbance that may have affected the results of the survey such as fire, flood or clearing	NOT A LIMITATION There were no disturbances recorded within the study area that influenced survey outcomes. Disturbances included grazing, presence of weeds, infrastructure roads and tracks. Disturbances did not impact on the ability to complete the field survey.
Was the appropriate area fully surveyed (effort and extent)	NOT A LIMITATION A Principal Botanist, Principal Ecologist and Ecologist spent six days covering the entire study area searching for conservation significant flora species and mapping vegetation types.
Access restrictions within the survey area	NOT A LIMITATION The study area was accessed on foot, noting that vegetation mapping was facilitated by high-resolution aerial photography. Access did not pose any restrictions to undertaking the field survey.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	NOT A LIMITATION The Principal Botanist working on the survey (Dr Jerome Bull) has more than 20 years' experience working in the region and across Western Australia.

The EPA Technical Guidance for fauna surveys (EPA 2020b) list potential limitations that field surveys may encounter. Limitations associated with the vertebrate fauna survey are addressed in Table 7.

Table 7 Relevance of limitations, as identified by EPA (2020b), to the vertebrate fauna survey.

Variable	Impact on Survey Outcomes
Availability of data and information	NOT A LIMITATION The desktop searches provided an extensive species list, background information and regional context for the study area. Several fauna surveys have been completed in close proximity to the study area. No significant issues with the reliability or accuracy of the desktop searches or previous surveys were identified. However, it is acknowledged that there may be errors in the data presented from these sources. Where required species lists from previous surveys and database searches were reviewed and nomenclature and conservation significance were updated.
Experience levels	NOT A LIMITATION The personnel who executed the survey are practitioners suitably qualified in their respective fields; Ms Jessica Waters (Principal Ecologist >ten years' experience) was project lead and has undertaken numerous surveys within the Bioregion and Western Australia.
Scope (fauna groups sampled)	NOT A LIMITATION All allocated tasks were achieved during the survey, with camera surveys, targeted searches and ground truthing undertaken.
Timing, weather, and season.	**MINOR LIMITATION** The basic fauna survey was undertaken during May 2025. Seasonal conditions were dry and additional surveys undertaken after significant rainfall would likely result in higher numbers of fauna species being recorded. The fauna observed within the study are representative of a basic survey with no trapping or detailed systematic surveying undertaken.
Disturbance to site which may affect survey results	NOT A LIMITATION None of the disturbances within the study area were a constraint to the completeness of the survey.
Adequacy of the survey intensity and proportion of survey achieved	NOT A LIMITATION Tasks completed from the scope of works included ground truthing to record opportunistic observations of birds, reptiles and mammals, map habitat types and identify habitats likely to support fauna of conservation significance. Infra-red motion sensor camera traps and acoustic recorders provided the ability to further increase total fauna, particularly for nocturnal species.
Remoteness and/or access	NOT A LIMITATION There were no access restrictions experienced during the survey. The study area was accessible on foot.
Proportion of fauna identified, recorded or collected	NOT A LIMITATION The targeted survey represented a snapshot of the fauna present over the survey period supplemented by camera trapping/acoustic recordings and did not include a formal trapping program. There are likely to be additional fauna species present following rainfall events.
Problems with data and analysis, including sampling biases	NOT A LIMITATION There were no problems encountered with the collection or analysis of survey data.

4.0 RESULTS

4.1 Literature Review

4.1.1 Previous Flora and Vegetation Surveys

The results from previous flora surveys completed in close proximity to the study area are summarised below and presented in Table 8. A multi-disciplinary study was conducted in the 1990s across the Carnarvon Basin extending approximately from Cape Range, near Exmouth south to the Murchison River and inland to the Kennedy Range (Burbidge *et al.* 2000). The study aimed to undertake surveys of the main environments present and determine biophysical factors influencing the distribution of flora and fauna taxa in order to inform conservation planning. The Carnarvon Region is described as supporting extensive alluvial plains dissected by the ephemeral Minilya, Gascoyne and Wooramel Rivers with vegetation of Snakewood (*Acacia xiphophylla*), Bowgada (*Acacia linophylla*), *Eremophila*, *Senna* and *Atriplex*. A total of 63 terrestrial sampling locations were surveyed utilising 30 m by 30 m quadrats. The survey recorded 2,133 plant taxa with the highest species diversity in the south-western part of the study area (Burbidge 2000). The fringes of Lake MacLeod were noted as supporting rich samphire communities. A total of 88 weed species were also recorded with Buffel Grass (*Cenchrus ciliaris*) identified as a serious environmental weed within the area.

Multiple surveys in the vicinity of the study area have focused on the wetland ecosystem of Lake MacLeod. Phillips *et al.* (2005), Kavazos and Horwitz (2016), and Ellison and Simmonds (2003) surveyed mangrove communities at Lake MacLeod. The Lake MacLeod system, covering approximately 2000 km^2 is predominantly comprised of dry lakebed periodically inundated by floods of the Minilya and Lyndon Rivers (Phillips *et al*. 2005). The north-western part of the Lake supports an area known as the 'Northern Ponds,' a permanent saline wetland fed by underground seawater seepage from the coast 18 km away. The Northern Ponds are proposed for Ramsar listing and support the largest inland area of Grey Mangroves (*Avicennia marina*) in the world (Phillips *et al.* 2005). The Department of Environment and Conservation (DEC) (2009) surveyed littoral vegetation fringing the Northern Ponds recording a total of eight species with vegetation dominated by closed samphire shrubland. Species recorded included *Avicennia marina, Tecticornia peltata, T. pruinosa, T. pergranulata, T. halocnemoides, T. auriculata, T.* sp. indet and *Muellerolimon salicorniaceum.* The Northern Ponds are located approximately 15 km north-east of the northern-most areas surveyed by Onshore Environmental in 2025.

Three previous flora and vegetation surveys have been conducted for NVCP as part of approvals for the Lake MacLeod Solar Salt Project under previous ownership by Dampier Salt. These surveys are listed below and the results presented in Table 8:

- Biota Environmental Sciences Pty Ltd (2005) Lake MacLeod Solar Salt Project Desktop Flora and Vegetation Assessment; Vegetation Clearing Permit Report;
- Outback Ecology Services (2011) Native Vegetation Clearing Permit Report; and
- Outback Ecology Services (2012) Lake McLeod Pits 50 to 53. Level 1 Vegetation and Flora Assessment.

Table 8 Results from flora surveys previously completed within the vicinity of the study area.

Survey	Author	Location	Field Survey Date	Survey Level	Taxa Recorded	Conservation Significant Flora Species
A biogeographic survey of the southern Carnarvon Basin, Western Australia: background and methods	Burbidge, *et al.* (2000)	The Carnarvon Basin	27 April - late May 1994, 26 September - 19 October 1994, 8 May - 3 June 1995	Multi-disciplinary study	2133 taxa	Not reported, several endemic species and range extensions
Lake MacLeod Solar Salt Project Desktop Flora and Vegetation Assessment; Vegetation Clearing Permit Report (as reported in Clearing Permit Decision Report: 973/1	Biota Environmental Sciences Pty Ltd (2005)	Lake MacLeod Operations	No field survey	Desktop	NA	*Ptilotus alexandri* (P2), *Schoenia filifolia* (P1), *Chthonocephalus tomentellus* (P2), *Eremophila glabra* (P2), *Lepidium biplicatum* (P2), *Chthonocephalus spathulatus* (P1), *Abutilon* sp. Quobba (P2), *Abutilon* sp. Hamelin (P2), *Stenanthum divaricatum* (P3), *Acacia ryaniana* (P2).
Native Vegetation Clearing Permit Report. (as reported in Clearing Permit Decision Report: 4203/2)	Outback Ecology Services (2011)	Lake MacLeod Operations	September 2010	Level 1	Three vegetation communities: AspFp, FpMp, and AtsPm	None specified
Lake McLeod Pits 50 to 53. Level 1 Vegetation and Flora Assessment (as reported in Clearing Permit Decision Report: 5310/3	Outback Ecology Services (2012)	Lake MacLeod Operations	23 February 2012	Level 1	52 flora species	None
Resource Condition Report for a Significant Western Australian Wetland: Lake MacLeod System	DEC (2009)	Lake MacLeod (Northern Ponds)	11 October 2008	NA	8 flora species were recorded	None
Structure and productivity of inland mangrove stands at Lake MacLeod, Western Australia	Ellison and Simmonds (2003)	Lake MacLeod (Northern Ponds)	Data collected across a period December 1997 to November 1999	NA	Grey mangrove (*Avicennia marina*) community	None

4.1.2 Previous Vertebrate Fauna Surveys

The results from previous vertebrate fauna surveys completed in close proximity to the study area are summarised below and presented in Table 9. Zoological survey work in the bioregion was conducted as part of a bioregional study of the Carnarvon Basin (Burbidge *et al.* 2000). Terrestrial vertebrate fauna were surveyed at 63 sampling areas of 400 m by 400 m centred on pit traps in 1994 and 1995. The survey identified 16 frog species, 146 reptile species and 279 bird species as occurring within the Carnarvon Basin. A total of 19 reptile species recorded from the surveys were undescribed. Of the bird species recorded, 162 breed within the Carnarvon Basin area with the remaining species including migratory species and occasional visitors. A total of 25 species (> 29,000 birds) were recorded from surveys of Lake MacLeod in October 1994. Vertebrate pests noted from the surveys included rabbits, goats, foxes and cats with goats noted as having significant impacts on vegetation.

Storr and Harold (1984) surveyed the herpetofauna of the Lake MacLeod region approximately from Coral Bay to Carnarvon (covering the area from 23º S to 25º S). A total of 104 herpetofauna species were identified within the area from 46 genera and 14 families. None of the species recorded were identified as being of conservation significance.

Localised biological surveys include surveys by Phillips *et al.* (2005) and Kavazos and Horwitz (2016) targeting the Northern Ponds area of Lake MacLeod (as described above in Section 4.1.1). The Northern Ponds is proposed as a Ramsar site due to its significance for migratory shorebirds. The area is considered as internationally important meeting five of eight criteria for a wetland of international significance (Phillips *et al*. 2005):

- Unique wetland within the bioregion supporting the largest inland community of Grey Mangrove;
- Significant stop-over for migratory shorebirds with seven waterbird species recorded breeding at the site;
- Wetlands supporting large aggregations of waterbirds regularly exceeding 20,000 birds; and
- For six species of waterbird the site regularly supports 1% of the individuals of the total population.

Surveys of the Northern Ponds have counted more than 50,000 waterbirds with 70 species recorded (Phillips *et al.* 2005). A total of 28 species recorded are listed under international conservation agreements and the site represents an important stop-over for migratory birds of the East Asian-Australasian Flyway. The large aggregations of shorebirds counted are predominantly associated with the shallows and mudflats surrounding the permanent wetland areas of the Northern Ponds (Phillips *et al.* 2005). Aquatic invertebrates and fish species associated with the permanent wetland provide an important food source for bird species utilizing the wetlands. The wetlands provide critical high-quality feeding grounds for small to medium-size migratory shorebirds both post and premigration (Kavazos and Horwitz 2016).

In 2005, Biota Environmental Sciences Pty Ltd (2005) completed a desktop survey for the approval of clearing permits at the Lake MacLeod Solar Salt Project. The desktop survey identified a total of 70 waterbird species occurring within a 50 km radius of the study area including 25 migratory species.

Table 9 Results from vertebrate fauna surveys previously completed within the vicinity of the study area.

Survey	Author	Location	Field Survey Date	Survey Level	Taxa Recorded	Conservation Significant Fauna Species
A biogeographic survey of the southern Carnarvon Basin, Western Australia: background and methods	Burbidge *et al.* 2000)	The Carnarvon Basin	27 April to late May 1994, 26 September to 19 October 1994, 8 May to 3 June 1995	Multi-disciplinary Study	16 frog species, 146 reptile species and 279 bird species (as reported in Burbridge 2000)	Not reported
Aquatic Invertebrates and waterbirds of wetlands and rivers of the southern Carnarvon Basin, Western Australia	Halse *et al.* (2000)	35-100km north of the study area	Winter and Summer of 1994 and 1995	Comprehensive biological survey	57 waterbird species, 492 aquatic invertebrate species	None
Lake MacLeod Solar Salt Project Desktop Flora and Vegetation Assessment; Vegetation Clearing Permit Report (as reported in Clearing Permit Decision Report: 973/1	Biota Environmental Sciences Pty Ltd (2005)	Lake MacLeod Operations	No Field Survey undertaken	Desktop	70 waterbird species	25 migratory species
Ecological Character of the Lake MacLeod Wetland of International Importance	Phillips *et al.* (2005)	Lake MacLeod (Northern Ponds)	2004	Not Specified	37 waterbird species	28 migratory species
Herpetofauna of the Lake MacLeod Region, Western Australia	Storr and Harold (1984)	Lake MacLeod Region	October 1980	Not Specified	104 species of herpetofauna	None

Survey	Author	Location	Field Survey Date	Survey Level	Taxa Recorded	Conservation Significant Fauna Species
Biodiversity and Ecosystem Functioning of the Northern Ponds, Lake MacLeod, Western Australia	Kavazos and Horwitz (2016)	Northern Ponds, Lake MacLeod	November 2012, July 2013 & November 2013	Not Specified	6 species of fish and 37 species of shore birds	Curlew Sandpiper (*Calidris ferruginea*) listed as Critically Endangered under the EPBC and BC Acts, Bar-tailed Godwit (*Limosa lapponica*) listed as Migratory under the EPBC and BC Acts, Red Knot (*Calidris canutus*) listed as Endangered under the EPBC and BC Acts, and Great Knot (*Calidris tenuirostris*) listed as Critically Endangered under the EPBC and BC Acts.

4.2 Desktop Review - Flora and Vegetation

4.2.1 Threatened Flora listed under the EPBC Act

A search of the Commonwealth EPBC Act Protected Matters database was undertaken for a 40 km radius around the study area (DCCEEW 2025). There were no Threatened Flora taxa listed under the EPBC Act recorded as occurring within the 40 km search radius.

4.2.2 Threatened Flora listed under the IUCN Red List

A search of the International Union for Conservation of Nature (IUCN) database (IUCN 2025) determined that no Threatened Flora taxon was likely to occur within the study area.

4.2.3 Threatened Flora listed under the BC Act

There were no Threatened flora identified from the DBCA rare flora database search (DBCA 2025a) within a 40 km radius of the study area (Table 10).

4.2.4 Priority Flora recognised by the DBCA

The DBCA rare flora database search (DBCA 2025a) identified 29 Priority flora taxa as potentially occurring within a 40 km radius of the study area (Table 10).

4.2.5 TECs listed under State and Federal Legislation

The Protected Matters search tool indicated that the federally listed Subtropical and Temperate Coastal Saltmarsh TEC (listed as Vulnerable) occurs within the search area. This community is not listed by Western Australia. The community is described as "*consisting of organisms including and associated with saltmarsh in coastal regions of sub-tropical and temperate Australia*".

The DBCA database search results indicated that there were no Commonwealth or State listed TECs occurring within a 40 km radius of the study area.

4.2.6 PECs recognised by DBCA

A search of the State communities database by DBCA (2025b) identified three PECs occurring within a 40 km radius of the study area. The closest PEC was the Lyell Land System occurring approximately 15 km to the south-east of the study area. (Figure 7). The PECs are described below:

- Lyell Land System (Priority 3): sandplains with reticulate dunes and saline interdunal plains with acacia shrublands and saltbush;
- Lake MacLeod invertebrate assemblages (Priority 4): saline aquatic community comprised of a rich birrida[1] community with strong marine and terrestrial components; and

[1] Landlocked saline lakes characteristic of Shark Bay and surrounds.

- Barrabiddy Land System (Priority 3); flood plains and broad channelled drainage zones with shallow acacia shrublands, saltbush and tussock grasses.

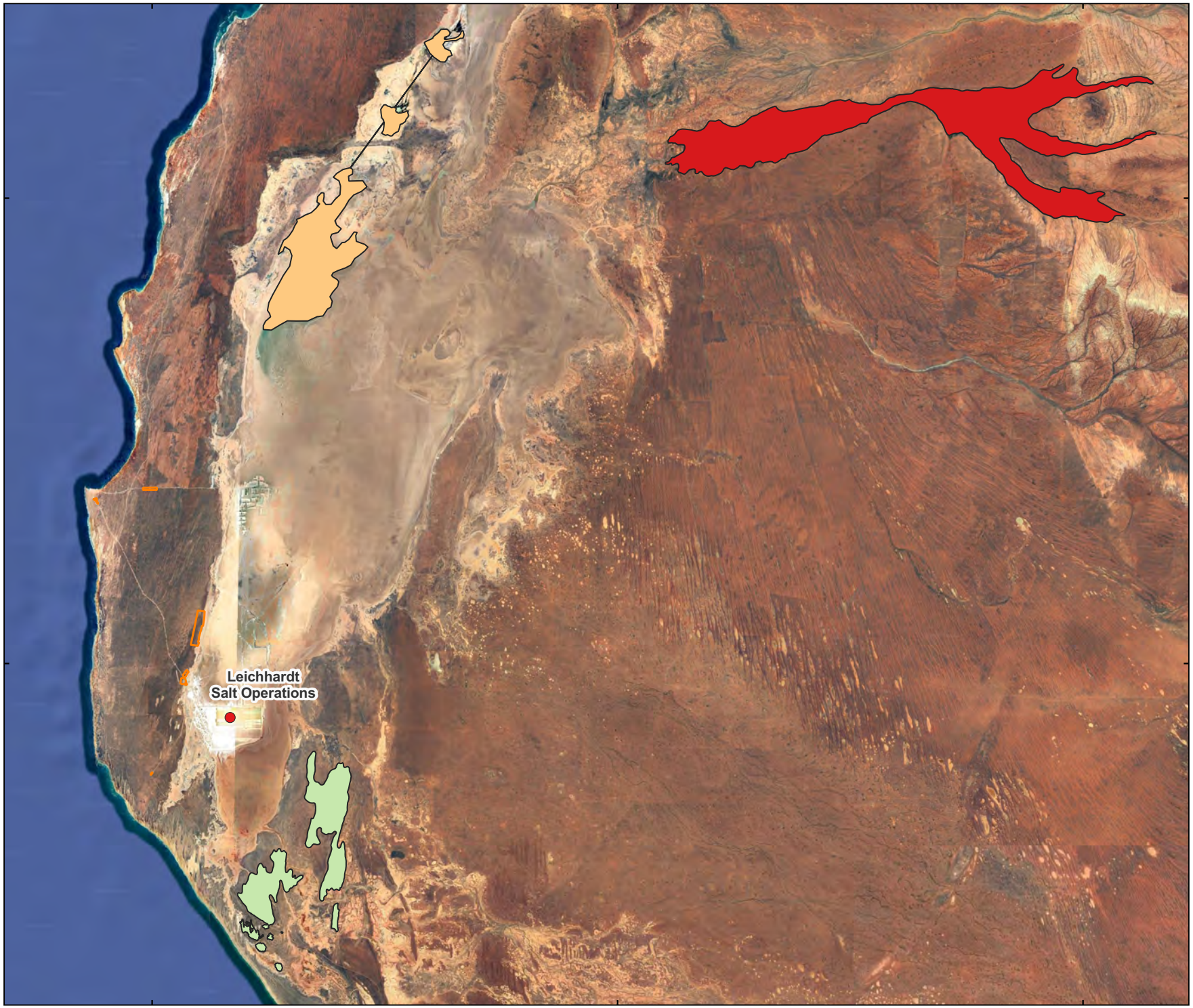
The Lyell and Barrabiddy Land System PECs are threatened by grazing and Buffel Grass invasion.

4.2.7 Likelihood of Occurrence in the Study Area

A total of 29 species of conservation significant flora were identified as potentially occurring within a 40 km radius of the study area from the database searches (Table 10). One species had previously been recorded within the study area, *Stenanthemum divaricatum*, five species were considered *likely* to occur within the study area, four species were considered as *possibly* occurring within the study area, and the remaining 19 species were considered *unlikely* to occur within the study area (Table 10).

Table 10 Likelihood of conservation significant flora recorded from the desktop assessment occurring within the study area.

Species	State Cons. Code	Federal Cons. Code	Habitat Description	Likelihood
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	3		Red sand on sand dunes.	Possible
Abutilon sp. Quobba (H. Demarz 3858)	2		Sand plains.	Likely
Acacia ryaniana	2		White or red sand on coastal sand dunes.	Likely
Atriplex spinulosa	1		Clay flats.	Unlikely
Balladonia aervoides	3		Orange-brown sand on coastal sandplains near limestone outcropping.	Unlikely
Bergia auriculata	2		Clay soils, mud flats.	Unlikely
Calandrinia rubrisabulosa	3		Red sand on upper slope or crest of sand dune.	Unlikely
Calandrinia sphaerophylla	2		Skeletal soils on limestone outcrops along the coastline.	Unlikely
Carpobrotus sp. Thevenard Island (M. White 050)	3		Coarse white sand on dune tops and disturbed areas.	Unlikely
Chthonocephalus spathulatus	3		Red-brown loam or sandy clay on undulating plains.	Possible
Chthonocephalus tomentellus	2		Red sand on undulating plains, sand dunes and near saline depressions.	Unlikely
Crinum flaccidum	2		Loam, clay, sandstone in swamps and creeks.	Unlikely
Eremophila youngii subsp. *lepidota*	4		Stony red sandy loam on flats plains, floodplains, sometimes semi-saline, and clay flats.	Unlikely
Gymnanthera cunninghamii	3		Sandy soils.	Unlikely
Indigofera rotula	3		Limestone.	Unlikely
Lepidium biplicatum	3		Coastal regions, sandy salt flats.	Possible
Lepidium scandens	3		Red sand, clay.	Unlikely
Lysiandra fuernrohrii	3		Red sandy loam or sand.	Likely
Owenia acidula	3		Clay.	Unlikely
Ptilotus alexandri	2		Red-white sand on sand dunes.	Likely
Rumex crystallinus	2		Arid and semi-arid areas.	Unlikely
Schoenia filifolia subsp. *arenicola*	1		Sand or red clay on sub-coastal sand ridges.	Unlikely
Scholtzia sp. Folly Hill (M.E. Trudgen 12097)	2		Yellow or red sand on sand dunes.	Unlikely
Sondottia glabrata	2		Saline flats.	Unlikely
Sporobolus blakei	3		Red sandy clay, loam. Creeks.	Unlikely
Stackhousia clementii	3		Skeletal soils on sandstone hills.	Likely
Stenanthemum divaricatum	3		White or yellow sand over sandstone.	Recorded
Swainsona ecallosa	1		Stony flats.	Possible
Triodia plurinervata	3		Red to orange-brown sand., limestone, sandy loam. Sand dunes and steppes, often coastal areas, drainage basins, and salt lakes.	Unlikely



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Figure 7: Threatened and Priority Ecological Communities

Legend

- Study Area

TECs and PECS

- Barrabiddy Land System
- Lake MacLeod invertebrate assemblages
- Lyell Land System

0 5 10 15 km

1:550,000

Document Control	
Date:	4th June 2025
Status:	Final
Figure:	7
Sheet Size:	A4
File Reference:	LM_Figure6_TEC

Datum: GDA 2020
Projection: MGA Zone 50

4.3 Desktop Review - Vertebrate Fauna

4.3.1 Potentially Occurring Significant Fauna Species

Database searches were undertaken (as detailed in Section 3.2.2) to identify conservation significant vertebrate fauna previously recorded within, or in the vicinity of, the study area. The EPBC database search identified a total of 31 fauna species listed as Threatened Fauna under the EPBC Act and 73 taxa listed as Migratory species (DCCEEW 2025). The DBCA searches identified 84 significant fauna species listed under the BC Act including 27 species listed as Threatened Fauna, 51 migratory species and seven species listed as Priority Fauna or other specially protected fauna (DBCA 2025c).

Marine birds, marine mammals and sharks were removed from the above database search results to provide a list of species potentially occurring within the study area. A total of 66 conservation significant species were identified from the combined desktop and literature searches as potentially occurring within the study area, comprising six mammals, 58 birds, and two reptiles. The Gnaraloo Mulch Slider (*Lerista haroldi*) had previously been recorded within the Borrow Pit 13 survey area within the study area. Based on the known distribution and habitat preference 15 species were determined as “likely” to occur within the study area (Table 11):

1. Common Sandpiper (*Actitis hypoleucos*, Migratory);
2. Fork-tailed Swift (*Apus pacificus*, Migratory);
3. Ruddy Turnstone (*Arenaria interpres*, Migratory);
4. Long-toed Stint (*Calidris subminuta*, Migratory);
5. Common Redshank (*Tringa tetanus*, Migratory);
6. Greater Sand Plover (*Charadrius leschenaultia*, Vulnerable and Migratory);
7. Gull-billed Tern (*Gelochelidon nilotica*, Migratory);
8. Oriental Pratincole (*Glareola maldivarum*, Migratory);
9. Caspian Tern (*Hydroprogne caspia*, Migratory);
10. Osprey (*Pandion haliaetus*, Migratory);
11. Glossy Ibis (*Plegadis falcinellus*, Migratory);
12. Pacific Golden Plover(*Pluvialus fulva*, Migratory);
13. Grey Plover (*Pluvialus squatarola* , Migratory);
14. Wood Sandpiper (*Tringa glareola*, Migratory); and
15. Common Greenshank (*Tringa nebularia*, Migratory).

The majority of the species listed above are migratory shorebirds and while suitable habitat may occur within the study area, the availability of habitat is likely to be limited and habitats within the study area are most likely to be utilised occasionally after infrequent significant rainfall events and inundation. The majority of records for these species are associated with the permanent saline wetlands of the Northern Ponds and the adjacent lakebed and mud-flats of Lake MacLeod (proper). Ten additional species were determined as “possibly” occurring within the study area, with the remaining species identified as “unlikely” to occur in the study area (Table 11).

Table 11 Significant fauna previously recorded from desktop searches surrounding the study area.

Taxon Name	Common Name	EPBC Act	BC Act	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Actitis hypoleucos	Common Sandpiper	MI	MI	Lakes and wetlands	Yes	Likely	Nearest record 150 m east of the study area.
Aphelocephala leucopsis	Southern Whiteface	VU	P4	Open woodlands and shrublands dominated by acacias or eucalypts	Yes	Possible	Nearest record 33 km south-east (ALA 2025)
Apus pacificus	Fork-tailed Swift	MI	MI	Aerial, inland plains but sometimes above foothills or in coastal areas	Yes	Likely	Nearest record 500 m east of the study area
Arenaria interpres	Ruddy Turnstone	MI	MI	Coastal shores, occasionally lake shores. Nests on coastal plains, marshes and tundra	Yes	Likely	Records within 10 km
Botaurus poiciloptilus	Australasian Bittern	EN	EN	Reed beds and areas dominated by sedges, rushes, reeds or cutting grass. Usually freshwater environments but can tolerate brackish environments	No	Unlikely	No suitable habitat, however records occur in close proximity
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	Lakes and wetlands	Yes	Possible	Records within 10 km from the 1970s
Calidris alba	Sanderling	MI	MI	Open sandy beaches, sand bars and spits	No	Unlikely	No suitable habitat
Calidris canutus	Red Knot	EN, MI	EN	Sandy estuaries with tidal mudflats	No	Unlikely	No suitable habitat, however records occur in close proximity
Calidris falcinellus	Broad-billed Sandpiper	MI	MI	Muddy and boggy areas on the shore of ponds and lakes	Yes	Possible	Historic record 33 km to the north east of the study area
Calidris ferruginea	Curlew Sandpiper	CR, MI	CR	Intertidal mudflats and ephemeral and permanent lakes	Yes	Possible	Records within 10 km from the 1970s
Calidris melanotos	Pectoral Sandpiper	MI	MI	Lakes and wetlands	Yes	Unlikely	No records in close proximity
Calidris pugnax	Ruff	MI	MI	Wetland habitats, reservoirs to coastal mudflats	Yes	Unlikely	No records in close proximity
Calidris ruficollis	Red-necked Stint	MI	MI	Lakes and wetlands, beaches and tidal mudflats	Yes	Possible	Records within 10 km from the 1970s
Calidris subminuta	Long-toed Stint	MI	MI	Shallow inland wetlands, with muddy shorelines and short grass	Yes	Likely	Records within 10 km

Taxon Name	Common Name	EPBC Act	BC Act	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Calidris tenuirostris	Great Knot	CR, MI	CR	Intertidal mudflats and sandflats in sheltered coasts	No	Unlikely	No suitable habitat, however records occur in close proximity
Charadrius dubius	Little Ringed Plover	MI	MI	Fresh and brackish wetland habitats	Yes	Unlikely	No records in close proximity
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	VU, MI	VU	Open, dry, treeless, uncultivated areas	Yes	Likely	Records within 10 km
Charadrius mongolus	Lesser Sand Plover	EN, MI	EN	On the beaches of sheltered bays, in harbours and estuaries with large intertidal sand flats or mudflats	No	Unlikely	No suitable habitat, however records occur in close proximity
Charadrius veredus	Oriental Plover	MI	MI	Open grasslands in arid and semi-arid zones	Yes	Unlikely	Nearest records 36 km to the north east
Chlidonias leucopterus	White-winged Black Tern	MI	MI	Coastal or sub-coastal wetlands	Yes	Possible	Records within 10 km, recent records are coastal
Elanus scriptus	Letter-winged Kite		P4	Open country and grasslands in arid and semi-arid zones where there are tree-lined streams or water courses	Yes	Possible	Two records within 10 km from 1994
Erythrotriorchis radiatus	Red Goshawk	EN	VU	Coastal and subcoastal tall open forests and woodlands	No	Unlikely	No suitable habitat
Falco hypoleucos	Grey Falcon	VU	VU	Shrubland, grassland and wooded watercourses, wetlands	Yes	Unlikely	Single record 30 km to the south east of the survey areas
Falco peregrinus	Peregrine Falcon		OS	Inhabits areas with cliffs, gorges, timbered watercourses, drainage lines and rivers, wetlands, plains, and open woodlands.	Yes	Possible	A single record from the 1970s occurs within 10 km
Gelochelidon nilotica	Gull-billed Tern	MI	MI	Beaches, estuaries, lakes and wetlands	Yes	Likely	Records within 10 km
Glareola maldivarum	Oriental Pratincole	MI	MI	Open grasslands and muddy floodplains	Yes	Likely	Records within 10 km
Hirundo rustica	Barn Swallow	MI	MI	Open habitats, especially large fields and wetlands	Yes	Unlikely	No records in close proximity
Hydroprogne caspia	Caspian Tern	MI	MI	Beaches, wetlands and estuaries	Yes	Likely	Records within 10 km
Leipoa ocellata	Malleefowl	VU	VU	Scrubland and woodland dominated by mallee and wattle species	Yes	Unlikely	Historical record 32 km to the south-east of the study area

Taxon Name	Common Name	EPBC Act	BC Act	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Lerista haroldi	Gnaraloo Mulch Slider		P1	Grassland	Yes	Recorded	Recorded within the Borrow Pit 13 study area
Limnodromus semipalmatus	Asian Dowitcher	MI	MI	Sheltered coastal environments, primarily estuarine and intertidal mudflats, breeds in extensive freshwater wetlands	Yes	Unlikely	No records in close proximity
Limosa lapponica	Bar-tailed Godwit	MI	MI	Estuarine mudflats, beaches and mangroves	No	Unlikely	No suitable habitat, however records occur in close proximity
Limosa lapponica menzbieri	Bar-tailed Godwit (Northern Siberian)	CR	CR	Large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays	No	Unlikely	No suitable habitat
Limosa limosa	Black-tailed Godwit	MI	MI	Inland wetlands	Yes	Possible	Records within 10 km, from the 1970s
Malurus assimilis bernieri	Shark Bay Variegated Fairy-wren		VU	Forest, woodland and shrubland habitats	Yes	Unlikely	Population confined to islands in Shark Bay
Motacilla cinerea	Grey Wagtail	MI		Various habitats with open waterbodies (Johnstone & Storr 2004).	Yes	Unlikely	No records in close proximity
Motacilla flava	Yellow Wagtail	MI		Utilises areas of short grass and bare ground. Can be found around salt marshes, swamp margins and ovals.	Yes	Unlikely	No records in close proximity
Numenius madagascariensis	Eastern Curlew	CR, MI	CR	Intertidal mudflats and sandflats, estuaries, mangrove swamps, bays, harbours and lagoons	No	Unlikely	No suitable habitat, however records occur in close proximity
Numenius minutus	Little Curlew	MI	MI	Coastal and inland grasslands and black soil plains	No	Unlikely	No suitable habitat, however records occur in close proximity
Numenius phaeopus	Whimbrel	MI	MI	Tidal and estuarine mudflats, especially near mangroves	No	Unlikely	No suitable habitat, however records occur in close proximity
Onychoprion anaethetus	Bridled Tern	MI	MI	Nests on rocky offshore islands	No	Unlikely	No suitable habitat
Pandion haliaetus	Osprey	MI	MI	On the coast and terrestrial wetlands	Yes	Likely	Records within 10 km
Pezoporus occidentalis	Night Parrot	EN	CR	Seeding spinifex on stony rises, breakaways and sandy lowlands. Chenopod	Yes	Unlikely	Unconfirmed record within 10 km

Taxon Name	Common Name	EPBC Act	BC Act	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
				shrublands, succulents and flats around salt lakes.			
Phalaropus lobatus	Red-necked Phalarope	MI	MI	Saline lakes and coastal areas	Yes	Unlikely	No records in close proximity
Plegadis falcinellus	Glossy Ibis	MI	MI	Wetlands, mudflats and floodplains	Yes	Likely	Records within 10 km
Pluvialus fulva	Pacific Golden Plover	MI	MI	Muddy, rocky and sandy wetlands, shores, paddocks, saltmarsh, coastal golf courses, estuaries and lagoons	Yes	Likely	Records within 10 km
Pluvialus squatarola	Grey Plover	MI	MI	Marine shores, inlets, estuaries and lagoons with large tidal mudflats or sandflats	Yes	Likely	Records within 10 km
Rostratula australia	Australian Painted Snipe	EN	EN	Shallow, brackish or freshwater terrestrial wetlands	Yes	Unlikely	No records in close proximity
Sterna dougallii	Roseate Tern	MI	MI	Coastal; salt bays, estuaries, ocean	No	Unlikely	No suitable habitat, however records occur in close proximity
Sterna hirundo	Common Tern	MI	MI	Sheltered coastal waters	No	Unlikely	No suitable habitat, however records occur in close proximity
Sternula albifrons	Little Tern	MI	MI	Beaches, sheltered inlets, estuaries, lakes, sewage farms, lagoons, river mouths and deltas	Yes	Possible	Nearby records are coastal
Sternula nereis nereis	Fairy Tern	VU	VU	Coastal beaches, inshore and offshore islands, sheltered inlets, sewage farms, harbours, estuaries and lagoons	No	Unlikely	No suitable habitat, however records occur in close proximity
Thalasseus bergii	Crested Tern	MI	MI	Coastal areas including beaches, estuaries, inlets and islands	No	Unlikely	No suitable habitat, however records occur in close proximity
Tringa brevipes	Grey-tailed Tattler	MI	P4, MI	Intertidal mudflats and mangrove areas	No	Unlikely	No suitable habitat, however records occur in close proximity
Tringa glareola	Wood Sandpiper	MI	MI	Wetlands	Yes	Likely	Records within 10 km
Tringa nebularia	Common Greenshank	MI	MI	Wetlands and mudflats	Yes	Likely	Records within 10 km
Tringa stagnatilis	Marsh Sandpiper	MI	MI	Wetlands	Yes	Unlikely	No records in close proximity

Taxon Name	Common Name	EPBC Act	BC Act	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Tringa totanus	Common Redshank	MI	MI	Wetland habitats	Yes	Likely	No records in close proximity
Xenus cinereus	Terek Sandpiper	MI	MI	Mangrove swamps, tidal mudflats and the seashore	No	Unlikely	No suitable habitat, however records occur in close proximity
MAMMALS							
Bettongia lesueur lesueur	Shark Bay Burrowing Bettong, Boodie (Shark Bay)	VU	CD	Spinifex, claypans, low heath, scrub, saltbush and sandhills	Yes	Unlikely	Population confined to islands in Shark Bay
Lagorchestes hirsutus bernieri	Shark Bay Rufous Hare-wallaby	VU	VU	Low scrub and spinifex on sandy soils	Yes	Unlikely	Population confined to islands in Shark Bay
Lagostrophus fasciatus fasciatus	Banded Hare-wallaby, Mernine	VU	VU	Dense *Acacia* thickets	No	Unlikely	No suitable habitat or records in the vicinity
Perameles bougainville	Shark Bay Bandicoot, Western Barred Bandicoot, Little Marl	EN	VU	Grassy shrublands	Yes	Unlikely	Population confined to islands in Shark Bay
Phascogale calura	Red-tailed Phascogale, Kenngoor	VU	CD	Dense and tall vegetation, particularly *Eucalyptus wandoo* and *Allocasuarina huegeliana*	No	Unlikely	No suitable habitat or records in proximity
Pseudomys gouldii	Gould's mouse, Shark Bay mouse, djoongari	VU	VU	Coastal dune vegetation dominated by *Spinifex longifolius* and *Olearia axillaris*	Yes	Unlikely	Population confined to islands in Shark Bay
REPTILES							
Egernia stokesii badia	Western Spiny-tailed Skink	EN	VU	Woodlands with suitable hollow logs for refuge sites or on rocky outcrops with crevices	Yes	Unlikely	No records in the vicinity
Lerista haroldi	Gnaraloo Mulch Slider		P1	Grassland	Yes	Recorded	Recorded within the Borrow Pit 13 study area

4.4 Field Survey Results - Flora

4.4.1 Flora Species

A total of 124 plant taxa (including varieties and subspecies) from 41 families and 90 genera were recorded from the study area (Table 12, Appendix 4). Species representation was greatest among the Chenopodiaceae, Fabaceae, Malvaceae, Asteraceae and Goodeniaceae families (Table 12). The most speciose genera were *Acacia, Tecticornia, Scaevola* and *Atriplex.*

Table 12 Statistics for total flora recorded from the study area.

Overview	No. Taxa
Families	41
Genera	90
Taxa (species, subspecies, varieties)	124
Native Taxa	121
Introduced Taxa	5
Threatened Flora	0
Priority Flora	2
Range Extension	1
Species of interest	1
Speciose Families	**No. Taxa**
Chenopodiaceae	21
Fabaceae	16
Malvaceae	9
Poaceae	8
Asteraceae	7
Goodeniaceae	7
Speciose Genera	**No. Taxa**
Acacia	9
Tecticornia	6
Atriplex	4
Scaevola	4
Acanthocarpus	3
Eremophila	3
Solanum	3

4.4.2 Threatened Flora

No plant taxon recorded from the study area was listed as Threatened Flora under the Commonwealth EPBC Act or the Western Australian BC Act.

4.4.3 Other Conservation Significant Flora

Two Priority flora, one range extension and one species of interest were recorded from the study area (Figure 8, Appendix 5):

- *Indigofera* cf. *oraria* (Priority 1 and range extension);

- *Stenanthemum divaricatum* (Priority 3);
- *Olax aurantia* (range extension);
- *Eriachne* aff. *obtusa* (species of interest).

Indigofera oraria (Priority 1) (Family: Fabaceae)

Indigofera oraria (Priority 1) is a spreading subshrub to 0.2-0.3 m in height growing in near coastal regions in the northern Carnarvon Bioregion. The leaves are pinnate, containing (3–)5–7 leaflets and are subtended by small narrowly triangular stipules approximately 1 mm long. Each leaflet is approximately 5.5–15 mm long by 3–7 mm wide and covered with dense appressed hairs that endow the plant with an overall 'grey' appearance. Inflorescences are 60–170 mm long, generally presented above the foliage, and produce small (about 9mm) red to red-orange pea-shaped flowers. Fruiting pods are grey to brown, sausage shaped, 15–32 mm long by 2.5–3 mm wide and produce 7–9 cuboid seeds 1.5–2.5 mm long.

Flowering and fruiting records for *Indigofera oraria* are few and not readily available, but like many perennial Fabaceae species in the Eremaean Province, it is presumed that flowering occurs sporadically between May and August in response to summer or winter rainfall events.

Indigofera oraria is currently only known from a restricted area approximately 100 km south-southwest of Exmouth and 195 km north of Carnarvon. It grows in sand dunes immediately adjacent to the coastline at these locations (Florabase, Wilson and Rowe 2015).

Indigofera cf*. oraria* was recorded from a solitary location within the study area; the far eastern section of the Borrow Pit 13 survey area (Figure 8, Plate 1). An additional location for this species was recorded outside the study area between the Road Maintenance 2 survey area and Borrow Pit 13 survey area. A single plant was recorded within the study area approximately 0.2 m in height and 0.3 in width. The sole plant observed was in poor condition with only a few surviving leaves. The specimen collected outside the study area had more intact vegetative material which assisted with identification. Due to the poor seasonal conditions many short-lived perennial and herbaceous species were likely absent from or in poor condition across the study area. It is therefore likely that this species is more common within the proposed Borrow Pit 13 survey area.

Indigofera cf. *oraria* was found within Vegetation Unit: SA McHsTdd Tg which is described as 'Open Low Scrub A of *Acacia ligulata, Acacia coriacea* subsp. *coriacea* and *Acacia tetragonophylla* (with *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Stylobasium spathulatum* over Dwarf Scrub D (to Open Dwarf Scrub D) of *Melaleuca cardiophylla*, *Hakea stenophylla* subsp. *stenophylla* and *Thryptomene dampieri* subsp. *dampieri* (with *Dampiera spicigera* and Calothamnus *borealis* subsp. *borealis*) over Mid-Dense Hummock Grass of *Triodia glabra* (with *Triodia epactia*) in orange sand on undulating sand plains and low hills'.

Further populations of *Indigofera* cf. *oraria* are likely to be interspersed across the study area in similar habitats especially those with deep sandy profiles such as at the

Borrow Pits 10 and Borrow Pit 13 survey areas. Many dead plants of similar stature were observed in these areas and they may represent additional populations of the species, however this could not be verified due to poor seasonal conditions.

The identification of *Indigofera* cf. *oraria* was based on vegetative material only and could not explicitly be confirmed without flowering material. The leaflets of the one collected specimen were covered with a dense indumentum of appressed grey-white hairs, which was the primary diagnostic character used for the identification. However, it was noted that many leaflets on the plant had showed marked hair 'loss' due to continual weathering from dry conditions.

There are two other *Indigofera* species from the study area with which *Indigofera.* cf. *oraria* could be confused; *Indigofera chamaeclada* subsp. *chamaeclada* and *Indigofera melanostricta*. All three species have pinnate leaves with 5-11 leaflets, a moderately densely hairy tomentum on the leaflet surface and terete pods. *Indigofera*. *oraria* differs in having an elongated staminal tube (>5 mm long), a lack of a marked speckled appearance of the young stems (as in *Indigofera melanostricta*), a very dense, appressed and silvery indumentum on the foliage and a spreading to descending pod arrangement on the inflorescence spike (ascending in *Indigofera chamaeclada*). Further collections of *Indigofera* cf. *oraria* within good seasonal conditions are recommended to confirm/ disconfirm the identification from this survey.

The collection of *Indigofera* cf*. oraria*, if definitively confirmed, represents a range extension of approximately 125 km south from Coral Bay.



Plate 1 *Indigofera* cf*. oraria* from the study area.

Stenanthemum divaricatum (Priority 3) (Family: Rhamnaceae)

Stenanthemum divaricatum is a small, mounded, much branched and often spinescent subshrub to approximately 0.2 m high. It has small, narrowly fan-shaped leaves, mostly 3–8 mm long and 1.5–4 mm wide with a glabrescent upper leaf surface, a softly hairy lower leaf surface, recurved leaf margins, a distinctly bilobed apex and a small straight mucro (not recurved or apiculate) (Plate 2). The flowers are very small (<2 mm high), inconspicuous and moderately to densely covered with soft, greyish hairs (Kellerman and Thiele 2021). Flowering occurs in August and September. It has a moderately geographically restricted distribution between Lake MacLeod to Kalbarri, spanning the Carnarvon, Yalgoo and Geraldton Sandplain Bioregions of southwestern Western Australia. The species has been recorded growing in shrublands within white or yellow sands over sandstone (Western Australian Herbarium 2025, ALA 2025).

Approximately 35 individual plants of *Stenanthemum divaricatum* were recorded at five spot locations across the study area (Figure 8). Plants ranged from 0.15 to 0.2 m high and formed a scattered minor component of the low shrub layer (generally 0.5% to <1% cover). *Stenanthemum divaricatum* was found primarily within Vegetation type HC McTddBcb TgTe which is described as 'Scattered Shrubs of *Acacia tetragonophylla*, *Exocarpos aphyllus* and *Dodonaea bursariifolia* over Dwarf Scrub D of *Melaleuca cardiophylla*, *Thryptomene dampieri* subsp. *dampieri* and *Beyeria cinerea* subsp. *borealis* (with *Scaevola* cf. *anchusifolia*, *Acanthocarpus humilis* and *Dipteracanthus australasicus* subsp. *corynothecus*) over Mid-Dense Hummock Grass of *Triodia glabra* and *Triodia epactia* in orange sand on a limestone hillcrest / upper hillslope'. A historical location point of *Stenanthemum divaricatum* on the northern edge of the Borrow Pit 13 survey area was revisited in May 2025, however no individuals were recorded and it is presumed to be absent from this area.



Plate 2 *Stenanthemum divaricatum* from the study area.

Olax aurantia (Range extension) (Family: Olacaceae)

Olax aurantia is a slender, openly branched glabrous shrub from 0.6-2 m high. The leaves are smooth, obovate to broadly elliptic, 5-18 mm long by 3-10 mm wide with a rounded apex and are characteristically vivid green. Flowers are white-cream, 6-7 mm long with yellow stamens and produced from March to May or July. Flowering is eventually followed by ellipsoidal shaped fruits (drupes) 10-14 mm long by 8-9 mm wide and bright orange when ripe. *Olax aurantia* currently has a bimodal distribution along the mid coastal regions of Western Australia, with the main populations occurring between Shark Bay and Jurien Bay within the Yalgoo and Geraldton Sandplains Bioregions of southwestern Western Australia. An outlier population occurs on the Cape Range in the Carnarvon Bioregion, some 500 km to the north of the main population (Western Australian Herbarium 2025). *Olax aurantia* appears to be restricted to sand dune habitats where it grows in yellow sand over limestone or in red sands (Flora of Australia 1984, Western Australian Herbarium 2025).

A solitary plant of *Olax aurantia* was recorded from one spot location in the Borrow Pit 13 survey area (Figure 8, Plate 3). Despite several transect walks through the area, no further individuals were recorded. The plant was 1.2 m high by 0.6 m wide and was growing in deep orange sandy soils within Vegetation type SA GbMcAl Te, which is characterised by scattered tall shrubs of *Acacia coriacea* subsp. *coriacea*, Acacia *tetragonophylla* and *Exocarpos aphyllus* over a mid-shrub layer dominated by *Grevillea bundera* (with *Melaleuca cardiophylla* and *Acacia ligulata*) over mixed low shrubs and a spinifex hummock grassland. This record represents a major range infill for the species. The closest known locations according to Florabase are approximately 220 km to the north on the Cape Range near the town of Exmouth, and approximately 275 km to the south near Shark Bay. Despite the paucity of records in the region, the occurrence of *Olax aurantia* at Lake MacLeod suggests it is likely to occur in similar habitats outside the study area.



Plate 3 *Olax aurantia* from the study area.

Eriachne aff. *obtusa* (species of interest) (Family: Poaceae)

An unknown robust grass opportunistically collected from the May 2025 field survey could not be definitively identified to species level. The collection has affinities with the Northern Wanderrie Grass, *Eriachne obtusa* (Flora of Australia 1999). The following description is based on two old inflorescences, so measurements are preliminary and more fertile collections are required to refine the description.

Eriachne aff. *obtusa* is a robust perennial, tufted, grass up to 30-60 cm tall, rounded in outline and sometimes forming continuous small groves of interlocking plants reminiscent of the sedge family Restionaceae (Plate 4). Root butts are thickened and hairy (not woolly). Culms are sinuous, blue green, striate, conspicuously geniculate, repeatedly branched and have glabrous mid-culm nodes. The ligule is a fringe of short hairs. Leaf-blades are generally involute (except at juncture with the leaf sheath where they are shortly flattened), hardened, glabrous to sparsely hairy (with stiff tubercle-based hairs), about 1–3 cm long, 1–2 mm wide and have an attenuate, hardened apex.

The inflorescence appears to be a contracted (rather than open) panicle with few lateral branches. Observed inflorescences were ovate, elliptic to oblong in outline, moderately dense, <4 cm long and c. 1–2 cm wide. Spikelets appeared paired or solitary. Fertile spikelets are 2-flowered, comprising 2 fertile florets, broadly ovate to reniform to hemispherical, laterally compressed, compressed slightly, 2–2.5 mm long, somewhat intact at maturity with spikelets disarticulating below the glumes and dropping as a complete unit of 2 florets with the glumes attached (though some parts breaking up/ disarticulating with age). Glumes are opposite, persistent, similar, thinner than fertile lemma, c. 3/4 length of lemma/ floret. Both glumes are broadly ovate to almost orbicular, 1.5–1.8 mm long, membranous. Glume surfaces are smooth or scabrous, glabrous, with an obtuse to broadly acute apex and a mucronulate tip. Fertile lemmas are elliptic or ovate, 2–2.5 mm long, membranous or coriaceous, 5-7-nerved. Lemma surface are without grooves, villous in lower half with ciliate margins. Lemma apex is acute, muticous. Palea 100% of length of lemma, coriaceous. Palea surface smooth with indented and indurated adaxial surface. Palea apex entire, acute, muticous. Grain with adherent pericarp with a small mucron.

The flowering period of *Eriachne* aff. *obtusa* is largely unknown since most of the collections from the May 2025 survey were sterile. However, there were some collections with remnant fruiting heads which suggests that flowering occurred late summer to early autumn. Like much of the arid zone flora, it is likely that flowering occurs sporadically and in response to rainfall events.

A total of 35 plants of *Eriachne* aff. *obtusa* from three spot locations were recorded within the Borrow Pit 13 survey area where it provided between 3-5% foliar cover in the understorey. Plants were approximately 0.4 m in height and were growing in orange sandy soils on undulating sand plains and low sandy hills with occasional limestone gravels. It occurred within Vegetation type SA McHsTdd Tg described as ‘Open Low Scrub A of *Acacia ligulata*, *Acacia coriacea* subsp. *coriacea* and *Acacia tetragonophylla* (with *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Stylobasium spathulatum* over Dwarf Scrub D (to Open Dwarf Scrub D) of

Melaleuca cardiophylla, *Hakea stenophylla* subsp. *stenophylla* and *Thryptomene dampieri* subsp. *dampieri* (with *Dampiera spicigera* and *Calothamnus borealis* subsp. *borealis*) over Mid-Dense Hummock Grass of *Triodia glabra* (with *Triodia epactia*)'.

Eriachne aff. *obtusa* was also recorded at one spot location outside the study area, approximately 3.5 km west of Borrow Pit 13 and adjacent to the Gypsum Haul Road survey area. A total of ten plants were counted at this location. Vegetation was primarily a Closed Hummock Grassland of *Triodia glabra* with scattered low shrubs, suggesting that *Eriachne* aff. *obtusa* is not confined to Vegetation type SA McHsTdd Tg found at Borrow Pit 13 and likely to be more widely distributed.

It is likely that this taxon is more common elsewhere within the study area, both within and surrounding Borrow Pit 13 but also at other sites with similar landforms and deep sandy substrates, such as the northern section of Borrow Pit 10.



Plate 4 *Eriachne* aff. *obtusa* from the study area.



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 8: Significant flora occurring within the study area

Legend

- Study Area

Significant Flora

- Eriachne aff. obtusa (species of interest)
- Indigofera cf. oraria (P1)
- Olax aurantia (range extension)
- Stenanthemum divaricatum (P3)

0 0.5 1 km

1:25,000

Document Control	
Date:	23rd June 2025
Status:	Final
Figure:	8
Sheet Size:	A4
File Reference:	LM_Figure9_significant_flora

Datum: GDA 2020
Projection: MGA Zone 50

4.4.4 Introduced Flora

There were five introduced plant species recorded from the study area. One weed species recorded is listed a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act): *Tamarix aphylla* (Athel Tree). This species is widely planted as a shade tree in dry areas. Within the study area it was present as planted trees around mine infrastructure at the administration area. The diversity of weed species would likely be higher under good seasonal conditions following rainfall.

4.4.5 Vegetation Condition

The majority of vegetation within the study area was in *good* to *poor* condition (Table 13, Figures 9a-9f).

Table 13 Vegetation condition across all study area.

Vegetation Condition	Area	% Area
Completely Degraded	13.19	3.32
Degraded	55.45	13.97
Good	159.69	40.23
Poor	124.04	31.25
Very Good	44.54	11.22
Total	396.92	100.00

Major disturbances present within the study area included a combination of grazing and edge effects along cleared road and access track corridors, mining infrastructure and road maintenance activities.

The Road Maintenance survey area supported vegetation in *completely degraded* to *poor* condition (Table 14). The Road Maintenance 1 survey area had been heavily impacted by grazing from goats with vegetation condition was rated as *degraded*. The Road Maintenance 2 survey area had been impacted by road infrastructure, rock piles and ground disturbance, with surface erosion evident.

Vegetation of the Borrow Pit 13 survey area was predominantly in *very good* condition with minor impacts resulting from grazing. Condition deteriorated to *good* adjacent to the main Gypsum Haul Road due to the presence of old tracks and rehabilitated borrow pits (Table 14).

Vegetation condition was variable across the Borrow Pit 10 survey area ranging from *degraded* in the south and east to *very good* in the north-western sector (Table 14). The degraded parts of this survey area had been impacted by the Gypsum Access Road and associated borrow pits and rehabilitation. The presence of Buffel Grass (**Cenchrus ciliaris*) and grazing by goats also reduced vegetation condition within this survey area.

The majority of vegetation within the Water Dam 2 and Borrow Pit 11 survey areas was in poor and degraded condition with disturbances including grazing and edge effects along roads and infrastructure areas (Table 14).

Table 14 Vegetation condition within each of the six survey areas surveyed.

Study Area	Condition	Area (ha)	%Area
Borrow Pit 10	Poor	87.60	30.13
	Very Good	14.23	4.89
	Good	148.47	51.07
	Degraded	40.44	13.91
Total		290.73	100.00
Borrow Pit 11	Degraded	4.76	20.77
	Poor	18.17	79.23
Total		22.94	100.00
Borrow Pit 13	Very Good	32.31	88.06
	Completely Degraded	1.21	3.30
	Good	3.17	8.64
Total		36.69	100.00
RM1	Degraded	1.41	60.16
	Completely Degraded	0.93	39.84
Total		2.34	100.00
RM2	Poor	3.23	33.85
	Completely Degraded	4.34	45.45
	Degraded	1.98	20.70
Total		9.54	100.00
Water Dam	Degraded	6.86	19.79
	Completely Degraded	6.71	19.36
	Poor	15.04	43.37
	Good	6.06	17.48
Total		34.68	100.00



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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9a: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

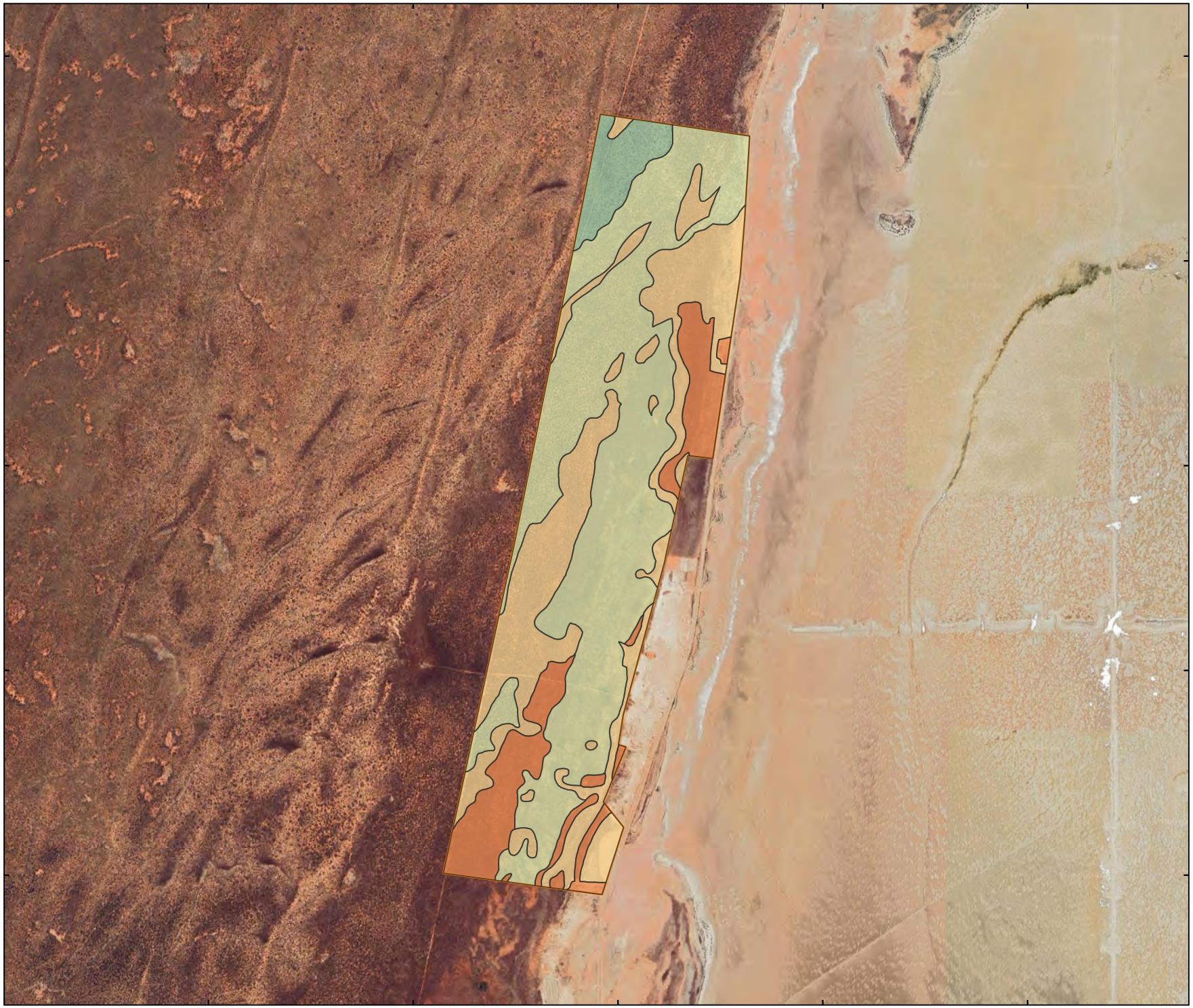
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- Degraded
- Poor
- Good

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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9b: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

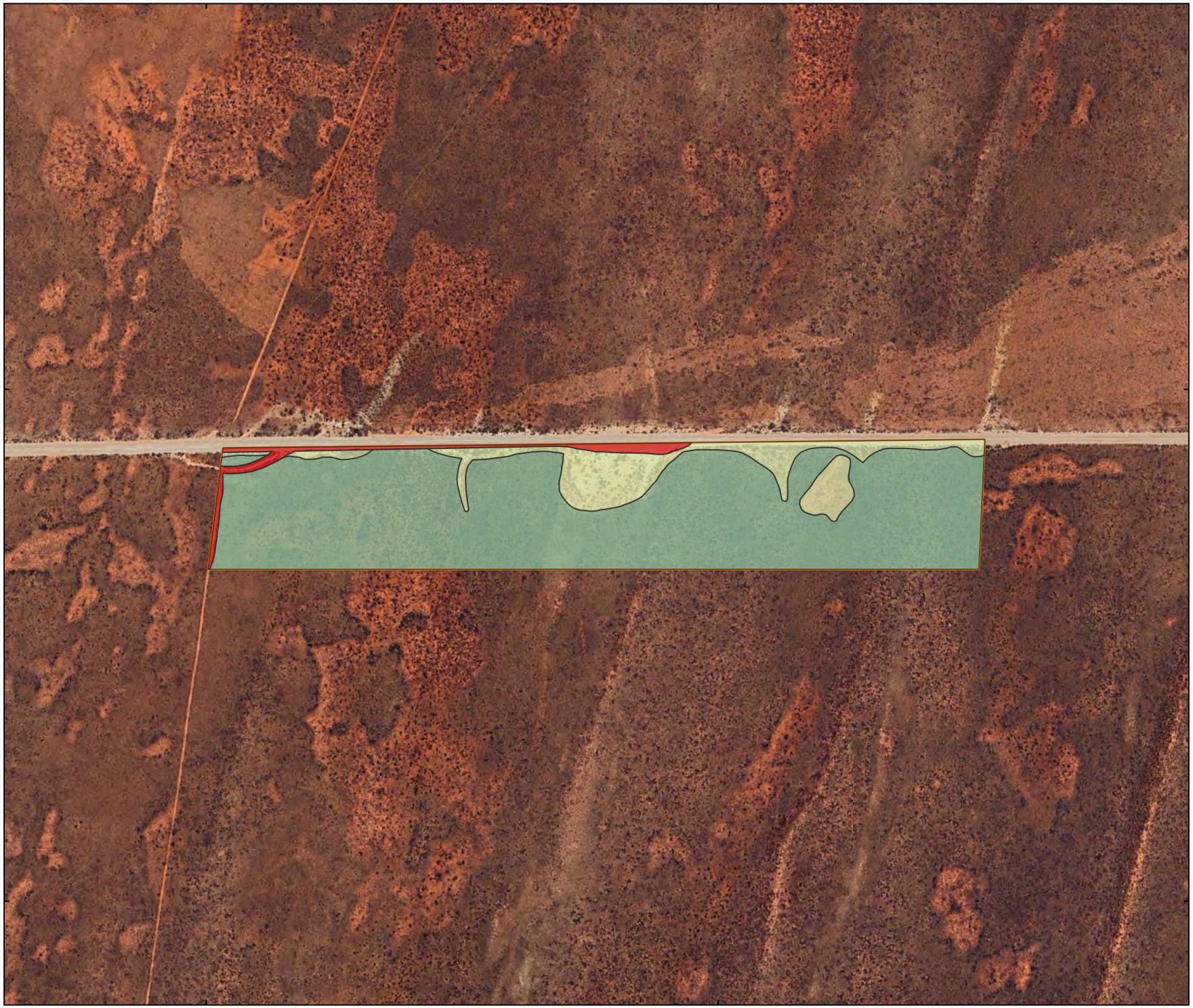
- Degraded
- Poor
- Good
- Very Good

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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9c: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

- Completely Degraded
- Good
- Very Good

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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9d: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

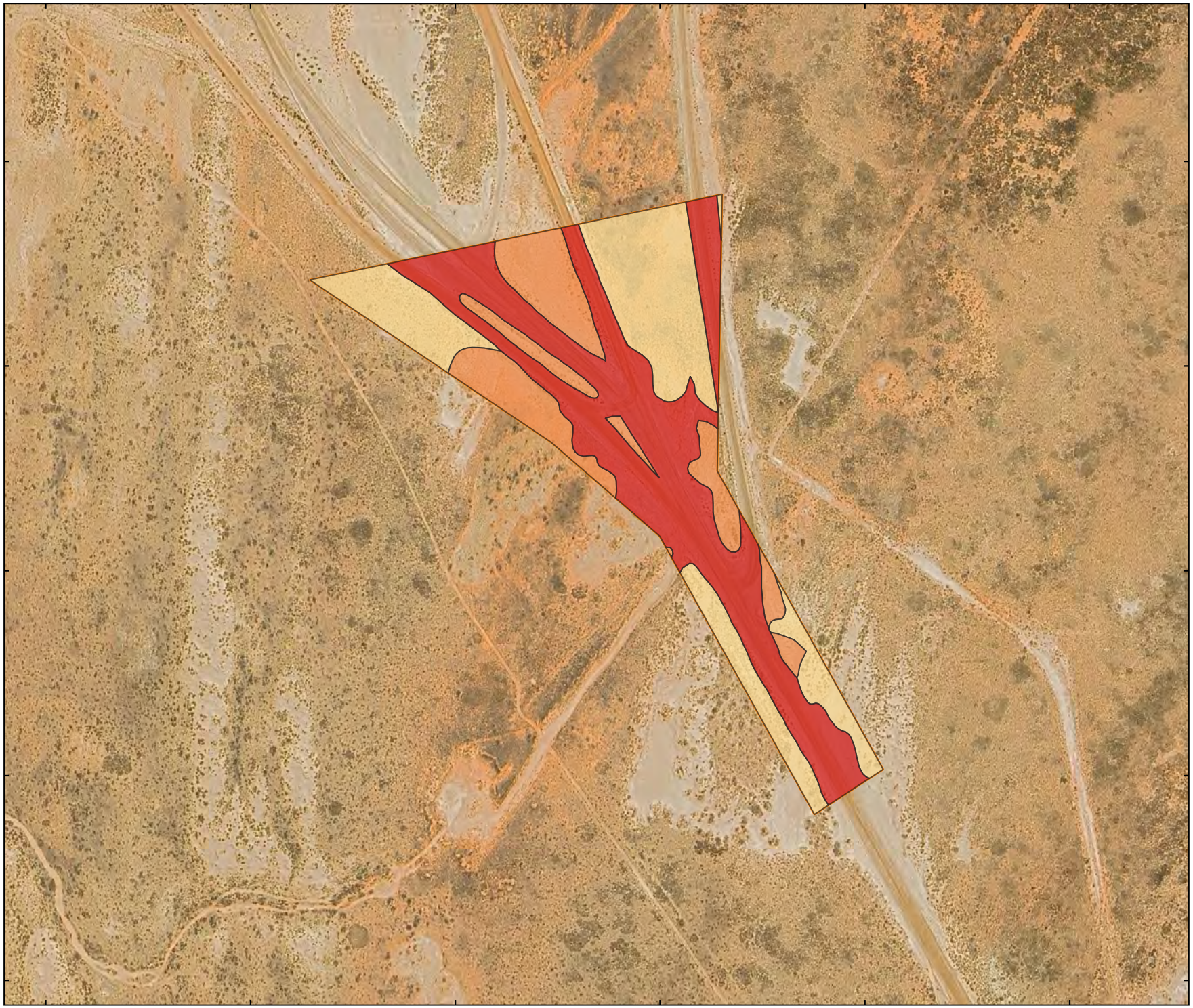
- Degraded
- Poor

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Projection: MGA Zone 50



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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9e: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

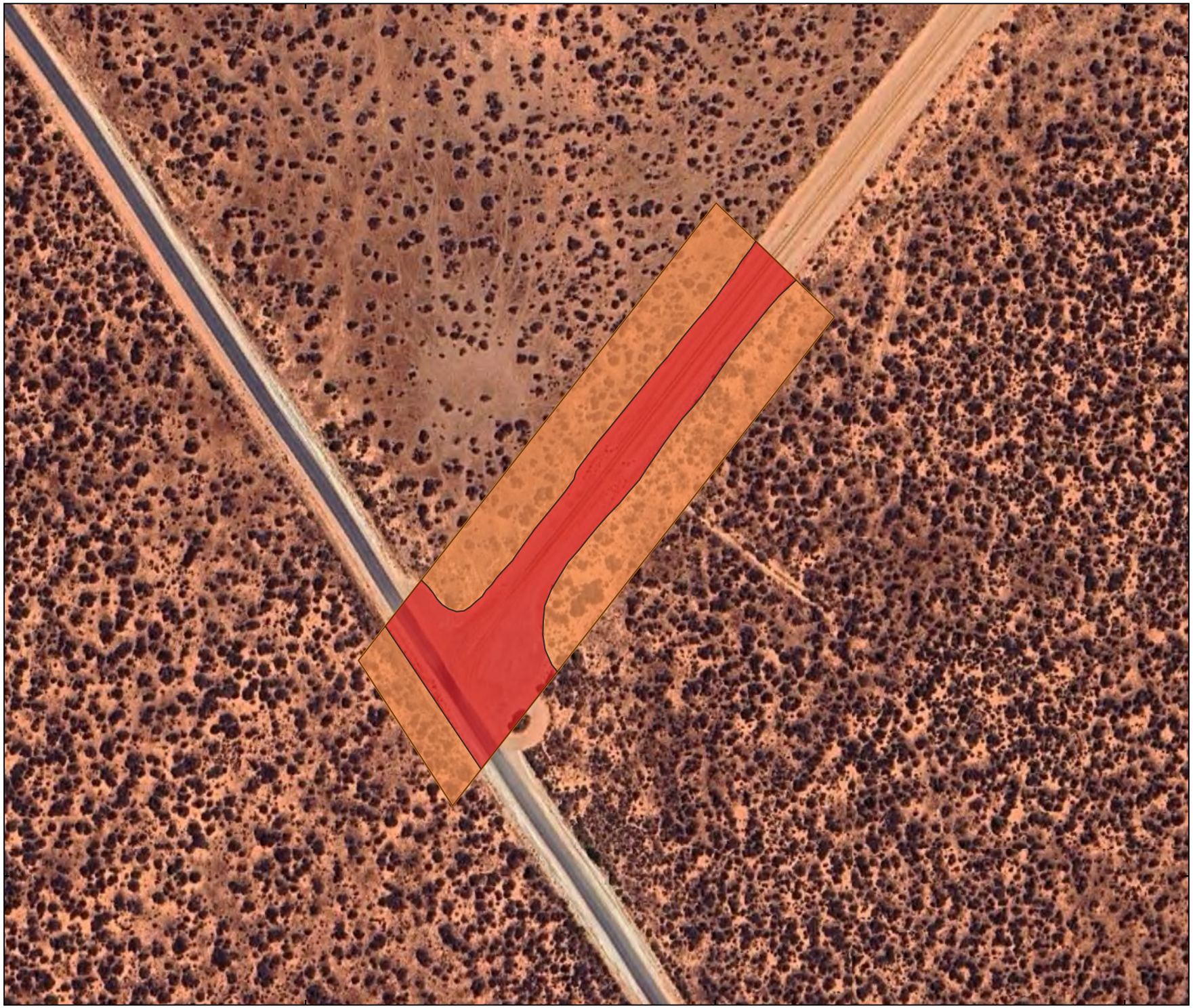
- Completely Degraded
- Degraded
- Poor

0 100 200 m

1:5,000

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Datum: GDA 2020
Projection: MGA Zone 50



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LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 9f: Vegetation condition occurring within the study area

Legend

- Study Area

Vegetation Condition

- Completely Degraded
- Degraded

0 50 100 m

1:2,500

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	9
Sheet Size:	A4
File Reference:	LM_Figure7_veg_cond

Datum: GDA 2020
Projection: MGA Zone 50

4.4.6 Vegetation Types

A total of 21 vegetation types were mapped and described occurring across the six survey areas (Table 15, Figure 10). The area of each vegetation type within each of the six areas surveyed is presented in Table 16. Four broad landform types were present within the survey areas including calcrete outcrops/plains, drainage areas/floodplains, low undulating hills and hillslopes, sandy/stony plains and sand dunes, and saltmarshes.

Vegetation types associated with sandy/stony plains and sand dunes were the most commonly occurring vegetation types (Figure 10). Large areas of sand plain occurred within the Borrow Pit 10 survey area supporting Low Scrub of *Rhagodia preissii* subsp*. obovata, Rhagodia latifolia* subsp*. latifolia* and *Pimelea microcephala* with Scrub of *Acacia sclerosperma* (SA RpoRIIPm PoSlFp)*.* This vegetation type was also dominant at the Road Maintenance 1 survey area. Two sand dune vegetation types were also described at the Borrow Pit 10 and Road Maintenance 2 survey areas.

Calcrete outcrops and plains occurred in the Borrow Pit survey areas and at the Water Dam survey area supporting Heath or Dwarf Scrub of chenopod species including *Atriplex bunburyana*, *Atriplex paludosa* subsp. *baudinii* and *Rhagodia latifolia* subsp. *latifolia* generally over low grass of **Cenchrus ciliaris.* A small drainage area (<1 ha) occurred adjacent to the dam within the Water Dam 2 survey area dominated by a Low Heath of *Samolus* sp. Shark Bay (M.E. Trudgen 7410) with *Tecticornia* species. Low undulating hills intersected the Road Maintenance 2 survey area supporting Scrub of *Rhagodia preissii* subsp. *obovata* and *Atriplex paludosa* subsp. *baudinii* over an Open Hummock Grassland. Hillcrests and upper hillcrests at the Borrow Pit 13 survey area also supported Hummock Grasslands with a Dwarf Scrub of *Melaleuca cardiophylla*, *Thryptomene dampieri* subsp. *dampieri* and *Beyeria cinerea* subsp. *borealis.*

Saline flats and marsh areas occurred on the fridges of the Borrow Pit 10, Borrow Pit 11 and Water Dam 2 survey areas (Figure 10). These areas were dominated by a Low Heath of *Tecticornia* (samphire) species including *Tecticornia pruinosa*, *Tecticornia indica* subsp. *bidens*, *Tecticornia pterygosperma* subsp. *denticulata* and *Tecticornia* cf. *halocnemoides.* These areas showed affinities with the federally listed TEC 'Subtropical and Temperate Coastal Saltmarsh' listed as Vulnerable. While the EPBC Protected Matters Search indicated that TEC may occur within a 50 km radius of the study area, vegetation did not meet key diagnostic characteristics of the community as described in the Conservation Advice (DCCEEW 2025) and the vegetation type was not considered to be a TEC.

Table 15 Vegetation types occurring within the Lake MacLeod study area.

Code	Landform	Vegetation Description	Area (ha)	Areas occurring
CA AbFp Cc	Calcrete Outcrops	Low Heath D of *Atriplex bunburyana*, *Atriplex paludosa* subsp. *baudinii* and *Frankenia pauciflora* (with *Threlkeldia diffusa*, *Ptilotus obovatus* and *Dissocarpus paradoxus*) over Very Open Low Grass of **Cenchrus ciliaris* in brown silty loam and sandy loam on limestone outcrops	45.60	Borrow Pit 10 and 11, Water Dam 2
CA Al TddDbAl TgTe	Calcrete Outcrops	Low Scrub A of *Acacia ligulata* (with *Acacia chartacea* and *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Dodonaea bursariifolia* over Dwarf Scrub D of *Thryptomene dampieri* subsp. *dampieri*, *Dodonaea bursariifolia* and *Acacia ligulata* over Hummock Grass of *Triodia glabra* and *Triodia epactia* in brown cream sandy loam on limestone outcrops (rehabilitated borrow pit vegetation)	2.02	Borrow Pit 13
CA AsyRll PoElSr	Calcrete Plain	Scattered Shrubs of *Acacia synchronicia* (with Acacia *sclerosperma* subsp. *sclerosperma*) over Scattered Low Shrubs of *Acacia synchronicia* and *Rhagodia latifolia* subsp. *latifolia* over Open Dwarf Scrub D of *Ptilotus obovatus*, *Eremophila* cf. *latrobei* and *Sclerolaena recurvicuspis* over Low Grass of **Cenchrus ciliaris* in brown sandy loam on limestone plain	37.50	Borrow Pit 10
CA FpPoAs Cc	Calcrete Plain	Open Dwarf Scrub C of *Rhagodia latifolia* subsp. *latifolia* and *Atriplex bunburyana* over Dwarf Scrub D of *Frankenia pauciflora, Ptilotus obovatus*, *Atriplex semilunaris* (with *Solanum lasiophyllum, Dissocarpus paradoxus* and *Sclerolaena recurvicuspis*) over Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of **Asphodelus fistulosus* and **Mesembryanthemum crystallinum* in orange sandy loam on limestone plain	17.79	Borrow Pit 11, Water Dam 2
DZ Ssb	Drainage Area/ Floodplain	Low Heath D of *Samolus* sp. Shark Bay (M.E. Trudgen 7410) (with *Tecticornia pruinosa*, *Tecticornia* cf. *halocnemoides*, *Muellerolimon salicorniaceum*) in brown light medium clay on drainage area/ zone	0.22	Water Dam 2
HC McTddBcb TgTe	Hillcrest/ Upper Hillslope	Scattered Shrubs of *Acacia tetragonophylla, Exocarpos aphyllus* and *Dodonaea bursariifolia* over Dwarf Scrub D of *Melaleuca cardiophylla*, *Thryptomene dampieri* subsp. *dampieri* and *Beyeria cinerea* subsp. *borealis* (with *Scaevola* cf. *anchusifolia*, *Acanthocarpus humilis* and *Dipteracanthus australasicus* subsp. *corynothecus*) over Mid-Dense Hummock Grass of *Triodia glabra* and *Triodia epactia* in orange sand on a limestone hillcrest / upper hillslope	1.57	Borrow Pit 13
HS RpoAiPo TgTe	Undulating Low Hills	Open Dwarf Scrub C of *Rhagodia preissii* subsp. *obovata*, *Atriplex paludosa* subsp. *baudinii* and *Exocarpos aphyllus* over Dwarf Scrub D of *Rhagodia preissii* subsp. *obovata*, *Atriplex paludosa* subsp. *baudinii* and *Ptilotus obovatus* (with *Corchorus crozophorifolius* and *Pimelea microcephalus*) over Open Hummock Grass of *Triodia glabra* and *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of mixed dead herb species in light brown sand on undulating low hills	3.77	Road Maintenance 2
HS TibAsFp	Undulating Low Hills	Open Dwarf Scrub D of *Atriplex semilunaris, Tecticornia indica* subsp. *bidens* and *Frankenia pauciflora* (with *Atriplex paludosa* subsp. *baudinii*, *Neobassia astrocarpus* and *Tecticornia pruinosa*) in cream-pink sand on undulating low hills (disturbed)	0.81	Road Maintenance 2

Code	Landform	Vegetation Description	Area (ha)	Areas occurring
SA CocPoSs Te	Sand Plain	Open Scrub (to Scrub) of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius* over Open Low Scrub A of *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* over Dwarf Scrub D of *Corchorus crozophorifolius*, *Ptilotus obovatus* and *Stylobasium spathulatum* (with *Dipteracanthus australasicus* subsp. *corynothecus*, *Eremophila* cf. *latrobei* and *Thryptomene dampieri* subsp. *dampieri*) over Mid-Dense Hummock Grass of *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* in pink loamy sand on undulating sand plain	32.22	Borrow Pit 10
SA GbMcAl Te	Sand Plain	Scattered Tall Shrubs of *Acacia coriacea* subsp. *coriacea*, *Acacia tetragonophylla* and *Exocarpos aphyllus* over Open Low Scrub A of *Acacia ligulata, Exocarpos aphyllus* and *Grevillea bundera* over Dwarf Scrub C of *Grevillea bundera*, *Melaleuca cardiophylla* and *Acacia ligulata* over Dwarf Scrub D of *Melaleuca cardiophylla*, *Corchorus crozophorifolius* and *Thryptomene dampieri* subsp. *dampieri* (with *Hannafordia quadrivalvis* subsp. *recurva*) over Mid-Dense Hummock Grass of *Triodia epactia* (with *Triodia glabra*) in orange sand on undulating sand plains and deep sandy swales	7.53	Borrow Pit 13
SA McHsTdd Tg	Sand Plain	Open Low Scrub A of *Acacia ligulata*, *Acacia coriacea* subsp. *coriacea* and *Acacia tetragonophylla* (with *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Stylobasium spathulatum* over Dwarf Scrub D (to Open Dwarf Scrub D) of *Melaleuca cardiophylla*, *Hakea stenophylla* subsp. *stenophylla* and *Thryptomene dampieri* subsp. *dampieri* (with *Dampiera spicigera* and *Calothamnus borealis* subsp. *borealis*) over Mid-Dense Hummock Grass of *Triodia glabra* (with *Triodia epactia*) in orange sand on undulating sand plains and low hills	24.36	Borrow Pit 13
SA RpoRllPm PoSlFp	Sand Plain	Scrub to Open Scrub of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius* over Low Scrub A to Open Low Scrub A of *Rhagodia preissii* subsp. *obovata*, *Rhagodia latifolia* subsp. *latifolia* and *Pimelea microcephala* over Dwarf Scrub D of *Ptilotus obovatus, Solanum lasiophyllum* and *Frankenia pauciflora* (with *Ptilotus divaricatus*, *Stylobasium spathulatum* and *Corchorus crozophorifolius*) over Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of **Asphodelus fistulosus* in orange or cream brown sand on sand plain	110.90	Road Maintenance 1, Borrow Pit 10
SD CocTddSs Te	Sand Dune	Open Scrub of *Acacia coriacea* subsp. *coriacea*, *Banksia ashbyi* and *Acacia tetragonophylla* over Open Low Scrub A of *Alectryon oleifolius* subsp. *oleifolius*, *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* (with *Banksia ashbyi*) over Dwarf Scrub D of *Corchorus crozophorifolius, Thryptomene dampieri* subsp. *dampieri* and *Stylobasium spathulatum* over Hummock Grass of *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* and *Eragrostis eriopoda* in light pink sand on sand dune	2.72	Borrow Pit 10
SD MmRpo SlTg	Sand Dune	Open Low Scrub B of *Myoporum montanum* and *Rhagodia preissii* subsp. *obovata* over Open Dwarf Scrub C of *Atriplex paludosa* subsp. *baudinii*, *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* over Open Dwarf Scrub D of *Atriplex paludosa* subsp. *baudinii*, *Ptilotus obovatus* and *Enchylaena tomentosa* over Open Hummock Grass of *Spinifex longifolius* and *Triodia glabra* over Very Open Low Grass of **Cenchrus ciliaris* in white/brown sand on sand dune	0.63	Road Maintenance 2

Code	Landform	Vegetation Description	Area (ha)	Areas occurring
SM Th Sv	Saline Flats and Marsh	Low Heath D of *Tecticornia* cf. *halocnemoides* (with *Muellerolimon salicorniaceum*, *Tecticornia indica* subsp. *bidens* and *Tecticornia pterygosperma* subsp. *denticulata*) over Very Open Low Grass of *Sporobolus virginicus* in brown light clay on saline flats and marsh	4.67	Borrow Pit 10 and 11, Water Dam 2
SM TpTibTh	Saline Flats and Marsh	Low Heath D of *Tecticornia pruinosa*, *Tecticornia indica* subsp. *bidens*, *Tecticornia pterygosperma* subsp. *denticulata* and *Tecticornia* cf. *halocnemoides* over Scattered Herbs in brown clay loam on saline flats and marsh	4.13	Borrow Pit 11, Water Dam 2
SP AooAsyAt EaPmRll PoMp	Sandy/ Stony Plain	Thicket of *Alectryon oleifolius* subsp. *oleifolius*, *Acacia synchronicia* and *Acacia tetragonophylla* over Low Scrub A of *Exocarpos aphyllus, Pimelea microcephala* and *Rhagodia latifolia* subsp. *latifolia* over Dwarf Scrub D of *Ptilotus obovatus* and *Maireana polyptergygia* over Very Open Low Grass of **Cenchrus ciliaris* in brown sandy clay loam on sandy / stony plain	2.74	Borrow Pit 10
SP AsyAi Mp Cc	Sandy/ Stony Plain	Scattered Shrubs of *Acacia synchronicia* and *Atriplex* sp. over Dwarf Scrub D of *Maireana* polypterygia (with *Solanum lasiophyllum*, *Dissocarpus paradoxus* and *Ptilotus obovatus*) over Scattered Low Grass of **Cenchrus ciliaris* over Scattered Herbs (dead) in orange silty loam and loamy sand on sandy / stony plain	57.10	Borrow Pit 10 and 11
SP PoFpSl Cc	Stony Plain	Open Low Scrub A of *Acacia synchronicia* over Dwarf Scrub D of *Ptilotus obovatus*, *Frankenia pauciflora* and *Solanum lasiophyllum* (with *Corchorus crozophorifolius*) over Low Grass of **Cenchrus ciliaris* in cream silty loam on stony plain (rehabilitated borrow pit vegetation)	4.70	Borrow Pit 10
SP PoSlCoc Cc	Sandy/ Stony Plain	Scattered Tall Shrubs (to Open Scrub) of *Acacia sclerosperma* subsp. *sclerosperma*, *Hakea preissii* and *Acacia synchronicia* (with *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius*) over Open Low Scrub A of *Rhagodia latifolia* subsp. *latifolia*, *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia synchronicia* (with *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Eremophila* cf. *latrobei* and *Atriplex bunburyana* over Dwarf Scrub D (to Open Dwarf Scrub D) of *Ptilotus obovatus*, *Solanum lasiophyllum* and *Corchorus crozophorifolius* (with *Frankenia pauciflora*) over Low Grass of **Cenchrus ciliaris* in orange loamy sand on sandy / stony plain	21.03	Borrow Pit 10
SP TpTibFp Cc	Stony Plain	Dwarf Scrub D of *Tecticornia pruinosa* (and/or T. *indica* subsp. *bidens* and *Frankenia pauciflora*) over Very Open Low Grass of **Cenchrus ciliaris* in cream brown silty loam on stony plain (rehabilitated borrow pit vegetation)	1.73	Borrow Pit 10 and 11
Roads / tracks		Roads and tracks	6.97	Water Dam 2, Road Maintenance 1 & 2, Borrow Pit 13
Cleared / Infrastructure		Cleared areas and areas containing infrastructure including water dams	6.23	Water Dam 2

Table 16 Vegetation types occurring within each of the six survey areas.

Study Area	Vegetation Type	Area (ha)	% Area
RM 2	HS RpoAiPo TgTe	3.77	39.5
	HS TibAsFp	0.81	8.5
	SD MmRpo SlTg	0.63	6.6
	Roads/tracks	4.34	45.5
Total		9.54	100.0
RM 1	SA RpoRllPm PoSlFp	1.41	60.2
	Roads/tracks	0.93	39.8
Total		2.34	100.0
Water Dam 2	CA AbFp Cc	9.72	28.0
	CA FpPoAs Cc	12.86	37.1
	DZ Sr	0.22	0.6
	Roads/tracks	0.49	1.4
	SM Th Sv	1.73	5.0
	SM TpTibTh	3.44	9.9
	Cleared/Infrastructure	6.23	18.0
Total		34.68	100.0
Borrow Pit 11	CA AbFp Cc	11.78	51.4
	CA FpPoAs Cc	4.93	21.5
	SA RpoRllPm PoSlFp	2.36	10.3
	SM TpTibTh	0.68	3.0
	SP AsyAi Mp Cc	2.31	10.1
	SP TpTibFp Cc	0.87	3.8
Total		22.94	100.0
Borrow Pit 13	CA Al TddDbAl TgTe	2.02	5.5
	HC McTddBcb TgTe	1.57	4.3
	SA GbMcAl Te	7.53	20.5
	SA McHsTdd Tg	24.36	66.4
	Roads/tracks	1.21	3.3
Total		36.69	100.0
Borrow Pit 10	CA AbFp Cc	24.10	8.3
	CA AsyRll PoElTd	37.50	12.9
	SA CocPoSs Te	32.22	11.1
	SA RpoRllPm PoSlFp	107.14	36.8
	SD CocTddSs Te	2.72	0.9
	SM Th Sv	2.94	1.0
	SP AooAsyAt EaPmRll PoMp	2.74	0.9
	SP AsyAi Mp Cc	54.79	18.8
	SP PoFpSl Cc	4.70	1.6
	SP PoSlCoc Cc	21.03	7.2
	SP TpTibFp Cc	0.85	0.3
Total		290.73	100.0



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Figure 10a: Vegetation types occurring within the study area

Legend

Vegetation Types

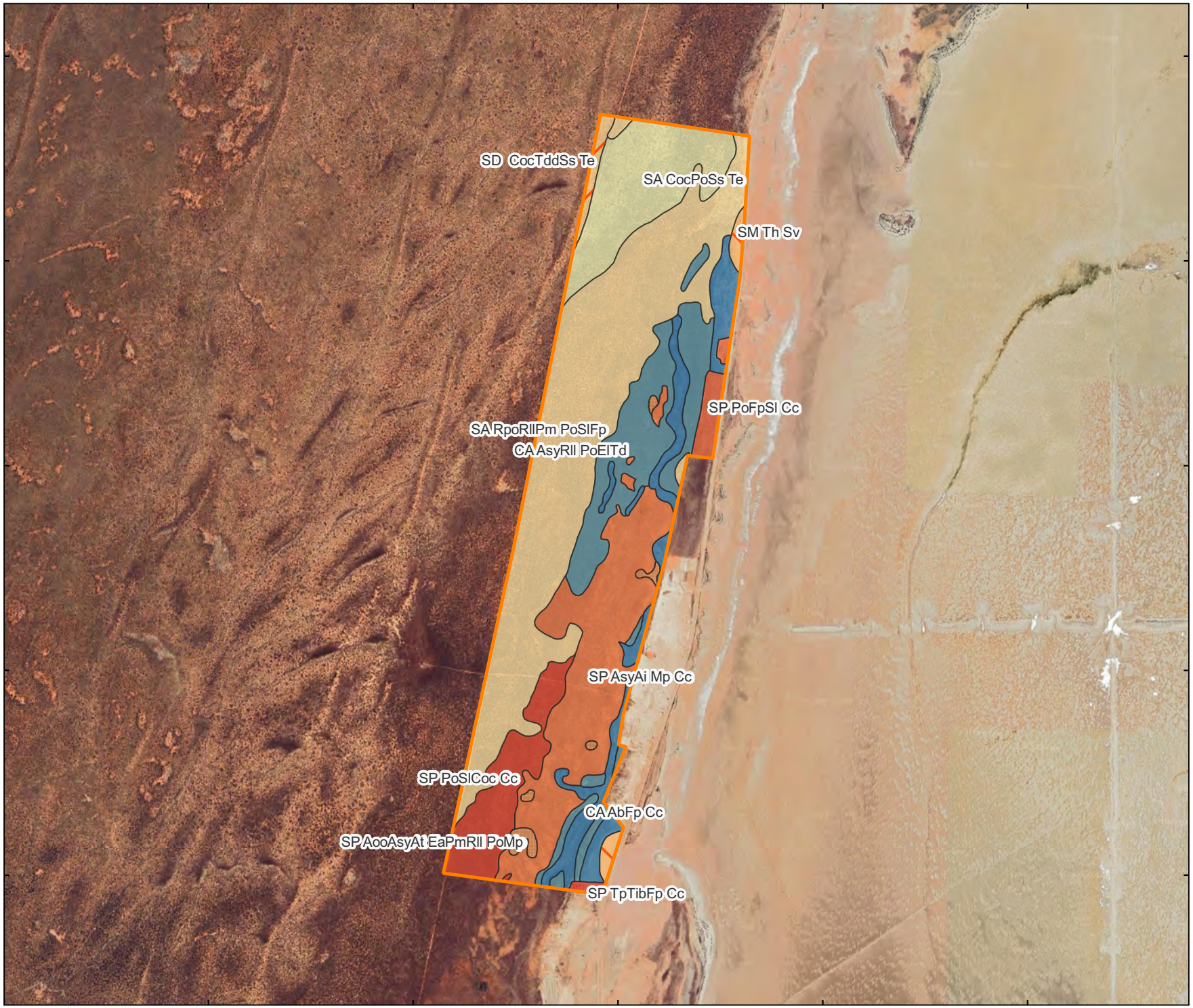
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- CA FpPoAs Cc
- DZ Sr
- SM Th Sv
- SM TpTibTh
- Cleared/Infrastructure
- Roads/tracks

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Status:	Final
Figure:	10
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File Reference:	LM_Figure6_veg_map

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Figure 10b: Vegetation types occurring within the study area

Legend

Vegetation Types

- CA AbFp Cc
- CA AsyRll PoElTd
- SA CocPoSs Te
- SA RpoRllPm PoSlFp
- SD CocTddSs Te
- SM Th Sv
- SP AooAsyAt EaPmRll PoMp
- SP AsyAi Mp Cc
- SP PoFpSl Cc
- SP PoSlCoc Cc
- SP TpTibFp Cc

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Figure 10c: Vegetation types occurring within the study area

Legend

Vegetation Types

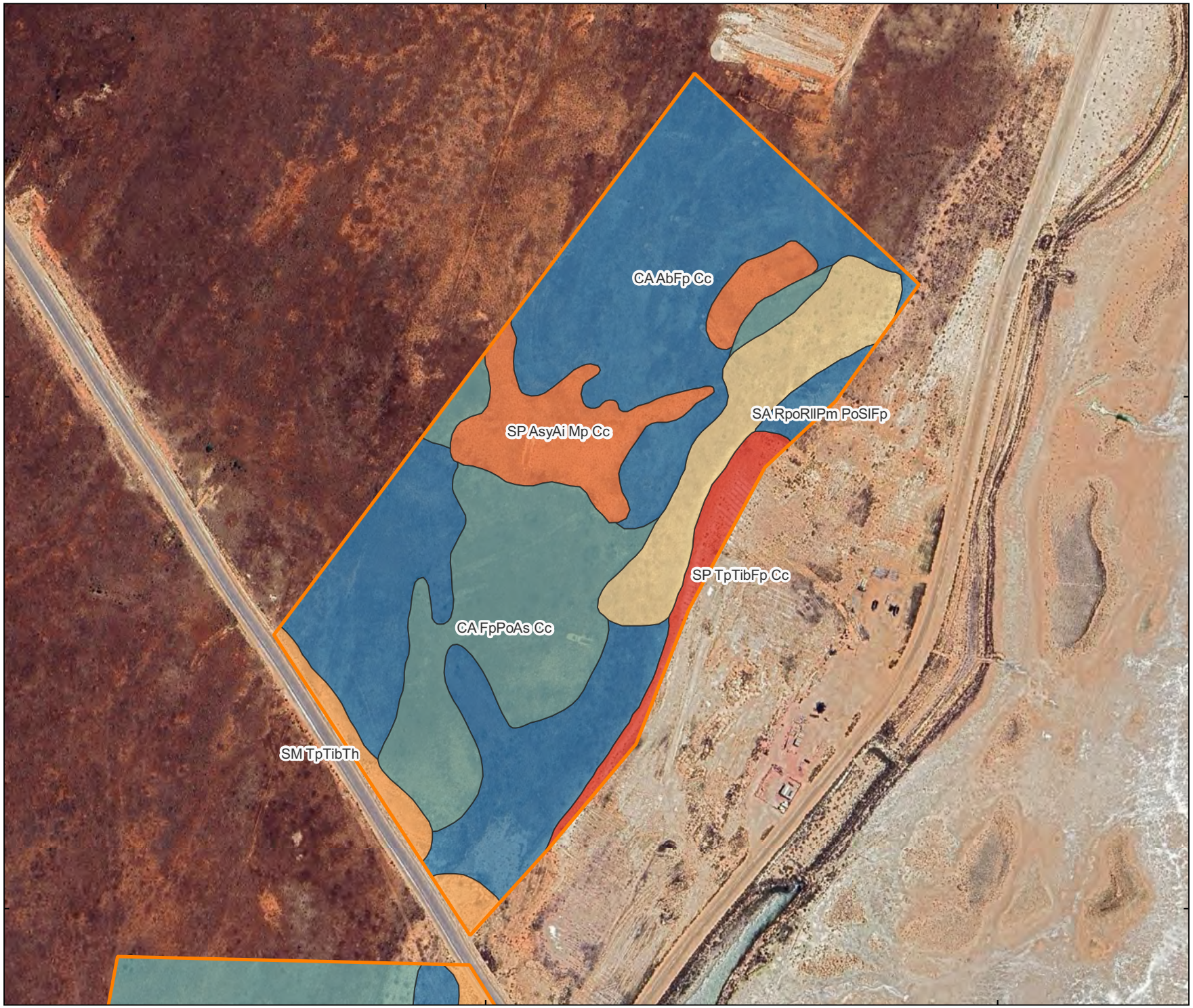
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- HC McTddBcb TgTe
- SA GbMcAl Tg
- SA McHsTdd Tg
- Roads/tracks

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Figure 10d: Vegetation types occurring within the study area

Legend

Vegetation Types

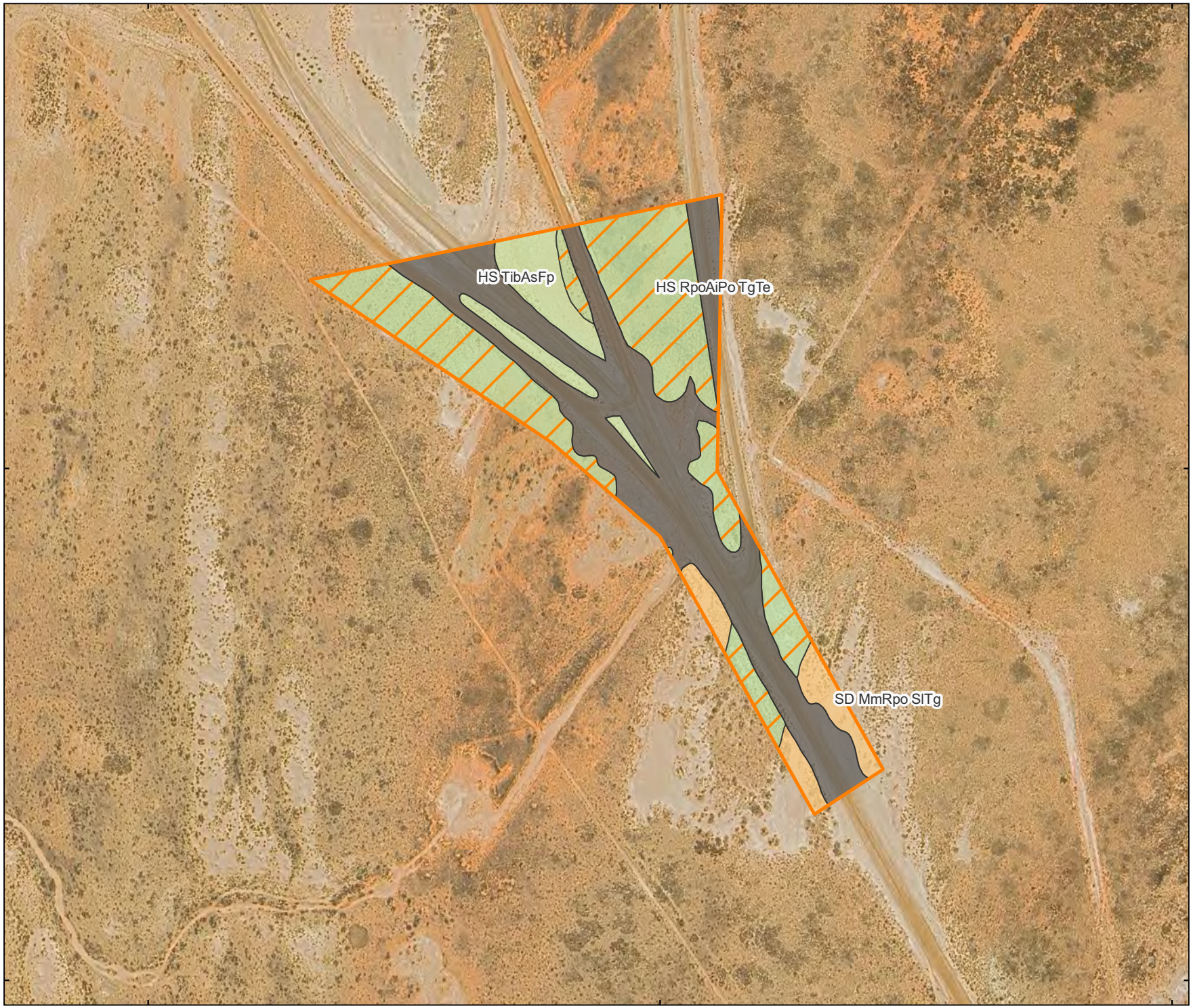
- CA AbFp Cc
- CA FpPoAs Cc
- SA RpoRIIPm PoSIFp
- SM TpTibTh
- SP AsyAi Mp Cc
- SP TpTibFp Cc

0 50 100 150 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	10
Sheet Size:	A4
File Reference:	LM_Figure6_veg_map

Datum: GDA 2020
Projection: MGA Zone 50



LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 10e: Vegetation types occurring within the study area

Legend

Vegetation Types

- HS RpoAiPo TgTe
- HS TibAsFp
- SD MmRpo SlTg
- Roads/tracks

0 50 100 150 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	10
Sheet Size:	A4
File Reference:	LM_Figure6_veg_map

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 10f: Vegetation types occurring within the study area

Legend

Vegetation Types

- SA RpoRIIPm PoSIFp
- Roads/tracks

0 50 100 m

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Document Control	
Date:	10th June 2025
Status:	Final
Figure:	10
Sheet Size:	A4
File Reference:	LM_Figure6_veg_map

Datum: GDA 2020
Projection: MGA Zone 50

Description of vegetation types recorded from the study area

Code	SM TpTibTh
Broad Floristic Formation	*Tecticornia* Low Heath D
Vegetation Type	Low Heath D of *Tecticornia pruinosa, Tecticornia indica* subsp. *bidens, Tecticornia pterygosperma* subsp. *denticulata* and *Tecticornia* cf. *halocnemoides* over Scattered Herbs in brown clay loam on saline flats and marsh



Releves	ONS-2061
Area (ha)	4.13 ha Borrow Pit 11, Water Dam 2
Soils and Geology	Brown clay loam
Landform	Saline flats and marsh
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Good
Disturbances	Rubbish, road / access track, mining infrastructure
Average Fire Age	Old (6+yr)

Code	SM Th Sv
Broad Floristic Formation	*Tecticornia* Low Heath D
Vegetation Type	Low Heath D of *Tecticornia* cf. *halocnemoides* (with *Muellerolimon salicorniaceum, Tecticornia indica* subsp. *bidens* and *Tecticornia pterygosperma* subsp. *denticulata*) over Very Open Low Grass of *Sporobolus virginicus* in brown light clay on saline flats and marsh



Releves	ONS-2066, ONS-2149
Area (ha)	4.67 ha Borrow Pit 10 and 11, Water Dam 2
Soils and Geology	Brown light clay
Landform	Saline flats and marsh
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor
Disturbances	Rubbish, road / access track, weeds, mine site infrastructure and disturbance, siltation from road run off.
Average Fire Age	Old (6+yr)

Code	CA AbFp Cc
Broad Floristic Formation	*Atriplex* Low Heath D
Vegetation Type	Low Heath D of *Atriplex bunburyana, Atriplex paludosa* subsp. *baudinii* and *Frankenia pauciflora (*with *Threlkeldia diffusa, Ptilotus obovatus* and *Dissocarpus paradoxus*) over Very Open Low Grass of **Cenchrus ciliaris* in brown silty loam and sandy loam on limestone outcrops



Releves	ONS-2067, ONS-2079, ONS-2142, ONS-2148, ONS-2198
Area (ha)	45.60 ha Borrow Pit 10 and 11, Water Dam 2
Soils and Geology	Brown silty loam and sandy loam
Landform	Limestone outcrops and raised limestone platforms
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor to Good
Disturbances	Goat grazing, rubbish, road / access track, weeds
Average Fire Age	Old (6+yr)

Code	CA AsyRII PoElSr
Broad Floristic Formation	*Cenchrus* Low Grass
Vegetation Type	Scattered Shrubs of *Acacia synchronicia* (with *Acacia sclerosperma* subsp. *sclerosperma*) over Scattered Low Shrubs of *Acacia synchronicia* and *Rhagodia latifolia* subsp. *latifolia* over Open Dwarf Scrub D of *Ptilotus obovatus*, *Eremophila* cf. *latrobei* subsp. *latrobei* and *Sclerolaena recurvicuspis* over Low Grass of **Cenchrus ciliaris* in brown sandy loam on limestone plain



Releves	ONS-2145
Area (ha)	37.50 ha Borrow Pit 10
Soils and Geology	Brown sandy loam
Landform	Limestone plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Degraded
Disturbances	Goat grazing, road / access track, weeds dominant
Average Fire Age	Old (6+yr)

Code	CA FpPoAs Cc
Broad Floristic Formation	*Frankenia* Dwarf Scrub D
Vegetation Type	Open Dwarf Scrub C of *Rhagodia latifolia* subsp. *latifolia* and *Atriplex bunburyana* over Dwarf Scrub D of *Frankenia pauciflora*, *Ptilotus obovatus*, *Atriplex semilunaris* (with *Solanum lasiophyllum*, *Dissocarpus paradoxus* and *Sclerolaena recurvicuspis*) over Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of **Asphodelus fistulosus* and **Mesembryanthemum crystallinum* in orange sandy loam on limestone plain



Releves	ONS-2071, ONS-2076, ONS-2087, ONS-2200
Area (ha)	17.79 ha Borrow Pit 11, Water Dam 2
Soils and Geology	Orange to orange-brown sandy loam
Landform	Limestone plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor
Disturbances	Goat grazing, road/ access track, rubbish, weeds, historical soil disturbance
Average Fire Age	Old (6+yr)

Code	DZ Ssb
Broad Floristic Formation	*Samolus* Low Heath D
Vegetation Type	Low Heath D of *Samolus* sp. Shark Bay (M.E. Trudgen 7410) (with *Tecticornia pruinosa*, *Tecticornia* cf. *halocnemoides*, *Muellerolimon salicorniaceum*) in brown light medium clay on drainage area/ drainage zone



Releves	ONS-2081
Area (ha)	0.22 ha Water Dam 2
Soils and Geology	Brown light medium clay
Landform	Drainage area/ drainage zone
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor
Disturbances	Road / access track, rubbish, mining infrastructure, possible historical drainage alteration
Average Fire Age	Old (6+yr)

Code	SA RpoRIIPm PoSIFp
Broad Floristic Formation	*Acacia* Scrub
Vegetation Type	Scrub to Open Scrub of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius* over Low Scrub A to Open Low Scrub A of *Rhagodia preissii* subsp. *obovata*, *Rhagodia latifolia* subsp. *latifolia* and *Pimelea microcephala* over Dwarf Scrub D of *Ptilotus obovatus*, *Solanum lasiophyllum* and *Frankenia pauciflora* (with *Ptilotus divaricatus*, *Stylobasium spathulatum* and *Corchorus crozophorifolius*) over Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of **Asphodelus fistulosus* in orange or cream brown sand on sand plain



Releves	ONS-2057, ONS-2060, ONS-2103, ONS-2150, ONS-2202
Area (ha)	110.9 ha Road Maintenance 1, Borrow Pit 10
Soils and Geology	Orange or cream brown sand
Landform	Sand plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor to Degraded
Disturbances	Rabbit/ goat grazing, road / access track, rubbish, high weed load, historical soil disturbance
Average Fire Age	Old (6+yr)

Code	SD MmRpo SlTg
Broad Floristic Formation	*Myoporum* Open Low Scrub B
Vegetation Type	Open Low Scrub B of *Myoporum montanum* and *Rhagodia preissii* subsp. *obovata* over Open Dwarf Scrub C of *Atriplex paludosa* subsp. *baudinii*, *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* over Open Dwarf Scrub D of *Atriplex paludosa* subsp. *baudinii*, *Ptilotus obovatus* and *Enchylaena tomentosa* over Open Hummock Grass of *Spinifex longifolius* and *Triodia glabra* over Very Open Low Grass of **Cenchrus ciliaris* in white/ brown sand on sand dune



Releves	ONS-2091, ONS-2102
Area (ha)	0.63 ha Road Maintenance 2
Soils and Geology	White/ brown sand
Landform	Sand dune
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor
Disturbances	Sheep/ goat/ kangaroo grazing, road / access track, weeds, historical soil disturbance, mining infrastructure
Average Fire Age	Old (6+yr)

Code	HS RpoAiPo TgTe
Broad Floristic Formation	*Rhagodia* Dwarf Scrub D
Vegetation Type	Open Dwarf Scrub C of *Rhagodia preissii* subsp. *obovata*, *Atriplex paludosa* subsp. *baudinii* and *Exocarpos aphyllus* over Dwarf Scrub D of *Rhagodia preissii* subsp. *obovata*, *Atriplex paludosa* subsp. *baudinii* and *Ptilotus obovatus* (with *Corchorus crozophorifolius* and *Pimelea microcephalus*) over Open Hummock Grass of *Triodia glabra* and *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* over Very Open Herbs of mixed dead herb species in light brown sand on undulating low hills



Releves	ONS-2096, ONS-2099
Area (ha)	3.77 ha Road Maintenance 2
Soils and Geology	Light brown sand
Landform	Undulating low hills
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Poor
Disturbances	Goat/ kangaroo grazing, road / access track, rubbish, weeds, historical soil disturbance, mining infrastructure
Average Fire Age	Old (6+yr)

Code	HS TibAsFp
Broad Floristic Formation	*Atriplex* Open Dwarf Scrub D
Vegetation Type	Open Dwarf Scrub D of *Atriplex semilunaris, Tecticornia indica* subsp. *bidens* and *Frankenia pauciflora* (with *Atriplex paludosa* subsp. *baudinii*, *Neobassia astrocarpus* and *Tecticornia pruinosa*) in cream-pink sand on undulating low hills (disturbed)



Releves	ONS-2098
Area (ha)	0.81 ha Road Maintenance 2
Soils and Geology	Cream-pink sand
Landform	Undulating low hills (disturbed)
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Degraded
Disturbances	Road / access track, rubbish, weeds, historical soil disturbance (altered landscape from road and infrastructure construction), mining infrastructure, salt deposition from truck spills
Average Fire Age	Old (6+yr)

Code	SP PoSlCoc Cc
Broad Floristic Formation	*Cenchrus* Low Grass
Vegetation Type	Scattered Tall Shrubs (to Open Scrub) of *Acacia sclerosperma* subsp. *sclerosperma*, *Hakea preissii* and *Acacia synchronicia* (with *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius*) over Open Low Scrub A of *Rhagodia latifolia* subsp. *latifolia*, *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia synchronicia* (with *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Eremophila* cf. *latrobei* and *Atriplex bunburyana* over Dwarf Scrub D (to Open Dwarf Scrub D) of *Ptilotus obovatus*, *Solanum lasiophyllum* and *Corchorus crozophorifolius* (with *Frankenia pauciflora*) over Low Grass of **Cenchrus ciliaris* in orange loamy sand on sandy / stony plain



Releves	ONS-2106, ONS-2111, ONS-2112, ONS-2155
Area (ha)	21.03ha Borrow Pit 10
Soils and Geology	Orange loamy sand
Landform	Sandy / stony plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Degraded
Disturbances	Goat/ kangaroo grazing, road / access track, high weed load
Average Fire Age	Old (6+yr)

Code	SP AsyAi Mp Cc
Broad Floristic Formation	*Maireana* Dwarf Scrub D
Vegetation Type	Scattered Shrubs of *Acacia synchronicia* and *Atriplex* sp. over Dwarf Scrub D of *Maireana polypterygia* (with *Solanum lasiophyllum*, *Dissocarpus paradoxus* and *Ptilotus obovatus*) over Scattered Low Grass of **Cenchrus ciliaris* over Scattered Herbs (dead) in orange silty loam and loamy sand on sandy / stony plain



Releves	ONS-2108, ONS-2140, ONS-2199
Area (ha)	57.1ha Borrow Pit 10 and 11
Soils and Geology	Orange silty loam and loamy sand
Landform	Sandy / stony plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Good
Disturbances	Goat/ kangaroo grazing, rubbish, weeds
Average Fire Age	Old (6+yr)

Code	CA AI TddDbAI TgTe
Broad Floristic Formation	*Acacia* Low Scrub A
Vegetation Type	Low Scrub A of *Acacia ligulata* (with *Acacia chartacea* and *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Dodonaea bursariifolia* over Dwarf Scrub D of *Thryptomene dampieri* subsp. *dampieri*, *Dodonaea bursariifolia* and *Acacia ligulata* over Hummock Grass of *Triodia glabra* and *Triodia epactia* in brown cream sandy loam on limestone outcrops (rehabilitated borrow pit vegetation)



Releves	ONS-2113
Area (ha)	2.02 ha Borrow Pit 13
Soils and Geology	Brown cream sandy loam
Landform	Limestone outcrops (rehabilitated borrow pit vegetation)
TEC / PEC	No
Conservation Significant Flora	None (possibly *Stenanthemum divaricatum* P3 present)
Vegetation Condition	Good
Disturbances	Road / access track, historical soil disturbance (old borrow pit), topsoil/ borrow material removal
Average Fire Age	Old (6+yr)

Code	HC McTddBcb TgTe
Broad Floristic Formation	*Triodia* Mid-Dense Hummock Grass
Vegetation Type	Scattered Shrubs of *Acacia tetragonophylla*, *Exocarpos aphyllus* and *Dodonaea bursariifolia* over Dwarf Scrub D of *Melaleuca cardiophylla*, *Thryptomene dampieri* subsp. *dampieri* and *Beyeria cinerea* subsp. *borealis* (with *Scaevola* cf. *anchusifolia*, *Acanthocarpus humilis* and *Dipteracanthus australasicus* subsp. *corynothecus*) over Mid-Dense Hummock Grass of *Triodia glabra* and *Triodia epactia* in orange sand on hillcrest / upper hillslope



Releves	ONS-2119
Area (ha)	1.57 ha Borrow Pit 13
Soils and Geology	Orange sand
Landform	Hillcrest / upper hillslope
TEC / PEC	No
Conservation Significant Flora	*Stenanthemum divaricatum* (P3)
Vegetation Condition	Very Good
Disturbances	None discernible
Average Fire Age	Old (6+yr)

Code	SA McHsTdd Tg
Broad Floristic Formation	*Triodia* Mid-Dense Hummock Grass
Vegetation Type	Open Low Scrub A of *Acacia ligulata*, *Acacia coriacea* subsp. *coriacea* and *Acacia tetragonophylla* (with *Exocarpos aphyllus*) over Open Dwarf Scrub C of *Acacia ligulata* and *Stylobasium spathulatum* over Dwarf Scrub D (to Open Dwarf Scrub D) of *Melaleuca cardiophylla*, *Hakea stenophylla* subsp. *stenophylla* and *Thryptomene dampieri* subsp. *dampieri* (with *Dampiera spicigera* and *Calothamnus borealis* subsp. *borealis*) over Mid-Dense Hummock Grass of *Triodia glabra* (with *Triodia epactia*) in orange sand on undulating sand plains and low hills



Releves	ONS-2123, ONS-2170, ONS-2186
Area (ha)	24.36 ha Borrow Pit 13
Soils and Geology	Orange sand
Landform	Undulating sand plains and low hills
TEC / PEC	No
Conservation Significant Flora	*Indigofera* cf. *oraria* (P1), *Stenanthemum divaricatum* (P3), *Eriachne* aff. *obtusa* (species of interest)
Vegetation Condition	Very Good
Disturbances	Goat/ sheep grazing, road / access track
Average Fire Age	Old (6+yr)

Code	SA GbMcAl Te
Broad Floristic Formation	*Triodia* Mid-Dense Hummock Grass
Vegetation Type	Scattered Tall Shrubs of *Acacia coriacea* subsp. *coriacea*, *Acacia tetragonophylla* and *Exocarpos aphyllus* over Open Low Scrub A of *Acacia ligulata*, *Exocarpos aphyllus* and *Grevillea b*undera over Dwarf Scrub C of Grev*illea* bundera, *Melaleuca cardiophylla* and *Acacia ligulata* over Dwarf Scrub D of *Melaleuca cardiophylla*, *Corchorus crozophorifolius* and *Thryptomene dampieri* subsp. dampieri (with *Hannafordia quadrivalvis* subsp. *recurva*) over Mid-Dense Hummock Grass of *Triodia epactia* and *Triodia glabra* in orange sand on undulating sand plains and deep sandy swales



Releves	ONS-2168, ONS-2177, ONS-2193
Area (ha)	7.53 ha Borrow Pit 13
Soils and Geology	Orange sand
Landform	Undulating and deep sandy swales
TEC / PEC	No
Conservation Significant Flora	*Olax aurantia* (range extension)
Vegetation Condition	Very Good
Disturbances	Goat/ sheep grazing, road / access track
Average Fire Age	Old (6+yr)

Code	SD CocTddSs Te
Broad Floristic Formation	*Triodia* Hummock Grass
Vegetation Type	Open Scrub of *Acacia coriacea* subsp. *coriacea*, *Banksia ashbyi* and *Acacia tetragonophylla* over Open Low Scrub A of *Alectryon oleifolius* subsp. *oleifolius*, *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* (with *Banksia ashbyi*) over Dwarf Scrub D of *Corchorus crozophorifolius*, *Thryptomene dampieri* subsp. *dampieri* and *Stylobasium spathulatum* over Hummock Grass of *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* and *Eragrostis* eriopoda in light pink sand on sand dune



Releves	ONS-2133
Area (ha)	2.72 ha Borrow Pit 10
Soils and Geology	Light pink sand
Landform	Sand dune
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Very Good
Disturbances	Goat grazing, road / access track, weeds
Average Fire Age	Old (6+yr)

Code	SA CocPoSs Te
Broad Floristic Formation	*Triodia* Mid-Dense Hummock Grass
Vegetation Type	Open Scrub (to Scrub) of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla* and *Alectryon oleifolius* subsp. *oleifolius* over Open Low Scrub A of *Rhagodia preissii* subsp. *obovata* and *Exocarpos aphyllus* over Dwarf Scrub D of *Corchorus crozophorifolius*, *Ptilotus obovatus* and *Stylobasium spathulatum* (with *Dipteracanthus australasicus* subsp. *corynothecus*, *Eremophila* cf. *latrobei* and *Thryptomene dampieri* subsp. *dam* *pieri*) over Mid-Dense Hummock Grass of *Triodia epactia* over Very Open Low Grass of **Cenchrus ciliaris* in pink loamy sand on undulating sand plain



Releves	ONS-2136, ONS-2137, ONS-2152
Area (ha)	33.22 ha Borrow Pit 10
Soils and Geology	Pink loamy sand
Landform	Undulating sand plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Very Good
Disturbances	Goat grazing, road / access track, weeds
Average Fire Age	Old (6+yr)

Code	SP PoFpSl Cc
Broad Floristic Formation	*Cenchrus* Low Grass
Vegetation Type	Open Low Scrub A of *Acacia synchronicia* over Dwarf Scrub D of *Ptilotus obovatus*, *Frankenia pauciflora* and *Solanum lasiophyllum* (with *Corchorus crozophorifolius*) over Low Grass of **Cenchrus ciliaris* in cream silty loam on stony plain (rehabilitated borrow pit vegetation)



Releves	ONS-2144
Area (ha)	4.7 ha Borrow Pit 10
Soils and Geology	Cream silty loam
Landform	Stony plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Degraded
Disturbances	Goat grazing, mine exploration, high weed load, historical soil disturbance (rehabilitated borrow pit)
Average Fire Age	Old (6+yr)

Code	SP TpTibFp Cc
Broad Floristic Formation	*Tecticornia* Dwarf Scrub D
Vegetation Type	Dwarf Scrub D of *Tecticornia pruinosa* (and/or *Tecticornia indica* subsp. *bidens* and *Frankenia pauciflora*) over Very Open Low Grass of *Cenchrus ciliaris* in cream brown silty loam on stony plain (rehabilitated borrow pit vegetation)



Releves	ONS-2156, ONS-2197
Area (ha)	1.73 ha Borrow Pit 10 and 11
Soils and Geology	Cream brown silty loam
Landform	Stony plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Degraded
Disturbances	Goat grazing, Mine exploration, road / access track, rubbish, high weed load, historical soil disturbance (rehabilitated borrow pit)
Average Fire Age	Old (6+yr)

Code	SP AooAsyAt EaPmRII PoMp
Broad Floristic Formation	*Alectryon* Thicket
Vegetation Type	Thicket of *Alectryon oleifolius* subsp. *oleifolius*, *Acacia synchronicia* and *Acacia tetragonophylla* over Low Scrub A of *Exocarpos aphyllus*, *Pimelea microcephalus* and *Rhagodia latifolia* subsp. *latifolia* over Dwarf Scrub D of *Ptilotus obovatus* and *Maireana polyptergygia* over Very Open Low Grass of **Cenchrus ciliaris* in brown sandy clay loam on sandy / stony plain



Releves	ONS-2161
Area (ha)	2.74 ha Borrow Pit 10
Soils and Geology	Brown sandy clay loam
Landform	Sandy / stony plain
TEC / PEC	No
Conservation Significant Flora	None
Vegetation Condition	Good
Disturbances	Goat grazing, road / access track, weeds
Average Fire Age	Old (6+yr)

4.4.7 Representation and Reservation of Vegetation

Three Beard (1981) vegetation associations intersect the study area:

- Coastal Dunes 95: Hummock grasslands, shrub steppe; *Acacia* and *Grevillea* over *Triodia basedowii*;
- Coastal Dunes 328: Succulent steppe with scrub; waterwood and *Acacia sclerosperma* over saltbush and samphire; and
- Coastal Dunes 329; Shrublands; dwarf waterwood (*Acacia coriacea*) shrubs on recent dunes.

All vegetation associations were determined to be well represented at all levels, state-wide, bioregional (IBRA region and IBRA sub-region), and local government authority, with >96% of the Pre-European extent remaining (Table 17).

However, vegetation associations were determined not to be well reserved with none of the current extent occurring within formal reserves at the IBRA level and local government level (Table 17). At the state level vegetation association 95 has 1.5% of the current extent reserved (Table 17).

Table 17 Pre-European extent of vegetation represented on the basis of identified datasets (Government of Western Australia 2019).

Vegetation System / Association	Pre-European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	Current Extent in Class I-IV Reserves (ha)	% Current Extent in Class I-IV Reserves
State-wide					
95	1,224,626.57	1,223,593.74	99.92	18,340.95	1.50
328	10,236.89	9,954.66	97.24		
329	27,383.07	26,333.31	96.17		
IBRA Region - Carnarvon					
95	390,084.97	389,947.89	99.96		
328	10,236.89	9,954.66	97.24		
329	25,113.19	25,100.87	99.95		
IBRA Sub-Region - Wooramel					
95	332,277.23	332,140.15	99.96		
328	10,236.89	9,954.66	97.24		
329	25,113.19	25,100.87	99.95		
Local Government Authority - Shire of Carnarvon					
95	385,399.51	384,366.68	99.73		
328	10,236.89	9,954.66	97.24		
329	27,383.07	26,333.31	96.17		

4.4.8 Conservation Significance of Vegetation

None of the 21 vegetation types recorded from the study area were aligned with a Commonwealth listed TEC or supported flora of national conservation significance. Therefore none of the vegetation types are considered to be of national conservation significance.

None of the 21 vegetation types recorded from the study area were aligned with Western Australian listed TECs or DBCA listed PECs. However, two vegetation types supported Priority flora taxa listed by the DBCA: SA McHsTdd Tg and HC McTddBcb TgTe. These two vegetation types were considered to be of state conservation significance.

Two vegetation types supported plant taxa considered to represent significant range extensions of 100 km or more, or species of interest. Therefore, these vegetation types were considered to be of local conservation significance. SA McHsTdd Tg (also of State significance) and SA GbMcAl Te.

4.5 Field Survey Results - Fauna

4.5.1 Fauna Habitat Types

A total of four fauna habitat types occurred across the six survey areas (Plates 5-8): *Acacia* Shrublands on sandplains and sand dunes, coastal hills and sand dunes, limestone plains and *Tecticornia* saltmarshes (Figure 11, Table 18). Coastal hills and sand dunes occurred within the Road Maintenance 2 survey area consisting of undulating hills and dunes and supported low chenopod shrublands and hummock grassland. This habitat had been significantly disturbed by road maintenance activities but included rockpiles and low shrubs. The *Acacia* Shrublands on sandplains and sand dunes habitat occurred across the majority of the Borrow Pit 13, Borrow Pit 10 and Road Maintenance 1 survey areas and was more localised within the Borrow Pit 11 survey area. The *Acacia* shrublands supported a variety of small bird species and sandy soils with suitability for burrowing was also a feature of this habitat. Limestone plains and saltmarsh occurred within the Borrow Pit 10 and 11 survey areas as well as the Water Dam 2 survey area. Both habitats occurred on the fringes of Lake MacLeod on limestone plains covering large areas supporting predominantly low chenopod shrublands with some *Acacia* species with a scattered stony mantle of limestone pebbles. The edges of the Lake MacLeod lake-bed and low points within these survey areas supported a saltmarsh habitat type with vegetation dominated by low *Tecticornia* (samphire) species. These saltmarsh areas would likely be subject to occasional inundation during flooding events and are the habitat most likely to be used by migratory shorebirds and waterbirds.

Table 18 Fauna habitats occurring within the study area.

Survey Area	Fauna Habitat	Area	% Area
Borrow Pit 10	*Tecticornia* Salt Marsh	3.80	1.3
	Acacia Shrubland on sand plains and dunes	214.14	73.7
	Limestone plains	72.79	25.0
		290.73	**100.0**
Borrow Pit 11	*Tecticornia* Salt Marsh	1.55	6.8
	Acacia Shrubland on sand plains and dunes	4.67	20.3
	Limestone plains	16.72	72.9
Total		**22.94**	**100.0**
Borrow Pit 13	Acacia Shrubland on sand plains and dunes	35.48	96.7
	Roads/tracks	1.21	3.3
		36.69	**100.0**
Road Maintenance 1	*Acacia* Shrubland on sand plains and dunes	1.41	60.2
	Roads/tracks	0.93	39.8
		2.34	**100.0**
Road Maintenance 2	Roads/tracks	4.34	45.5
	Coastal hills and sand dunes	5.21	54.5
		9.54	**100.0**
Water Dam 2	Roads/tracks	0.49	1.4
	Tecticornia Salt Marsh	5.39	15.5
	Cleared/Infrastructure	6.23	18.0
	Limestone plains	22.58	65.1
		34.68	**100.0**



Plate 5 Coastal hills and sand dunes habitat.



Plate 6 *Acacia* Shrubland on sand plains and dunes



Plate 7 Limestone Plain Habitat



Plate 8 *Tecticornia* saltmarsh habitat.



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11a: Fauna habitats occurring within the study area

Legend

- Study Area

Fauna Habitats

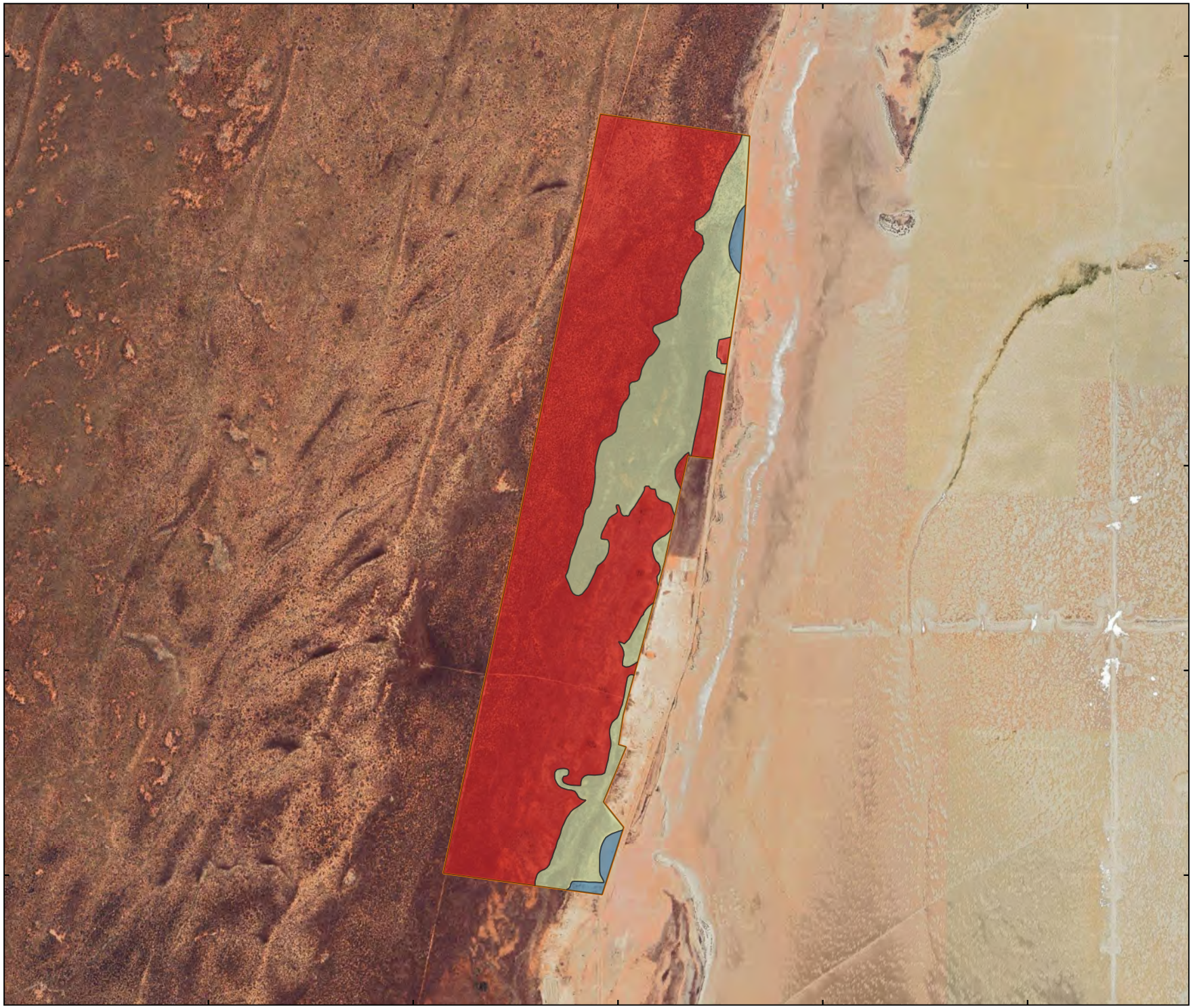
- Limestone plains
- Tecticornia Salt Marsh
- Cleared/Infrastructure
- Roads/tracks

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure10_habitats

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11b: Fauna habitats occurring within the study area

Legend

- Study Area

Fauna Habitats

- Acacia Shrublands on sand plains and dunes
- Limestone plains
- Tecticornia Salt Marsh

0 0.5 1 km

1:25,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure10_habitats

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11c: Fauna habitats occurring within the study area

Legend

- Study Area

Fauna Habitats

- Acacia Shrublands on sand plains and dunes
- Roads/tracks

0 100 200 300 m

1:10,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure10_habitats

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11d: Fauna habitats occurring within the study area

Legend

- Study Area

Fauna Habitats

- Acacia Shrublands on sand plains and dunes
- Limestone plains
- Tecticornia Salt Marsh

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure10_habitats

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11e: Fauna habitats occurring within the study area

Legend

Study Area

Fauna Habitats

Costal hills and sand dunes

Roads/tracks

0 100 200 m

1:5,000

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure10_habitats

Datum: GDA 2020
Projection: MGA Zone 50



ONSHORE ENVIRONMENTAL

LEICHHARDT LAKE MACLEOD OPERATIONS

Figure 11f: Fauna habitats occurring within the study area

Legend

- Study Area

Fauna Habitats

- Acacia Shrublands on sand plains and dunes
- Roads/tracks

0 50 100 m

1:2,500

Document Control	
Date:	10th June 2025
Status:	Final
Figure:	11
Sheet Size:	A4
File Reference:	LM_Figure7_veg_cond

Datum: GDA 2020
Projection: MGA Zone 50

4.5.2 Fauna Assemblage

A total of 67 vertebrate fauna species were recorded from the field survey, audio recorders and motion sensitive cameras, including 51 bird species, nine mammals and seven reptiles (Appendix 6).

4.5.3 Introduced Fauna

Four introduced fauna species were recorded from within the study area: Goats (*Capra aegagrus hircus*), Cat (*Felis catus*), Rabbit (*Oryctolagus cuniculus),* Sheep (*Ovis aries*). Grazing by sheep and goats has had a significant degrading influence on the vegetation within six survey areas. The presence of Cats has likely reduced the diversity and abundance of small birds, mammals and reptiles within the study area through predation pressure.

4.5.4 Conservation Significant Fauna

No fauna of conservation significance were recorded from within the study area. However, one conservation significant fauna species was recorded adjacent to the Water Dam 2 survey area: Glossy Ibis (*Plegadis falcinellus*), listed as Migratory. A single individual was observed from a water filled roadside drainage channel approximately 50 m outside the survey area (Plate 9).

Two additional species were considered likely to utilise the study area: the Gnaraloo Mulch Slider and Osprey, which are discussed below. The Fork-tailed Swift (*Apus pacificus*, Migratory) is also likely to fly over the study area occasionally but is an entirely aerial species and is not reliant on habitats within the study area.

Migratory shorebird and coastal species listed as conservation significant species may also occasionally utilise the study area. These species are most likely to utilise the saltmarsh habitat following significant rainfall events and may also utilise the existing dam within the Water Dam 2 survey area. As identified from the database searches the species most likely to utilise the study area include:

- Ruddy Turnstone (*Arenaria interpres*, Migratory);
- Long-toed Stint (*Calidris subminuta*, Migratory);
- Common Redshank (*Tringa tetanus*, Migratory);
- Greater Sand Plover (*Charadrius leschenaultia*, Vulnerable and Migratory);
- Gull-billed Tern (*Gelochelidon nilotica*, Migratory);
- Oriental Pratincole (*Glareola maldivarum*, Migratory);
- Caspian Tern (*Hydroprogne caspia*, Migratory);
- Pacific Golden Plover (*Pluvialus fulva*, Migratory);
- Grey Plover (*Pluvialus squatarola* , Migratory);
- Wood Sandpiper (*Tringa glareola*, Migratory); and
- Common Greenshank (*Tringa nebularia*, Migratory).

Glossy Ibis (*Plegadis falcinellus,* Migratory under the EPBC Act)

The Glossy Ibis occurs across much of the Australian mainland except for the arid interior and inhabits lakes, wetlands, floodplains, saline wetlands, mangroves and mudflats (Pizzey and Knight 2012). It is a non-breeding visitor to Western Australia with migratory movements to the Murray Darling Region, Macquarie Marshes and southern Queensland to breed. Breeding occurs in shallow nests of leafy vegetation in colonies between February and April in the north, and October to December the south. In the local area there are numerous records of this species around Carnarvon along the Gascoyne River and adjacent wetlands. This species may occasionally utilise the salt marsh habitat within the Water Dam survey area as well as saltmarsh habitat fringing the lake-bed at the Borrow Pit 11 and Borrow Pit 10 survey areas.

Gnaraloo Mulch Skink (*Lerista haroldi*, Priority 1)

The Gnaraloo mulch slider is a species of *Lerista* confined to a small area of the Western Australian coast between Gnaraloo and Cape Cuvier. It has been recorded from coastal dunes. A single record of this species within the Borrow Pit 13 survey area was recorded in 1995 by the WA Museum. An additional record occurs 2.5 km east of the Borrow Pit 13 survey area. The habitat within this area comprises *Acacia* shrubland on sand dunes and sand plains (Plate 10). Extensive areas of similar habitat occurred along the length of the Gypsum Haul Road survey area and within the Borrow Pit 10 survey area, and this species was considered likely to occur within this habitat. Hand searches and raking of leaf litter (Figures 6a-6f) was conducted in suitable habitat surrounding the previous record however no individuals were recorded.

Osprey (*Pandion haliaetus*, Migratory)

The Osprey is a large raptor commonly occurring along the Western Australian coastline. It is widespread around mainland Australia inhabiting bays, coasts, estuaries and islands. This species builds large nests of sticks on beaches, dunes, pylons and in trees. Two nests possibly used by Ospreys were observed in close proximity to the study area occurring adjacent to the Water Dam 2 and Road Maintenance 2 survey areas (Plate 11). Neither of the nests were active at the time of survey and therefore the species could not be confirmed. This species is considered likely to fly over habitats within the study area and is likely to breed in the local area.

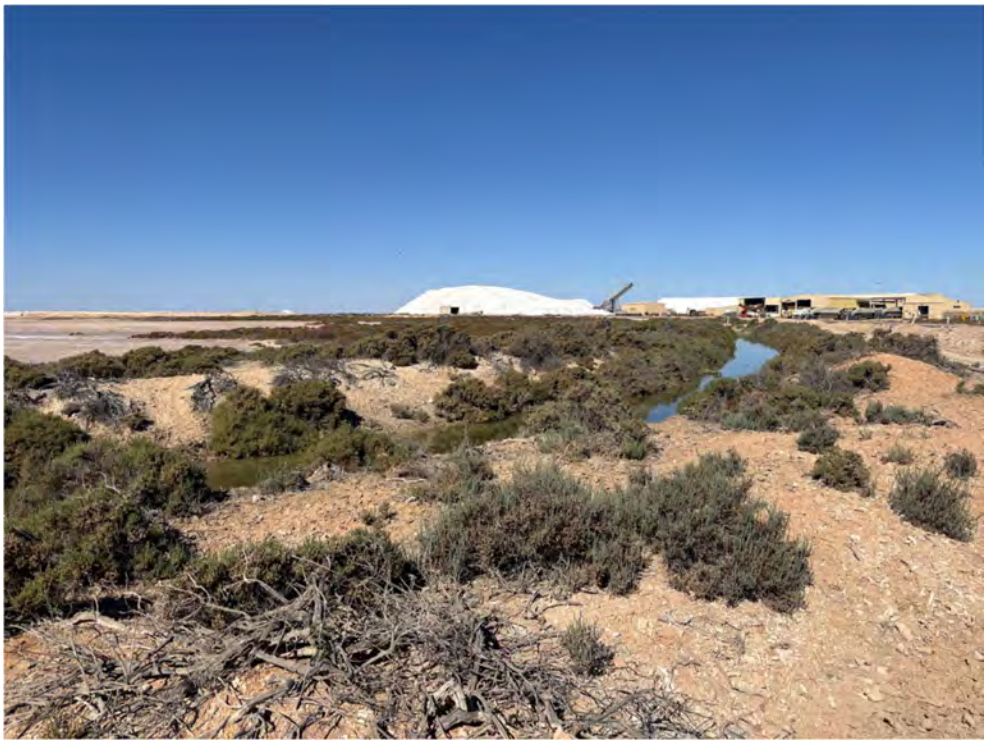


Plate 9 Roadside drainage channel where the Glossy Ibis was recorded.



Plate 10 Habitat suitable for the Gnarloo Mulch slider (*Lerista haroldi*) at the location of the previous record.



Plate 11 Large stick nest outside the Road Maintenance 2 survey area.

4.6 Native Vegetation Clearing Permit

The proposal to clear up to 290.73 ha of native vegetation across the six areas surveyed at the Lake MacLeod Solar Salt Project was assessed against the ten clearing principles (Appendix 7). The assessment determined that outcome from proposed clearing was unlikely to be at variance any of the ten clearing principles.

5.0 SUMMARY

Onshore Environmental completed a reconnaissance flora and vegetation survey and basic vertebrate fauna survey of six areas at the Lake MacLeod Solar Salt Project.

The reconnaissance flora and vegetation survey recorded a total of 124 plant taxa from 41 families and 90 genera. A total of 21 vegetation types were recorded across the six survey areas. Four species of conservation significance were recorded from the Borrow Pit 13 survey area:

- *Indigofera* cf. *oraria* (Priority 1 and range extension);
- *Stenanthemum divaricatum* (Priority 3);
- *Olax aurantia* (range extension); and
- *Eriachne* aff. *obtusa* (species of interest).

A total of 21 vegetation types occurring on for broad landform types were mapped from the study area. None of these were aligned with Commonwealth or Western Australian listed TECs, or DBCA listed PECs documented from the Gascoyne Bioregion. Vegetation condition was predominantly rated as *good* to *poor* (71% of the study area) with the major disturbances including grazing by domestic stock and edge effects along cleared road and access track corridors, mining infrastructure and road maintenance activities.

Four fauna habitat types occurred across the six survey areas:

- *Acacia* shrublands on sandplains and sand dunes;
- coastal hills and sand dunes;
- limestone plains; and
- *Tecticornia* saltmarshes.

A total of 67 fauna species were recorded including 51 bird species, nine mammals and seven reptiles. One species of conservation significance was recorded adjacent to the study area: Glossy Ibis (listed as Migratory under the EPBC Act). Three other conservation significant species were likely to occur within the study area;

- Gnaraloo Mulch Slider (Priority 1);
- Fork-Tailed Swift (Migratory); and
- Osprey (Migratory).

The Gnarloo Mulch Slider was likely to occur within the *Acacia* shrublands on sandplains and sand dunes habitat which occurred at the Borrow Pit 13, Borrow Pit 10 and Borrow Pit 11 survey areas. There was a previous record of this species within the Borrow Pit 13 survey area but it could not be confirmed during the field survey despite targeted searches. The Fork-tailed Swift and Osprey were likely to fly over the study area. Large stick nests possibly utilised by Ospreys were observed adjacent to two of the survey areas.

A number of migratory shorebirds may occasionally utilise the *Tecticornia* saltmarsh habitat within the Water Dam 2 and Borrow Pit 10 and 11 survey areas following significant rainfall events. This includes the Glossy Ibis which was recorded from a water filled drainage channel 50 m outside the Water Dam 2 survey area.

6.0 STUDY TEAM

The reconnaissance flora and vegetation survey and basic vertebrate fauna survey was planned, coordinated and executed by the following personnel:

Onshore Environmental Consultants P/L
ABN 41 095 837 120
PO Box 227
YALLINGUP WA 6282
M 0427 339 842
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Project Staff

Dr Darren Brearley	PhD	Project Manager and Principal Botanist
Dr Jerome Bull	PhD	Principal Botanist
Ms Jessica Waters	BSc	Principal Ecologist
Mr Thomas Mott	BSc	Ecologist

Licences

The field survey was conducted under the authorisation of the following licences issued by DBCA:

- Dr Jerome Bull, Onshore Environmental Consultants 'Flora Taking (Biological Assessment) Licence' - Licence No. FB62000103

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APPENDIX 1

Conservation codes for species and communities of conservation significance

Categories used under the EPBC Act		
Status	Code	Description
Critically Endangered	Cr	Taxa considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	En	Taxa considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	Vu	Taxa considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	Mi	Species that migrate to, over and within Australia and its external territories

Conservation Codes used under the BC Act		
Status	Code	Description
Critically Endangered	CR	Taxa rare or likely to become extinct, as critically endangered taxa
Endangered	EN	Taxa rare or likely to become extinct, as endangered taxa
Vulnerable	VU	Taxa rare or likely to become extinct, as vulnerable taxa
Presumed Extinct	EX	Taxa presumed to be extinct
Migratory	IA	Birds subject to international agreements relating to the protection of migratory birds
Conservation Dependent	CD	Taxa of special conservation need, being species dependent on ongoing conservation intervention
Special Protection	OS	Taxa in need of special protection

IUCN Red List Categories		
Status	Code	Description
Extinct	EX	There is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	The taxon is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range.
Critically Endangered	CR	When the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered	EN	When the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable	VU	When the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened	NT	When it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern	LC	When it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are often included in this category.
Data Deficient	DD	When there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	When it is has not yet been evaluated against the criteria.

Priority Flora and Fauna Under the BC Act		
Status	Code	Description
Priority 1: Poorly-known Species	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2: Poorly-known Species	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3: Poorly-known Species	P3	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4: Rare, Near Threatened and other species in need of monitoring	P4	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Definitions, Categories and Criteria for Threatened and Priority Ecological Communities General Definitions	
Ecological Community	A naturally occurring biological assemblage that occurs in a particular type of habitat. Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.
Threatened Ecological Community (TEC)	A threatened ecological community (TEC) is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”. Possible threatened ecological communities that do not meet survey criteria are added to DEC’s Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.
Assemblage	An assemblage is a defined group of biological entities.
Habitat	Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.
Occurrence	A discrete example of an ecological community, separated from other examples of the same community by more than 20 meters of a different ecological community, an artificial surface or a totally destroyed community. By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.
Adequately Surveyed	An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.
Community structure	The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage (e.g. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B) All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (I, ii, iii) i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities	
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in an area and/or was originally of limited distribution and is in danger of significant modification throughout it range or severe modification or destruction over most of its range in the near future An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A) Geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B) Current distribution is limited, and one or more of the following apply (I, ii, iii) i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii) There are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii) There may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.

Definitions and Criteria for Priority Ecological Communities	
Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.	
Priority 1 Poorly-known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 Poorly-known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 Poorly-known ecological communities	i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat or habitat destruction or degradation ii) communities known forma few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system bit are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stick, and inappropriate fire regimes Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them
Priority 4 Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring	a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c) Ecological communities that have been removed from the list of threatened communities during the past five years
Priority 5 Conservation Dependent ecological communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result int eh community becoming threatened within five years

APPENDIX 2

Vegetation classification based on Aplin.

Height Class	% Canopy Cover				
	100 - 70%	70 - 30%	30 - 10%	10 - 2%	< 2%
Trees > 30 m	High Closed Forest	High Open Forest	High Woodland	High Open Woodland	Scattered Tall Trees
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland	Scattered Trees
Trees < 10 m	Low Closed Woodland	Low Open Forest	Low Woodland	Low Open Woodland	Scattered Low Trees
Mallee	Closed Mallee	Mallee	Open Mallee	Very Open Mallee	Scattered Mallees
Shrubs > 2 m	Closed Scrub	Open Scrub	High Shrubland	High Open Shrubland	Scattered Tall Shrubs
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland	Scattered Shrubs
Shrubs < 1 m	Low Closed Heath	Low Open Heath	Low Shrubland	Low Open Shrubland	Low Scattered Shrubs
Hummock Grass	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland	Scattered Hummock Grass
Tussock Grass	Closed Tussock Grassland	Tussock Grassland	Open Tussock Grassland	Very Open Tussock Grassland	Scattered Tussock Grass
Bunch Grass	Closed Bunch Grassland	Bunch Grassland	Open Bunch Grassland	Very Open Bunch Grassland	Scattered Bunch Grass
Sedges	Closed Sedges	Sedges	Open Sedges	Very Open Sedges	Scattered Sedges
Herbs	Closed Herbs	Herbs	Open Herbs	Very Open Herbs	Scattered Herbs

APPENDIX 3

Vegetation condition scale
(as developed by Keighery 1994)

Condition	Code	Description
Pristine	1	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	3	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees and shrubs.

APPENDIX 4

Total flora list from the study area

* Denotes introduced flora species

Family	Taxon Name
Acanthaceae	*Dipteracanthus australasicus* subsp. *corynothecus*
Aizoaceae	**Mesembryanthemum crystallinum*
Amaranthaceae	*Ptilotus divaricatus*
Amaranthaceae	*Ptilotus obovatus*
Amaranthaceae	*Surreya diandra*
Apocynaceae	*Gymnema graniticola*
Arecaceae	*Phoenix dactylifera*
Asparagaceae	*Acanthocarpus humilis*
Asparagaceae	*Acanthocarpus robustus*
Asparagaceae	*Acanthocarpus verticillatus*
Asphodelaceae	**Asphodelus fistulosus*
Asteraceae	*Angianthus cf. tomentosus*
Asteraceae	*Centaurea melitensis*
Asteraceae	*Gnephosis gynotricha*
Asteraceae	*Olearia* sp. Kennedy Range (G. Byrne 66)
Asteraceae	*Olearia* sp. Wallabi Island (D.J. Edinger DJE 2727)
Asteraceae	*Pembertonia latisquamea*
Asteraceae	*Pterocaulon sphacelatum*
Boraginaceae	*Halgania cyanea* var. Allambi Stn (B.W. Strong 676)
Brassicaceae	*Lepidium* sp. indet
Chenopodiaceae	*Atriplex bunburyana*
Chenopodiaceae	*Atriplex paludosa* subsp. *baudinii*
Chenopodiaceae	*Atriplex semilunaris*
Chenopodiaceae	*Atriplex sp.*
Chenopodiaceae	*Dissocarpus paradoxus*
Chenopodiaceae	*Dysphania sphaerosperma*
Chenopodiaceae	*Enchylaena tomentosa* subsp. *tomentosa*
Chenopodiaceae	*Maireana polypterygia*
Chenopodiaceae	*Neobassia astrocarpus*
Chenopodiaceae	*Rhagodia latifolia* subsp. *latifolia*
Chenopodiaceae	*Rhagodia preissii* subsp. *obovata*
Chenopodiaceae	*Salsola australis*
Chenopodiaceae	*Sclerolaena recurvicuspis*
Chenopodiaceae	*Sclerolaena uniflora*
Chenopodiaceae	*Tecticornia* cf. *halocnemoides* subsp. *tenuis*
Chenopodiaceae	*Tecticornia* cf. *peltata*
Chenopodiaceae	*Tecticornia indica* subsp. *bidens*
Chenopodiaceae	*Tecticornia pergranulata* subsp. *elongata*
Chenopodiaceae	*Tecticornia pruinosa*
Chenopodiaceae	*Tecticornia pterygosperma* subsp. *denticulata*
Chenopodiaceae	*Threlkeldia diffusa*
Convolvulaceae	*Convolvulus remotus*
Euphorbiaceae	*Beyeria cinerea* subsp. *borealis*
Euphorbiaceae	*Euphorbia* cf. *tannensis subsp. eremophila*
Euphorbiaceae	*Euphorbia* sp. *indet*
Fabaceae	*Acacia ampliceps*
Fabaceae	*Acacia chartacea*
Fabaceae	*Acacia coriacea* subsp. *coriacea*
Fabaceae	*Acacia gregorii*

Family	Taxon Name
Fabaceae	*Acacia ligulata*
Fabaceae	*Acacia sclerosperma* subsp. *sclerosperma*
Fabaceae	*Acacia spathulifolia*
Fabaceae	*Acacia synchronicia*
Fabaceae	*Acacia tetragonophylla*
Fabaceae	*Chorizema racemosum*
Fabaceae	*Daviesia benthamii*
Fabaceae	*Indigofera cf. oraria*
Fabaceae	*Labichea cassioides*
Fabaceae	*Leptosema macrocarpum*
Fabaceae	*Senna glutinosa* subsp. *chatelainiana*
Fabaceae	*Swainsona cf. pterostylis*
Frankeniaceae	*Frankenia cinerea*
Frankeniaceae	*Frankenia pauciflora*
Goodeniaceae	*Dampiera incana* var. *incana*
Goodeniaceae	*Dampiera spicigera*
Goodeniaceae	*Lechenaultia subcymosa*
Goodeniaceae	*Scaevola anchusifolia*
Goodeniaceae	*Scaevola sericophylla*
Goodeniaceae	*Scaevola spicigera*
Goodeniaceae	*Scaevola tomentosa*
Hemerocallidaceae	*Dianella revoluta* var. *divaricata*
Hemerocallidaceae	*Tricoryne corynothecoides*
Lamiaceae	*Quoya loxoarpa*
Lauraceae	*Cassytha aurea* var. *aurea*
Loranthaceae	*Lysiana* cf. *casuarinae*
Malvaceae	*Abutilon geranioides*
Malvaceae	*Abutilon* sp. indet
Malvaceae	*Alyogyne pinoniana*
Malvaceae	*Corchorus crozophorifolius*
Malvaceae	*Hannafordia quadrivalvis* subsp. *recurva*
Malvaceae	*Lawrencia viridigrisea*
Malvaceae	*Malvaceae* sp. indet
Malvaceae	*Sida calyxhymenia*
Malvaceae	*Sida cf.* sp. Pindar (A. Mitchell 3585)
Moraceae	*Ficus brachypoda*
Myrtaceae	*Calothamnus borealis* subsp. *borealis*
Myrtaceae	*Melaleuca cardiophylla*
Myrtaceae	*Thryptomene dampieri* subsp. *dampieri*
Nitrariaceae	*Nitraria billardieri*
Nyctaginaceae	*Commicarpus australis*
Olacaceae	*Olax aurantia*
Oleaceae	*Jasminum* sp. Exmouth (G. Marsh 77)
Phyllanthaceae	*Lysiandra hamelinii*
Plumbaginaceae	*Muellerolimon salicorniaceum*
Poaceae	**Cenchrus ciliaris*
Poaceae	*Aristida holathera* var. *holathera*
Poaceae	*Eragrostis eriopoda*
Poaceae	*Eriachne aff. obtusa*

Family	Taxon Name
Poaceae	*Spinifex longifolius*
Poaceae	*Sporobolus virginicus*
Poaceae	*Triodia epactia*
Poaceae	*Triodia glabra*
Primulaceae	*Samolus* sp. Shark Bay (M.E. Trudgen 7410)
Proteaceae	*Banksia ashbyi*
Proteaceae	*Grevillea bundera*
Proteaceae	*Hakea preissii*
Proteaceae	*Hakea stenophylla* subsp. *stenophylla*
Rhamnaceae	*Stenanthemum divaricatum*
Santalaceae	*Exocarpos aphyllus*
Santalaceae	*Santalum spicatum*
Sapindaceae	*Alectryon oleifolius* subsp. *oleifolius*
Sapindaceae	*Diplopeltis intermedia* var. *incana*
Sapindaceae	*Dodonaea bursariifolia*
Scrophulariaceae	*Eremophila cf. latrobei* subsp. *latrobei*
Scrophulariaceae	*Eremophila glabra* subsp. *psammophora*
Scrophulariaceae	*Eremophila mackinlayi* subsp. *mackinlayi*
Scrophulariaceae	*Myoporum montanum*
Solanaceae	*Solanum cleistogamum*
Solanaceae	*Solanum lasiophyllum*
Solanaceae	*Solanum orbiculatum*
Surianaceae	*Stylobasium spathulatum*
Tamaricaceae	*Tamarix aphylla*
Thymelaeaceae	*Pimelea microcephala*
Zygophyllaceae	*Roepera* sp. *indet*

APPENDIX 5

Location of conservation significant flora within the study area

Taxon Name	WA ConStat	Abundance	Coverage %	Plant Height	Easting	Northing
Eriachne aff. *obtusa*	Species of interest	10	3	0.4	749643	7318678
Eriachne aff. *obtusa*	Species of interest	10	3	0.4	745653	7318268
Eriachne aff. *obtusa*	Species of interest	10	4	0.4	749188	7318800
Eriachne aff. *obtusa*	Species of interest	15	5	0.4	749095	7318817
Indigofera cf. *oraria*	Priority 1	1	<1	0.2	745500	7318216
Indigofera cf. *oraria*	Priority 1	1	<1	0.2	750392	7318697
Olax aurantia	Range extension	1	<1	1.2	749446	7318844
Stenanthemum divaricatum	Priority 3	15	0.5	0.2	749077	7318737
Stenanthemum divaricatum	Priority 3	10	0.5	0.15	749719	7318693
Stenanthemum divaricatum	Priority 3	3	<1	0.15	749672	7318684
Stenanthemum divaricatum	Priority 3	5	0.5	0.15	749702	7318660
Stenanthemum divaricatum	Priority 3	2	<1	0.15	749715	7318744

APPENDIX 6

Total fauna species list recorded from the study area

Group	Common Name	Taxon Name
Birds	Grey Teal	*Anas gracilis*
Birds	Australian Pipit	*Anthus australis*
Birds	Wedge-tailed Eagle	*Aquila audax*
Birds	Great Egret (Eastern Great Egret)	*Ardea alba*
Birds	Masked Woodswallow	*Artamus personatus*
Birds	Rufous Fieldwren	*Calamanthus campestris*
Birds	Horsfield's Bronze Cuckoo	*Chalcites basalis*
Birds	White-backed Swallow	*Cheramoeca leucosterna*
Birds	Silver Gull	*Chroicocephalus novaehollandiae*
Birds	Grey Shrikethrush	*Colluricincla harmonica*
Birds	Black-faced Cuckooshrike	*Coracina novaehollandiae*
Birds	Little Crow	*Corvus bennetti*
Birds	Emu	*Dromaius novaehollandiae*
Birds	White-faced Heron	*Egretta novaehollandiae*
Birds	Black-shouldered Kite	*Elanus axillaris*
Birds	Crimson Chat	*Epthianura tricolor*
Birds	Brown Falcon	*Falco berigora*
Birds	Nankeen Kestrel	*Falco cenchroides*
Birds	Singing Honeyeater	*Gavicalis virescens*
Birds	Western Gerygone	*Gerygone fusca*
Birds	Whistling Kite	*Haliastur sphenurus*
Birds	Pied Stilt (White-headed Stilt)	*Himantopus himantopus leucocephalus*
Birds	Welcome Swallow	*Hirundo neoxena*
Birds	White-winged Triller	*Lalage tricolor*
Birds	Pacific Gull	*Larus pacificus*
Birds	Purple-backed Fairywren	*Malurus assimilis*
Birds	White-winged Fairywren	*Malurus leucopterus*
Birds	Yellow-throated Miner	*Manorina flavigula*
Birds	Hooded Robin	*Melanodryas cucullata*
Birds	Crested Pigeon	*Ocyphaps lophotes*
Birds	Crested Bellbird	*Oreoica gutturalis*
Birds	Eastern Osprey	*Pandion haliaetus cristatus*
Birds	Australian Pelican	*Pelecanus conspicillatus*
Birds	Tree Martin	*Petrochelidon nigricans*
Birds	Red-capped Robin	*Petroica goodenovii*
Birds	Common Bronzewing	*Phaps chalcoptera*
Birds	Glossy Ibis	*Plegadis falcinellus*
Birds	Hoary-Headed Grebe	*Poliocephalus poliocephalus*
Birds	White-browed Babbler	*Pomatostomus superciliosus*
Birds	Chiming Wedgebill	*Psophodes occidentalis*
Birds	Redthroat	*Pyrrholaemus brunneus*
Birds	Grey Fantail	*Rhipidura albiscapa*

Group	Common Name	Taxon Name
Birds	Willie Wagtail	*Rhipidura leucophrys*
Birds	Spotted Scrubwren	*Sericornis maculatus*
Birds	Brown Goshawk	*Tachyspiza fasciata*
Birds	Australian Shelduck	*Tadorna tadornoides*
Birds	Australian Zebra Finch	*Taeniopygia castanotis*
Birds	Australian White Ibis	*Threskiornis molucca*
Birds	Straw-necked Ibis	*Threskiornis spinicollis*
Birds	Little Buttonquail	*Turnix velox*
Birds	Grey-breasted White-eye (Silvereye)	*Zosterops lateralis*
Mammals	Goat	*Capra aegagrus hircus*
Mammals	Cat	*Felis catus*
Mammals	Spinifex Hopping-mouse	*Notomys alexis alexis*
Mammals	Rabbit	*Oryctolagus cuniculus*
Mammals	Euro, Biggada	*Osphranter robustus erubescens*
Mammals	Red Kangaroo, Marlu	*Osphranter rufus*
Mammals	Sheep	*Ovis aries*
Mammals	Stripe-faced Dunnart	*Sminthopsis macroura*
Mammals	Short-beaked Echidna	*Tachyglossus aculeatus acanthion*
Reptiles	Gnaraloo Heath Dragon	*Ctenophorus parviceps*
Reptiles	Russet Dragon	*Ctenophorus rubens*
Reptiles		*Ctenophotus nuchalis*
Reptiles	North West Cape Ctenotus	*Ctenotus iapetis*
Reptiles	Leopard Ctenotus	*Ctenotus pantherinus*
Reptiles	Reticulated Whipsnake	*Demansia reticulata*
Reptiles	Varanus spp.	*Varanus spp.*

APPENDIX 7

Assessment against the ten clearing principles

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
a. Native vegetation should not be cleared if it comprises a high level of biological diversity			
The field survey recorded 124 plant taxa from 41 families and 90 genera from the study area. The basic fauna survey recorded 67 vertebrate fauna species including 51 bird species, nine mammals and seven reptiles. There were 21 vegetation types recorded. Vegetation condition ranged from very good to completely degraded, with the main degrading features related to weeds, grazing and the proximity of existing mine infrastructure, roads and tracks.	Clearing of native vegetation required for expansion at the Lake MacLeod operations will not impact any areas of significant biodiversity. Habitats and vegetation types present within the study area are well represented in the local area and regionally. The areas proposed to be cleared are primarily within terrestrial habitats adjacent to the southern lake-bed of Lake MacLeod. The areas to be cleared are adjacent to existing infrastructure and roads and have been impacted by multiple disturbances likely reducing biological diversity. The Northern Ponds area of Lake MacLeod is known for high biological diversity but is situated approximately 15 km north-east of the clearing areas.	To minimise impact of the clearing on the environment, the following control measures are proposed; - The maximum extent of native vegetation clearing will not exceed 397 hectares; - All earthmoving machinery will be cleaned and inspected for weeds prior to entry into the project area.	The proposed vegetation clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
b. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.			
The Northern Ponds area of Lake MacLeod is proposed as a Ramsar site due to its significance for migratory shorebirds. Surveys of the Northern Ponds have counted more than 50,000 waterbirds with 70 species recorded (Phillips *et al.* 2005). The basic fauna survey recorded one species listed as Migratory under the EPBC Act; the Glossy Ibis (*Plegadis falcinellus*) in a water-filled drainage channel adjacent to the Water Dam 2 area. Habitat areas to be cleared are primarily terrestrial and unlikely to be utilised by migratory shorebirds. The saltmarsh habitat described within the Water Dam 2, Borrow Pit 11 and Borrow Pit 10 study areas may occasionally be utilised by migratory shorebirds during flood events.	Migratory species may occasionally utilise the salt marsh habitat and dam within the Water Dam survey area as well as saltmarsh habitat fringing the lake-bed at the Borrow Pit 11 and Borrow Pit 10 survey areas. However, these habitats are not considered significant for these species. The majority of records and significant numbers of migratory shorebirds are associated with the permanent wetlands of the Northern Ponds occurring 15 km north-east of the proposed clearing areas.	Minimise clearing of and disturbance to saltmarsh habitat where possible.	The proposed vegetation clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
c. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.			
None of the plant taxa recorded from the study area were determined to be: - Threatened Flora under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); or - Threatened Flora under the Western Australian *Biodiversity Conservation Act (2016)* (BC Act). Four species recorded from the Borrow Pit 13 study area were listed as Priority flora by the DBCA and/or as range extensions occurring outside their current known distribution; - *Indigofera* cf. *oraria* (Priority 1 and range extension); - *Stenanthemum divaricatum* (Priority 3); - *Olax aurantia* (range infill); and - *Eriachne* aff. *obtusa* (species of interest).	No Threatened flora taxa were identified within the project area during the detailed flora and vegetation survey. The four flora of conservation significance included two priority flora, one range extension and one species of interest. All four taxa occurred within vegetation types that occurred extensively outside the area of proposed disturbance and were considered likely to occur more broadly within the same vegetation types. *Eriachne* aff. *obtusa* and *Indigofera* cf. *oraria* were confirmed to occur outside of the Borrow Pit 13 study area boundary (Figure 8). The area to be cleared is small compared to the local extent of the vegetation types supporting each species. The proposed clearing is therefore unlikely to significantly impact on the populations of these species.	Avoid clearing at locations supporting Priority flora where possible.	The proposed vegetation clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
d. Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a threatened ecological community.			
The field assessment confirmed that none of the vegetation types recorded from the study area were aligned with any known Commonwealth or State listed TECs or State listed PECs represented within the Region.	No TECs or PECs were recorded within the study area.	No management requirements necessary.	The proposed vegetation clearing is unlikely to be at variance with this principle.
e. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.			
Three Beard vegetation associations were represented within the study area: - 95: Hummock grasslands, shrub steppe; Acacia and Grevillea over *Triodia basedowii;* - 328: Succulent steppe with scrub; waterwood and *Acacia sclerosperma* over saltbush and samphire; and - 329; Shrublands; dwarf waterwood (*Acacia coriacea*) shrubs on recent dunes. All vegetation associations were determined to be well represented at all levels, state-wide, bioregional (IBRA region and IBRA sub-region), and local government authority, with at least 96% of the Pre-European extent remaining across all levels.	Vegetation within the study area is determined to be well represented at the state-wide, bioregional [IBRA region and IBRA sub-region] and local government authority levels.	No management requirements necessary.	The proposed vegetation clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
f. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.			
The study area primarily occurs on sandplains and limestone plains surrounding the fringes of the dry lake-bed of Lake MacLeod. Areas of saltmarsh habitat occurring within the study areas may be periodically inundated after floods and are therefore considered part of the wetland ecosystem of Lake MacLeod.	The area of saltmarsh to be cleared is minimal compared to the local extent of this habitat, i.e., fringing the entire lake-bed. Saltmarsh habitat within the study area has been degraded due to the proximity to existing infrastructure and roads and is in good to poor condition. Proposed saltmarsh areas to be cleared are likely only periodically inundated and their removal is unlikely to effect the wetland ecosystem function or hydrological processes of the wetland. Therefore, this proposal is not likely to be at variance to this principle.	Minimise clearing of and disturbance to saltmarsh habitat where possible.	The proposed vegetation clearing is unlikely to be at variance with this principle.
g. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.			
Proposed vegetation to be cleared includes areas where condition was rated as very good to completely degraded. Vegetation is situated within areas adjacent to roads, access tracks and mining infrastructure. Vegetation has also been impacted by pastoral activities with the introduction of weed species and significant grazing pressure from goats and sheep.	The study area has previously been influenced by disturbances and condition has been reduced. As such, the clearing is unlikely to cause appreciable land degradation.	The following control measures are proposed to reduce the potential for long term degradation of the study area: - The maximum extent of native vegetation clearing will not exceed 397 hectares; - All earthmoving machinery will be cleaned and inspected for weeds prior to entry into the project area; and - Progressive backfilling and rehabilitation of borrow pits that are no longer in use as soon as practicable.	The proposed vegetation clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of Potential Impacts	Proposed Control Measures	Outcome- Assessment of Variance with Clearing Principle
h. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.			
The proposed clearing area is not within or adjacent to any conservation area. The Northern Ponds area has been proposed as a RAMSAR site and is situated 15km north-east of the Borrow Pit 13 study area.	The proposed clearing will not impact on any conservation areas.	No management requirements necessary.	The proposed vegetation clearing is unlikely to be at variance with this principle.
i. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.			
The study areas primarily occur on sandplains and limestone plains surrounding the fringes of the dry lake-bed of Lake MacLeod. Small areas of salt marsh fringing Lake MacLeod may be periodically inundated following significant rainfall.	The clearing of small areas of salt marsh on the fridge of the dry lake-bed is unlikely to impact the quality of surface or ground water.	All clearing should be undertaken during dry conditions to minimise potential for erosion or runoff into Lake MacLeod.	The proposed vegetation clearing is unlikely to be at variance with this principle.
j. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.			
The proposed area of clearing primarily occurs on sandplains and limestone with small areas of saltmarsh. The small area of clearing within saltmarsh habitat is unlikely to cause or exacerbate flooding events.	The proposed clearing of the vegetation is unlikely to cause, or exacerbate, the incidence or intensity of flooding.	All clearing should be undertaken during dry conditions to minimise potential for erosion or runoff into Lake MacLeod.	The proposed vegetation clearing is unlikely to be at variance with this principle.