Onslow Power Infrastructure Upgrade Project
EPA Part IV Referral Supporting Document

21 July 2014

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Appendix A **Desktop Review of the Proposed Onslow Micro-Siting Survey Area**

ACRONYMS, ABBREVIATIONS AND TERMINOLOGY

°C	Degrees Celsius
AH Act	Aboriginal Heritage Act 1972
CAPL	Chevron Australia Pty Ltd
DBNGP	Dampier-to-Bunbury Natural Gas Pipeline
DDG	DBP Development Group Pty Ltd
DER	Department of Environment Regulation (WA) - formerly Department of Environment and Conservation (WA)
Domgas	Domestic Gas
EMP	Environmental Management Plan
EP Act (WA)	Environmental Protection Act 1986
Firm capacity	The minimum power ouput that the power station must achieve, as specified in the State Development Agreement
GHG	Greenhouse Gas
ha	hectare(s)
HP	Horizon Power
Installed capacity	Maximum theoretical power generating capacity without regard to operational constraints such as efficiency, longevity of equipment and redundancy
kL	kilolitre
km	kilometre(s)
kV	kilovolt(s)
kW	kilowatt(s)
LNG	Liquefied Natural Gas
m	metre(s)
mm	millimetre(s)
mg/L	milligrams per litre
MW	megawatt(s)
NEPM	National Environmental Protection Measure
Net generation capacity	Maximum power output taking into account operational constraints such as the requirement for redundancy, site de-rating, parasitic loads and auxillary loads
NO_x	Nitrogen Oxides
NVCP	Native Vegetation Clearing Permit
O_3	Ozone
OPIUP	Onslow Power Infrastructure Upgrade Project
OWIUP	Onslow Water Infrastructure Upgrade Project
PASS	Potential Acid Sulfate Soils

Proponent	Horizon Power
PV	Photo-Voltaic
SDA	State Development Agreement
VOC	Volatile Organic Compounds
WA	Western Australia

1 INTRODUCTION

1.1 Background

The township of Onslow's current electricity generation and transmission infrastructure requires upgrading to support the increase in demand related to the expansion of housing, businesses and services in Onslow. The Ashburton North State Development Agreement (SDA) signed in September 2011 mandates that Chevron Australia Pty Ltd (CAPL) will mitigate the impacts of the anticipated population growth as a result of implementing the Wheatstone Liquefied Natural Gas (LNG) Project.

This proposal will involve the construction of a new dual fuel natural gas and diesel-fired power station and associated infrastructure, a double-circuit 33 kV transmission line and a zone substation. Not included in this proposal is the natural gas supply infrastructure from the Dampier Bunbury Natural Gas Pipeline (DBNGP) to the power station site, which will be provided by Dampier Bunbury Pipeline Development Group (DDG) and is subject to a separate environmental assessment and regulatory process. The power station will be constructed on Lot 555, on Plan 74894, with the transmission network contained where possible within an expanded road reserve for Onslow Road, controlled by Main Roads Western Australia (WA). The transmission line will terminate at Lot 185, which is currently vested to the Water Corporation. The location of the Onslow Power Infrastructure Upgrade Project (OPIUP) area is shown in Figure 1.

1.1.1 Power Station

The power station will have an *installed capacity* of 18 MW, consisting of five (5) 2 MW gas fuelled reciprocating generating sets and four (4) 2 MW diesel fuelled reciprocating generating sets and associated infrastructure to accommodate redundancy and growth in demand. The *net generation capacity* when commissioned and connected to the town feeders in 2016 is not expected to exceed 10.8 MW.

For the avoidance of doubt, *Installed capacity* is the sum of the MW nameplate ratings of the generating sets installed at the power station, while the *net generation capacity* is the MW output at the terminals of the power station once redundancy, site de-rating, power station parasitic loads and auxiliary loads are taken into account.

The balance of plant for the power station and contained within Lot 555 are noted as follows:

- A reticulated natural gas pipework system
- A diesel fuel storage and transfer systems
- A lube oil storage and transfer system
- A coolant storage and transfer system
- A liquid waste storage and transfer and offloading system, including oil traps, oily water storage, sump pit, and coolant
- Fire systems, including automatic fire detection, fire water pumps, fire ring main, fire hydrants and standpipes, fire panels, hose reels and foam carts to provide the first-line emergency response capability
- An 11 kV switchroom
- Two (2) 11/33 kV step up transformers

- A 33 kV switchroom
- A 400 V system
- Workshop, administration and ablution facilities
- A compressed air system may be provided but is subject to the selection of the engine supplier and manufacturer. The system may consist of compressors, accumulators, filtration, dryers and reticulation pipework.

Operation of the station is automated and generally unmanned, and capable of remote operation. Operational personnel will provide maintenance services and emergency response. Bulk earthworks on Lot 555 will provide an expandable facility, including space for additional generators and fuel storage. Space for additional high voltage switchgear and additional fire suppression infrastructure is also considered in the overall design.

1.1.2 Transmission Network

A 16 km 33 kV double-circuit transmission line constructed on steel poles (including foundations etc.) will be designed for future expansion to a maximum rating of 25 MVA, with the poles reaching a maximum height of approximately 30 m. The transmission line will cross the Onslow Salt concentration ponds, spanning the pond entirely, without the requirement for any intermediate poles. Vehicle access will be provided to the poles in the road reserve subject to finalisation of detailed design.

1.1.3 Zone Sub-station

A 33/11 kV zone substation designed to provide 11 kV distribution to Onslow town will be constructed on Lot 185. The substation will include two transformers for redundancy and will likely occupy a 50 x 50 m^2 parcel of land. External telecommunication lines will be provided by a third party to facilitate remote control and monitoring.

Additional facilities on Lot 185 required to facilitate the construction and operation of the substation are earthworks for site offices, laydown areas, hardstand areas, building foundations, access roads, engineered slopes and retaining walls and foundations for all Onslow zone substation infrastructure. The proposed Onslow Ring Road will provide an intersection for the access to the zone substation.

1.1.4 DDG interconnection

DDG will supply gas to the OPIUP via a gas off-take at the DBNGP Compressor Station 2 facility. The gas pipeline will be routed from the off-take facility to a custody transfer metering station on Lot 555, adjacent to the boundary of the power station. All infrastructure from the tie-in point (typically outside of the power station fence line) associated with gas infrastructure is outside the scope of this referral package.

1.2 Proponent

Horizon Power (HP) is an independent regional power corporation. It was created in April 2006 by the separation of Western Power into four stand-alone businesses. The changes were part of the State Government reform of electricity generation, distribution and retailing in Western Australia. HP is owned by the State Government and has its own board that reports to the Minister for Energy.

HP will act as proponent for the purpose of this referral as the Project is being constructed for the State to be owned and operated by HP. HP will oversee the scope for which CAPL is responsible.

As the technical, engineering and commissioning lead on the Project, CAPL will act as proponent for the purposes of obtaining Part V approval, as required under the *Environmental Protection Act 1986* (EP Act).

1.2.1 Chevron Australia

As per the SDA, CAPL will design, procure and construct a 9 MW firm output Power Station and associated transmission network. Post-commissioning, the asset will be transferred to HP for operation.

1.3 Purpose and Scope of Document

This document provides supporting information for the environmental referral of the OPIUP for assessment by the Environmental Protection Authority (EPA) under Section 38(1) of the EP Act. This document, and the attached EPA referral form, has addressed the environmental impacts that may occur as a result of the implementation of this proposal.

An application for a Works Approval under Part V of the EP Act will be submitted to the WA Department of Environment Regulation (DER) following approval advice from the EPA and further development of the design. A Licence application may also be submitted to DER, subject to final design criteria and DER advice.

HP considers that the potential environmental impacts of the proposal can be sufficiently managed under Part V of the EP Act, whereby:

- Emissions and discharges can be managed accordingly under a Works Approval and Licence (if required)
- Impact to vegetation and flora can be managed accordingly under a Clearing Permit

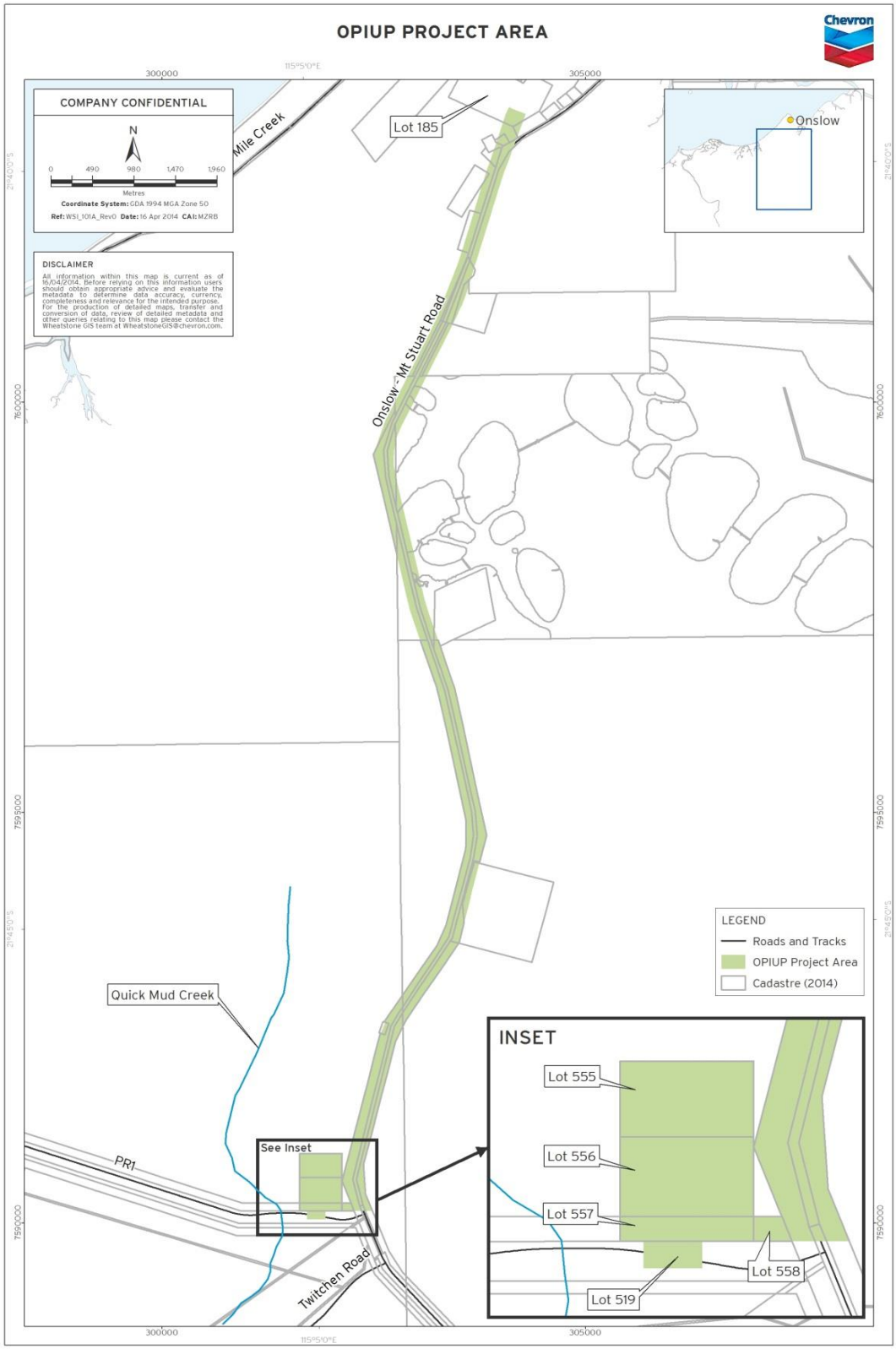

Figure 1: OPIUP Project Area

2 REGULATORY FRAMEWORK AND ENVIRONMENTAL ASSESSMENTS

The key legislation that applies to this referral supporting document includes, but is not limited to:

- *EP Act 1986*
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Wildlife Conservation Act 1950* (WC Act)
- *Aboriginal Heritage Act 1972* (AH Act).

An environmental assessment strategy has been developed and is displayed in **Error! Reference source ot found.**.

Table 1: Proposed Environmental Assessment Strategy

Agency/Authority	Assessment Required	Application Lodged
Department of Environmental Regulation (DER)	1. Native Vegetation Clearing Permit (NVCP) for Geotechnical Investigation 2. NVCP for construction of the OPIUP, if proposal is not assessed under Part IV below 3. Works Approval under Part V of the *EP Act 1986*	1. Yes. NVCP granted for Geotechnical investigation. 2. Construction NVCP dependent on outcome of the Part IV referral 3. No. Application to be lodged pending outcome of Part IV referral
Environmental Protection Authority (EPA)	Assessment under Part IV of the *EP Act 1986*	Yes. Contained within this document package
Department of Aboriginal Affairs (DAA)	Application under s18 of the *AH Act 1972* for potential disturbance to Aboriginal heritage sites	No. Subject to findings from baseline heritage report.

2.1 Approval under the EP Act 1986

The EP Act 1986 is the primary legislative tool for the assessment of potential environmental impacts in Western Australia. This Project is being referred to the EPA under Section 38(1) of the EP Act. To satisfy the conditions of Part V of the EP Act and to allow for preliminary geotechnical investigations, an NVCP was applied for and granted on the 17th of October 2013 by the DER.

2.2 Approval under the AH Act 1972

As the construction and pre-commissioning lead for the project, CAPL has a Native Title Agreement and Aboriginal Heritage Agreement with the Thalanyji that mandates heritage surveys to identify areas of archaeological and/or ethnographic significance prior to development. If heritage monitors identify items or sites of cultural significance that cannot be avoided, a Section 18 licence to disturb an Aboriginal site under the *Aboriginal Heritage Act 1972* (*AH Act*) will be applied for.

3 ALTERNATIVES TO PROPOSAL

A number of alternatives were evaluated for the OPIUP. A summary of options assessed and selected alternative are presented below.

3.1 Wheatstone Project Power Station

CAPL has constructed a temporary 12 MW power station to provide power for the Wheatstone Project Construction Village Camp. The possibility of upgrading this resource to supply power to the town as per the terms of the SDA was investigated. The following three major limitations were identified:

- Initial design was not conducive to modular upgrades. While possible, it was not economically viable due to the additional length of transmission line required and the technical requirements of the upgrade.
- The power station is currently providing power to the Wheatstone Project. The required shut-down operations would not be acceptable from the perspective of the Wheatstone Project construction schedule.
- Diesel Only – non-optimal greenhouse gas (GHG) balance.

3.2 CITIC Pacific Power Station

The possibility of linking Onslow to an existing Power Source was investigated. The nearest available source of power is the CITIC Pacific gas-fired power station, some 120 Km to the north-east. The option was only investigated to a pre-feasibility level, as the following limitations were identified:

- The length of transmission line required is cost-prohibitive
- Uncertainty of power access.

3.3 Generation Alternatives

The generation alternatives in the vicinity of Onslow are limited, primarily due to the availability of fuel sources. The proximity to the DBNGP offers the possibility of long term access to a reliable natural gas fuel source for the power station.. Two natural gas technology options were investigated:

- Gas-fired turbines
- Reciprocating engines

A number of different engine configurations have been identified, with the purpose of achieving maximum efficiency. The following alternative configurations to support the generation technologies were evaluated:

- Short term energy storage
- Waste heat recovery
- Combined cycle with steam turbine
- Combined cycle with organic rankine cycle
- Photo-Voltaic (PV)

All five evaluated engine configurations had the potential to improve efficiencies of the power station. Short term energy storage and combined cycle with organic rankin cycle would be limited by operational uncertainty, as the technologies are relatively new to the energy industry in Australia.. Waste heat recovery has been successfully adopted in the power industry in Australia, however due to the remote location of the power station, there would be no practical use for the heat produced. Combined cycle with steam turbine technology would be difficult to operate under variable load conditions and would require a critical volume of steam before implementation would be viable.

Two different configurations of PV were evaluated:

- Centralised PV power plant sized to 10% of area load (~900 kW)
- Centralised PV power plant sized to 20% of area load (~1.8 MW) with intermediate term storage.

A power plant with PV providing 10% load was demonstrated to have the potential to reduce load on the gas fired turbines, however does not offer a robust economic solution at this scale. At 20% load, intermediate (e.g. battery banks) energy storage is required, greatly increasing the capital cost of the investment, combined with the operational uncertainty associated with energy storage technology.

3.4 Project Justification

The remote nature of the Onslow town site limits the number of available power supply options. Natural gas is the most efficient fuel available in the proximity of the proposed site of the power station. The 'take no action' option is not feasible in this instance, as the current generating capacity of existing power infrastructure is not sufficient to cater for the expansion of the town. Binding commitments have been made by CAPL to the State in the SDA to provide and fully fund the construction of the power station and associated facilities..

4 KEY ENVIRONMENTAL FACTORS

4.1 Soils and Landforms

4.1.1 Baseline Environment

The Project Area lies within the Western Region soil landscape unit, which covers just under half of the total area of WA (Chevron 2010). This unit is further divided into provinces, with the Project Area contained entirely within the Exmouth Province. Soils in the Exmouth Province are mainly comprised mainly of the following:

- Sand plains and dunes dominated by deep red sands and deep sandy duplexes
- Red/brown cracking clays, hard cracking clays and deep red sandy duplexes on the alluvial plains and floodplains, along with some red loamy earths
- Tidal soils on the coastal flats
- Coastal dunes of calcareous sands and deep red sands
- Calcareous shallow loams, red loamy earths and stony soils on the Cape Range and other limestone hills
- Red deep sands on the undulating sandy plains to the south.

Areas of Potential Acid Sulfate Soils (PASS) have been identified in the nearby Ashburton North locality as part of site investigations conducted for the Wheatstone Project (Chevron 2010). Soil profiles indicative of PASS material are considered to be of marine/organic origin and are generally within landform units associated with intertidal flats, tidal creeks and supratidal salt flats (Chevron 2010). Investigations to date indicate a high probability the construction footprint of the project will intersect areas of PASS particularly during the construction the potable water transfer pipeline.

4.1.2 Impact Assessment

There are no specific landforms that are limited in extent to the Project Area. Soils in the Project Area are free draining and the risk of erosion occurring following development of the site is Low. The greatest risk to baseline soils and landform condition is the exposure and subsequent oxidation of PASS during the construction phase of the Project. Soils will be sampled and mapped for PASS during the geotechnical investigation. The high water table, lack of historical disturbance and high acid-neutralising characteristics of the regional soil profiles (Chevron 2010) will reduce the probability of intersecting areas of Actual Acid Sulfate Soils (AASS).

4.1.3 Proposed Management Measures

If exposed, identified areas of PASS will be treated in accordance with Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2011). A specific Environmental Management Plan (EMP) will address the management of PASS and identify targets to enforce compliance with legislative and site specific triggers. Management measures detailed in the EMP will include the development of a PASS risk map showing horizontal and vertical extent of PASS in soil profile and avoidance strategies for high risk areas.

4.1.4 Predicted Environmental Outcome

With the implementation of the management measures outlined in Section 4.1.3, the residual risk to Soils and Landforms from the construction and operation of the project is considered low and no significant deleterious impacts to soils or landforms are anticipated.

4.2 Water

4.2.1 Baseline Environment

Shallow groundwater in the vicinity of the Project Area is typically hyper saline, with Total Dissolved Solids (TDS) between 60 000 mg/L and 170 000 mg/L (URS 2013b). This shallow groundwater usually ranges between surface level and two metres beneath the surface (Chevron 2010).

In the deeper formations there are several confined aquifers, including the Windalia Radiolarite, Mungaroo Formation and the Birdrong Sandstone. The Birdrong Aquifer is a major regional groundwater resource for industrial quality water. The Birdrong Sandstone is predominately glauconitic sandstone with minor siltstone and conglomerate, and typically yields for production bores range from 500–4500 kL/day across the Carnarvon Basin (Chevron 2010).

Surface water in the Ashburton North locality is subject to several hydrological processes: local rainfall, run-off from upstream catchments and tidal inundation (Chevron 2010). Tidal inundation is not a factor in the hydrological systems relevant to the Project Area, with the possible exception of a large storm surge event associated with a tropical cyclone. The Onslow Salt concentrator ponds are the only surface water source that intersects the Project Area footprint. Water quality in the ponds is significantly saltier than seawater and only suitable for the production of salt.

4.2.2 Impact Assessment

The risk of impacts on surface water and groundwater arises primarily through loss of containment of hazardous substances such as hydrocarbons. Given the small quantities used and the implementation of management measures in Section 4.2.3 during construction and operation, the residual risk is low.

4.2.3 Proposed Management Measures

Surface water and groundwater monitoring will be conducted during construction and operations to detect any potential changes in water quality. The following water quality and environmental parameters will be monitored in the Project Area:

- Salinity
- Turbidity
- Selected metals (aluminium, barium, copper, lead, nickel, strontium and zinc)
- Nutrients (Nitrogen, Phosphorus and related compounds).

Hazardous materials will be managed through the use of Environmental Management Plans that stipulate adherence to applicable guidelines and standards such as the use of bunded hard stand areas for storage and minimum discharge criteria. Environmental Procedures will regulate key activities such as filling fuel storage tanks and disposal of waste.

4.2.4 Predicted Environmental Outcome

It is anticipated that there will be no deleterious impacts to groundwater or surface water as a result of implementing this proposal.

4.3 Flora and Vegetation

4.3.1 Baseline Environment

Seven flora and vegetation surveys have been conducted at the Onslow locality, all with survey boundaries intersecting with the Project Area. This has allowed interpolation of vegetation communities in the Project Area with a high level of certainty.

The Project Area has a long history of pastoral and industrial use with five per cent of the wider survey area mapped as Disturbed. The condition of the remaining 95% of the survey Area ranges from Good to Very Good (Biota 2013 – See Condition Scale Appendix A). Weed infestation of vegetation units by Buffel grass (*Cenchrus cilliarus*) is a major factor in determining vegetation condition within the Project Area. A further 1.6% of the survey Area has been mapped as bare mudflat, which contains no vegetation (Biota 2013).

Interpolation of vegetation units from existing studies has identified 15 distinct vegetation units and 206 flora species occurring in the wider Survey Area over six regionally extensive habitat types (Biota 2013). The Project Area is a subset of the unrefined Survey Area, as shown in Figure 2.

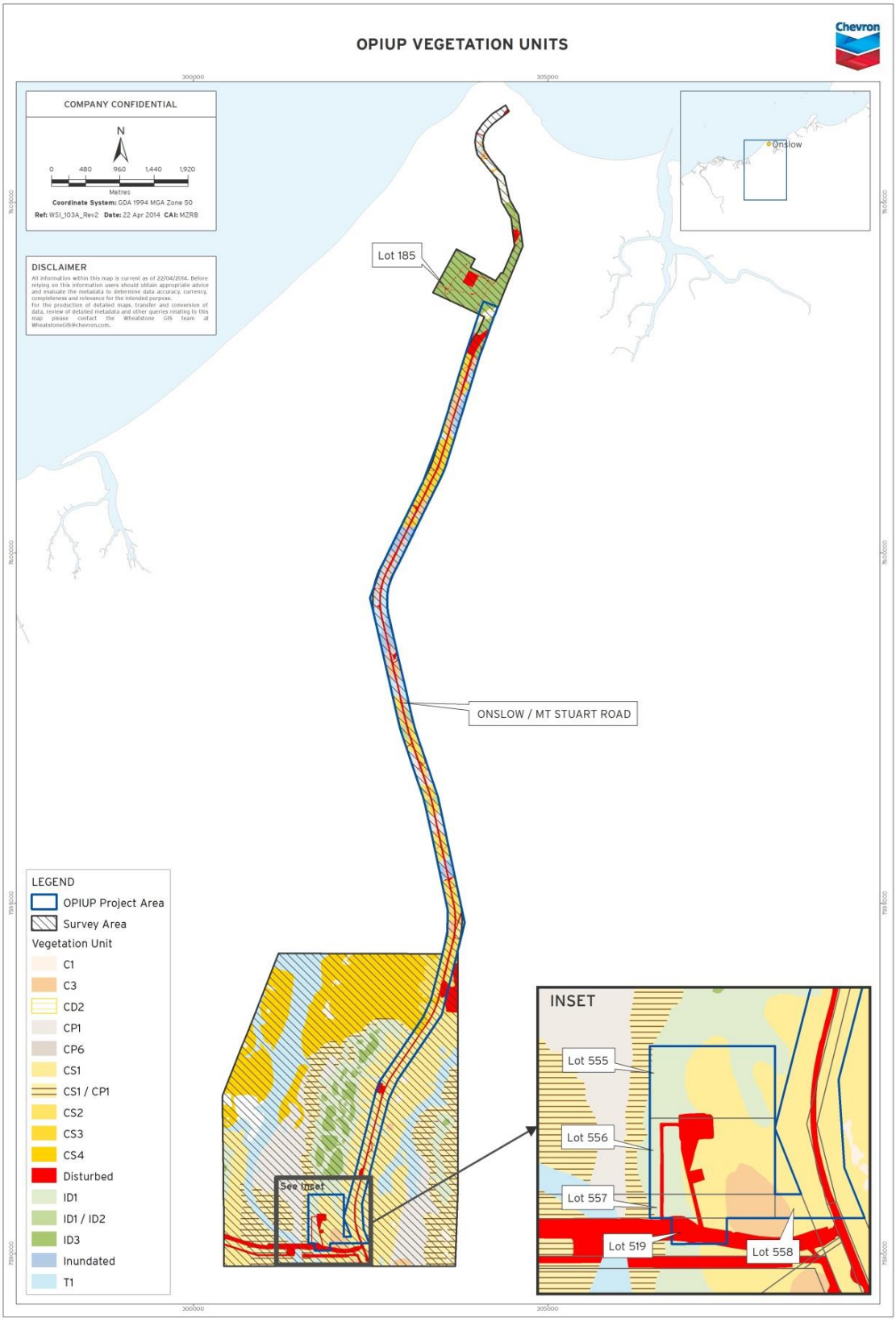
OPIUP VEGETATION UNITS
COMPANY CONFIDENTIAL
N
0 480 960 1,440 1,920
Metres
Coordinate System: GDA 1994 MGA Zone 50
Ref: WSI_103A_Rev2 Date: 22 Apr 2014 CAI: MZRB
DISCLAIMER
All information within this map is current as of 22/04/2014. Before relying on this information users should obtain appropriate advice and evaluate the metadata to determine data accuracy, currency, completeness and relevance for the intended purpose.
For the production of detailed maps, transfer and conversion of data, review of detailed metadata and other queries relating to this map please contact the Wheatstone GIS team at WheatstoneGIS@chevron.com.
Onslow
Lot 185
ONSLOW / MT STUART ROAD
See Inset
INSET
Lot 555
Lot 556
Lot 557
Lot 519
Lot 558
LEGEND
OPIUP Project Area
Survey Area
Vegetation Unit
C1
C3
CD2
CP1
CP6
CS1
CS1 / CP1
CS2
CS3
CS4
Disturbed
ID1
ID1 / ID2
ID3
Inundated
T1

Figure 2: Area subject to vegetation mapping

4.3.2 Impact Assessment

There are no Rare Flora, or Threatened/Priority Ecological Communities that will be impacted by the implementation of the Project. One species listed as Priority Flora (Flora of Conservation Significance) is known to occur within the Project Area. *Triumfetta echinata* (Priority 3) is known to occur on two ridges of red sand dunes within the Project Area, typical of the known habitat for the species (Biota 2013). This habitat is not restricted to the Project Area and is common and widespread in the locality (Biota 2011). The species has also been recorded from numerous locations outside of the Project Area (Chevron 2010).

Approximately 100 ha of the 321 ha of land within the Project Area will be directly cleared to construct the project, including temporary works such as access roads and lay down areas required to support construction. None of the vegetation units identified in the Project Area qualify as Threatened or Priority Ecological communities as listed by the DER (Table 1). Two vegetation units (ID1 and C3) in the Project Area are of elevated conservation significance, as they are known to support Priority and other flora of conservation significance in nearby areas (see Figure 2). The amount of each vegetation unit in the Project Area relative to the extent identified in regional botanical surveys is displayed in Table 1.

Table 1: Impact of clearing for the OPIUP on vegetation units in the Project Area

Vegetation Unit Code	Description	Conservation Significance	Amount in Project Area (ha)	Amount mapped by all surveys	Percentage to be cleared - Regional Surveys*
T1	*Tecticornia* spp. scattered low shrubs	Low	19.17	1366.11	1.40
CD2	*Acacia coriacea* subsp. *coriacea* tall shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland with *Cenchrus ciliaris* open tussock grassland	Low	3	57.68	5.20
ID1	*Grevillea stenobotrya* tall open shrubland over *Crotalaria*	High	14.97 ha plus 4.93 ha in mosaic with unit ID2	140.29	14.18

Vegetation Unit Code	Description	Conservation Significance	Amount in Project Area (ha)	Amount mapped by all surveys	Percentage to be cleared - Regional Surveys*
	cunninghamii, Trichodesma zeylanicum var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland				
ID2	*Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Hibiscus brachychlaenus* open shrubland over *Triodia schinzii, (T. epactia)* open hummock grassland	High	4.93 ha, occur only in mosaic with unit ID1.	197.20	2.50
ID3	*Acacia stellaticeps* shrubland over *Triodia epactia* hummock grassland	Low	4.46	146.47	5.35
CS1	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland	Low	79.54 ha	912.35 ha plus 171.68 in mosaic with CP1 and 636.21 ha in mosaic with CS2	8.72**
CS2	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland with **Cenchrus ciliaris* open tussock grassland	Low	47.28	254.61 ha plus 636.21 ha in mosaic with CS1	5.31

Vegetation Unit Code	Description	Conservation Significance	Amount in Project Area (ha)	Amount mapped by all surveys	Percentage to be cleared - Regional Surveys*
CS3	*Acacia tetragonophylla* scattered shrubs over *Scaevola pulchella, Indigofera monophylla* low open shrubland over *Triodia epactia* hummock grassland	Low	26.47	52.18	50.62**
CS4	**Prosopis pallida*, *Acacia tetragonophylla, A. synchronicia* scattered tall shrubs over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland	Low	3.20	298.15, plus 24.86 ha in mosaic with CP1 and 181.43 ha in mosaic with CS1	0.63
C1	Bare claypan	Low	0.22	47.78	0.46
C3	*Tecticornia* spp. low shrubland	High	22.98	551.19 plus 56.62 in mosaic with CP1 and 17.18 in mosaic with C2	3.68
CP1	*Sporobolus mitchellii, Eriachne* aff. *benthamii, E. benthamii, Eulalia aurea* tussock grassland	Moderate	10.22 ha plus 0.15 ha in mosaic with CS1	714.50	1.45
CP6	*Lawrencia viridigrisea* low open shrubland over *Triodia*	Low	15.28	25.03 ha ***	61.05 ***

Vegetation Unit Code	Description	Conservation Significance	Amount in Project Area (ha)	Amount mapped by all surveys	Percentage to be cleared - Regional Surveys*
	epactia open hummock grassland over **Cenchrus ciliaris* open tussock grassland				

Note: * Assumes 100% of unit within Project Area will be cleared; ** Does not include ha in mosaic with other units; *** This unit has only been described by one survey (Validus 2008).

4.3.3 Proposed Management Measures

Implementation of the project will utilise previously cleared areas where practicable and implement a Permit to Work system to manage vegetation clearing. Appropriate supervision of machinery operators will occur at all times. Management conditions associated with the required NVCP (if applicable) will be adhered to during construction. The current valid NVCP only authorises clearing for geotechnical and other investigative works.

4.3.4 Predicted Environmental Outcome

If the management measures in Section 4.3.3 are implemented, the risk of damage to flora and vegetation communities outside of the Project Area and associated with construction activities is low. No impact to the conservation status of any vegetation units or flora is anticipated.

4.4 Fauna

4.4.1 Baseline Environment

Extensive surveys of terrestrial fauna have been conducted in the vicinity of the Project Area. The desktop analysis conducted by Biota (2013) has collated this information for the purposes of this document. Six broad fauna habitats were identified in the Project Area (Biota 2013):

- Coastal Dune: *Acacia coriacea* tall shrubland over *Spinifex longifolius* open tussock grassland on coastal dune system
- Inland Dune: *Triodia epactia* dominated hummock grassland on inland dune system
- Sand/Loam Plain: *Acacia sp*. scattered shrubs over *Triodia epactia* hummock grassland on sand/loam plain
- Buffel on clay: Buffel Grass tussock grassland on clay plain
- Samphire: Samphire claypan
- Tussock on clay: Tussock grassland on heavy clay plain.

The Wheatstone LNG Fauna Study identified 128 vertebrate species, comprising 51 herpetofauna, 60 avifauna and 17 mammals (Chevron 2010). This assemblage is considered representative of the likely species list for the Project Area given the proximity of the Project Area to the Wheatstone LNG Fauna Survey boundaries and the identification of six of the seven fauna habitats in the Project Area (Biota 2013). The available data indicates a low likelihood of Schedule 1 fauna occurring in the Project Area. Three Priority fauna species were recorded from the Wheatstone LNG Fauna Survey Area:

- Little Northern Freetail-bat (*Mormopterus loriae cobourgensis*; Priority 1)
- Western Pebble-mound Mouse (*Pseudomys chapmani*; Priority 4)
- Australian Bustard (*Ardeotis australis*; Priority 4).

Studies have also demonstrated that the locality is not an important habitat for migratory bird species (URS 2009). Migratory species are not discussed further due to the small nature of clearing when compared to their available habitat within the region. Conservation significant fauna species recorded within 20 km of the Project Area are displayed in Table 2.

Table 2: Conservation significant species recorded from within 20 km of the Project Area

Species Name	Status	NatureMap	Chevron (2010)	Habitat	Likelihood
Burhinus grallarius	P4	Yes	-	Sparsely grassed, lightly timbered forest or woodland	Medium
Leggadina lakedownensis	P4	Yes	-	Craking clay and surrounding areas	Medium
Lerista planiventralis maryani	P1	Yes	-	Sandy Areas	Medium
Falco peregrinus	S4	Yes	-	Forest, woodlands, wetlands and open country.	Medium
Numenius madagascariensis	P4	Yes	-	Tidal mudflats and. Sandy beaches.	Medium

Subterranean fauna such as trolglofauna and stygofauna and other Short-Range Endemic (SRE) species are not anticipated to be found in this locality as investigations conducted for the Wheatstone LNG development found a lack of potential habitat.

4.4.2 Impact Assessment

Only a small number of Priority or conservation significant fauna species may potentially occur in the Project Area (see Section 4.4.1) and the small amount of clearing and disturbance to their potential available habitat in the region is very small (Biota 2013). The project will not impact the conservation status of any species (Biota 2013).

4.4.3 Proposed Management Measures

The following management and inspection measures will be put in place to minimise potential impacts to fauna during site activities:

- Fauna Rescue Personnel on site prior to and during clearing operations
- Personnel provided with information on the proper response to fauna encounters through the induction process, including the requirement not to interact with fauna and to report immediately to Contractor or Fauna-Rescue Personnel upon an encounter
- Inspection of cleared areas for fauna presence will occur immediately post clearing operations. Fauna will be removed from impacted areas using trained Fauna Rescue Personnel.

4.4.4 Predicted Environmental Outcome

Fauna of conservation significance that may occur in the Project Area are all highly mobile and not likely to be impacted by either the construction or operation of the project.

4.5 Air Quality

4.5.1 Regional Context

The Pilbara is an arid, pan tropical region with a strong summer-bias of rainfall due to the passage of tropical cyclones and low pressure systems. Winter rainfall is sporadic and low intensity and usually associated with the northern extend of cold fronts affecting the south-west coast of Western Australia. Cyclonic rainfall ranges from sporadic falls of up to 30 mm to high intensity events of up to 300 mm (Chevron 2010). Temperature has been recorded at the Onslow Airport since 1940. Maximum temperatures of 49°C have been recorded, with an average daily maximum temperature of 36°C during summer. Baseline air quality values reflect the arid, underpopulated nature of the region. Total Suspended Particulates, as measured by particulate matter (PM_{10}), average 22.9 micrograms per cubic metre ($\mu g/m^3$) (Chevron 2010) in the Dampier locality, reflecting the high dust loading in the Pilbara region. Baseline air quality values for nitrogen oxides (NO_x), ozone (O_3), and volatile organic compounds (VOC) are all well below National Environmental Protection Measure (NEPM) criteria air quality limits (Chevron 2010).

4.5.2 Impact Assessment

Early pre-feasibility modelling based on a 40 MW output determined that all emissions arising from the operation of the OPIUP are within statutory and regulatory guidance. Modelling indicates no impacts to environmental receptors.

4.5.3 Proposed Management Measures

Given the small size and remote location of the OPIUP, there is no applicable or cost-effective technology or operation that can reduce OPIUP GHG emissions. Dust emissions during construction will be managed through the use of EMPs and Contractor Procedures.

4.5.4 Predicted Environmental Outcome

No deleterious impacts are expected as a result of implementing this proposal.

4.6 Noise and Vibration

4.6.1 Baseline Environment

The Project Area is likely to have similar baseline noise levels as those identified for the Wheatstone Project. The Project Area is therefore largely free from anthropogenic noise emissions (Chevron 2010).

4.6.2 Impact Assessment

Clearing and construction works will involve the use of plant and machinery. The use of plant and machinery at any construction site causes increase in noise and vibration. Lot 555 is remote and has no sensitive receptors, which means that noise and vibration from construction is not a significant concern at this site.

Operation of the OPIUP will result in noise emissions. Preliminary noise modelling based on a power station with a firm 9 MW output has demonstrated that the cumulative noise impacts from the station and substation are expected to comply with relevant noise criteria with the provision of recommended buffer zones.

Additional noise modelling will be conducted for the power station and zone substation following finalisation of detailed design. Noise emanating from the Project Area will have minimal impact on fauna receptors, as the Project Area does not form a core habitat for sedentary species and migratory or transient species should relocate in the event of short term noise disturbance during construction.

4.6.3 Proposed Management Measures

Limiting construction working hours, spatial placement of noise emitting machinery and other design measures will be considered and implemented if deemed worthwhile. Construction site will comply with the relevant conditions of the Environmental (Noise) Regulations, 1997.

4.6.4 Predicted Environmental Outcome

There will be no deleterious outcome to people or the environment associated with noise and vibration as a result of implementing this Project.

4.7 Conservation Parks and Reserves

4.7.1 Baseline Environment

The closest Ramsar wetland to any of the proposed development areas is the Millstream Pools Proposed Ramsar addition over 225 km north east of the Project Area. The closest wetland of importance as listed by the Department of Sustainability, Environment, Water, People & Communities (now the Department of

the Environment) Protected Matters Search Tool from any part of the Project Area is 'Exmouth Gulf East', over 25 km to the southwest.

There are no occurrences of Threatened or Priority Ecological Communities within 35 km of the Project Area. The nearest ecological community of conservation significance is the Priority 1 Peedamulla (Cane River) Swamp Community located 50 km away.

The former Mt Minnie lease hold will be vested to the Department of Parks and Wildlife as an addition to the existing Cane River Conservation Park in 2015 and is currently under that department's management. It is located approximately 10 km from the Project Area.

4.7.2 Impact Assessment

There will be no impact to any National Parks, reserves or other conservation areas as a result of implementing this Project.

4.7.3 Proposed Management Measures

No management measures are required as there will be no impact to conservation parks or reserves.

4.7.4 Predicted Environmental Outcome

Conservation parks and reserves will remain unaffected by the implementation of this Project.

4.8 Social

4.8.1 Baseline Environment

The town of Onslow currently supports a population of between 600 and 900 people depending on seasonal fluctuations (Chevron 2010). Onslow's population is expected to increase to 2,201 by 2017 (Western Australian Planning Commission 2011).

4.8.1.1 Visual Amenity

Lot 555 is a remote site with no sensitive receptors. The finalised design will take visual impact and appropriateness for the receiving environment into account. The visual amenity of the transmission network will be a key consideration during detailed design. A specialist consultant will be engaged to ensure the design and placement of power poles is appropriate for the locality.

4.8.1.2 Light

Lot 555 is a remote site with no sensitive receptors. Light emissions will be restricted to levels and intensity appropriate for intended function, whilst minimising environmental impact to light sensitive species.

4.8.1.3 Restricted Access to Lot 555

Lot 555 does not have a history of public use. As the source of water for the construction of the BHPB's Macedon Project, Lot 555 has been subject to restricted access since 2011. Security measures will be implemented on Lot 555 during construction and operation to restrict public access.

4.8.1.4 Cultural Considerations

The Thalanyji are the Native Title holders of the lands that contain the Project Area and are recognised as a key stakeholder in the implementation of the project (see Section 5). Heritage surveys will be conducted over the entirety of the Project Area to identify areas of cultural significance (if any).

4.8.2 Impact Assessment

Visual amenity is considered an important concern due to the proximity of the transmission network to the Onslow/Mt Stuart road. Adoption of the recommendations of the visual amenity consultant should reduce this risk to 'as low as reasonable practicable' (ALARP) levels.

No impacts from light associated with the OPIUP are anticipated. A light study will be undertaken to confirm this. Implementation of the project will not result in additional access restrictions to recreation areas used by the public. Impacts, if any, to Aboriginal heritage will be determined post completion of the heritage surveys.

4.8.3 Proposed Management Measures

Design of the project will consider the environmental setting and visual amenity at all locations. Security measures will be implemented on Lot 555 during construction and operation however, to restrict public access.

The siting of infrastructure within the Project Area will be modified as required to minimise / eliminate the impact on areas of cultural significance and to ensure compliance with the *AHe Act 1972*. Worker inductions will encourage a high level of participation in heritage awareness and workers will be expected to exercise a 'Stop Work Authority' (SWA), in the event that construction works uncover unexpected heritage artefacts or remains.

4.8.4 Predicted Environmental Outcome

If the management measures in Section 4.8.3 are implemented, there will be no deleterious social impact as a result of the implementation of this Project.

5 STAKEHOLDER CONSULTATION

Horizon Power, as the provider of power in the Onslow area, is leading the stakeholder consultation for this project and has commenced some stakeholder engagement for the project (see Table 4 below). Local stakeholder feedback for the project has been positive, giving the community the reassurance that Horizon Power is planning for the forecast growth and increased energy demands within the area.

Selected stakeholders were informed about the proposal via email, including an Information Pack describing the proposal and potential impacts.

No concerns were raised in relation to the key environmental factors throughout the consultation.

Table 3: Stakeholder Engagement Summary

Stakeholder		Title	Organisation	Role	HP Contact	Method of Contact
John	Guld	Senior Environmental Officer		Regulator	Alastair Trolove	Email (9/4/2014) Meeting (10 April 2014)
Sally	Bowman	Senior Environmental Officer	Office of Environmental Protection Authority	Regulator	Alastair Trolove	Email (9/4/2014) Meeting (10 April 2014)
BTAC				Influencer	Maurice Ryan	BTAC presentation to board and Karratha members
Community Reference Group				Influencer	Maurice Ryan	Chevron – Onslow Community Reference Group meeting
Tim	Davoren	Minderoo		Neighbouring station	Maurice Ryan	Email (2/7/2014)
Rod	Parker	Station Manager	Peedumuller	Neighbouring station	Maurice Ryan	Email (2/7/2014)
Glenys	Hayes	BTAC Chairperson of Board	Buurabalayji Thalanyji Aboriginal Corporation (BTAC)	Influencer	Maurice Ryan	Email (2/7/2014)

Stakeholder		Title	Organisation	Role	HP Contact	Method of Contact
Rob	Baker	Mine Manager	Onslow salt	Influencer	Maurice Ryan	Email (2/7/2014)
Anita	Sarich	Commercial Manager	Onslow Salt	Influencer	Maurice Ryan	Email (2/7/2014)
Mike	Winslade	Director	Onslow Electric Power	Agent	Maurice Ryan	Email (2/7/2014)
Jerome	Frewer	BTAC Lawyer	Desert Management	Agent	Maurice Ryan	Email (2/7/2014)
Geoff	Herbert	Chairperson	Chamber of Commerce	Influencer	Maurice Ryan	Email (2/7/2014)
Kerry	White	Shire President	Shire of Ashburton	Influencer / Leader	Maurice Ryan	Email (2/7/2014) and Phone
Neil	Hartley	Shire CEO	Shire of Ashburton	Influencer	Maurice Ryan	Email (2/7/2014)
Marc	Griffiths	Principal project manager	Water Corporation	Agent	Maurice Ryan	Email (2/7/2014)
Jim	Ghaswala	Project Manager - Onslow Wastewater	Water Corporation	Agent	Maurice Ryan	Email (2/7/2014)

6 EPA SIGNIFICANCE TEST

6.1 Aim and Objective of the Significance Test

The objective of the *EP Act 1986* is to ensure the protection of the environment, having regard to the precautionary principle, intergenerational equity, conservation of biological diversity, ecological integrity, improved valuation, pricing and incentive mechanisms and waste minimisation (GGWA 2012).

The EPA developed new administrative procedures in 2012, to enhance the principles and practices of EIA, as defined in the Act. One of the key procedures was the implementation of the Significance Test to assist in determining whether the proposal would meet the EPA's objectives for environmental factors and consequently whether or not a referred proposal should be assessed. The OPIUP has been assessed against the Significance Test below.

6.2 Values, Sensitivity and Quality of the Environment which is Likely to be Impacted

The baseline environment of the OPIUP is broadly represented in the surrounding locality and implementation of this proposal will not adversely affect flora and fauna at a species level (Biota 2013). The Project Area does intersect with two vegetation units of high local conservation significance (refer to Table 1), however these units are not critical to the existence of Rare or Priority Flora and exist in much higher proportion outside of the Project Area. The Project Area does contain habitat known to support fauna of conservation significance and the broad fauna habitats identified in the Project Area are extensively represented in the western Pilbara (Biota 2013).

6.3 Extent (Intensity, Duration, Magnitude and Geographic Footprint) of the Likely Impacts

The majority of impacts to the receiving environment as a result of implementing this proposal are likely to be temporary and will occur during the construction phase of the project. Potential impacts that may persist during the operational phase will be predominately associated with emissions to air however; the OPIUP is a small power station and will only be a minor contributor to regional GHG emissions. Previous emission studies have identified that common air quality irritants and pollutants such as NO_x, O_3 and VOC are all below applicable standards for potential power outputs up to 60 MW and will disperse readily in the atmosphere due to the influence of prevailing winds.

The geographic footprint is under 100 ha and apart from areas cleared for permanent infrastructure, the majority of the Project Area will undergo rehabilitation works. The overall risk of deleterious environmental impacts to receiving environments as a result of implementing this proposal is low.

6.4 Consequence of the Likely Impacts (or Change)

Other than areas permanently cleared for infrastructure, there will be no irreversible impacts to local environmental values as a result of implementing this proposal. PASS may be exposed and oxidise during the construction phase however soil sampling and mapping during geotechnical investigations will reduce the risk of exposure. Treatment and management measures will be enacted if PASS are exposed, reducing the environmental impact to low.

It is anticipated that the small amount of clearing that is required for the project will not impact the conservation status of any vegetation units or flora. The one Priority Flora species which is known to occur within the Project Area exists in populations outside of this area. Only a small number of Priority or conservation significant fauna species may potentially occur in the Project Area. The small amount of clearing and minor disturbance to potential available habitat in the region is not anticipated to impact the conservation status of any species (Biota 2013).

Dust may be generated from the construction of the project. With the implementation of best practise mitigation measures, such as water application, compaction and the use of soil binding agents, impacts are anticipated to be minor. As detailed in Section 6.3 air emissions will be below NEPM standards.

Due to the remote location of Lot 555 with no receptors and the short term nature of the construction phase, noise and vibration generated during clearing and construction is not anticipated to have a significant impact. The remote nature of the site also means that visual amenity is a minor issue. No impacts from light associated with the OPIUP are anticipated. The potential impacts are not likely to have a measurable impact on the environment.

6.5 Resilience of the Environment to Cope with the Impacts or Change

The Pilbara region is subject to regular extreme weather events including elevated temperatures, drought, heavy precipitation and the impact of floodwaters. As a result of these naturally variable conditions, the baseline environment has undergone long periods of adaptation to extreme events and has demonstrated resilience to natural processes.

6.6 Cumulative Impact with Other Projects

Other Projects or users operating in proximity to the proposed area include:

- Chevron Australia Pty Ltd as proponent of the Wheatstone Project. This Project involves the construction and operation of a multi-train LNG and domestic gas (Domgas) plant at Ashburton North;
- Onslow Salt Pty Ltd who produce salt at a site north east of the Project Area. This operation also includes handling facilities to transport, process, store and load salt into ships for export;
- BHP Billiton as operator of the Macedon Gas Development. This Domgas project is 15km south west of Onslow;
- OWIUP—this proposed desalination plant and reticulation network is adjacent to the OPIUP on Lot 556. The plant is anticipated to be operated by the Water Corporation in 2016

While emissions from the Project Area will add to a cumulative total, impacts to receiving environments and species will be negligible.

6.7 Level of Confidence in the Prediction of Impacts and the Success of Proposed Mitigation

Modelling conducted has used conservative estimates including power outputs of up to 60 MW instead of the likely 10.8 MW (net generation capacity). This conservative modelling with inputs much higher than the

proposed output demonstrates that emissions to air will be below all applicable standards. Refinement of this modelling will be conducted following the finalisation of detailed design to validate the findings of the original model. Additionally, there is a high level understanding of the baseline environment as a result of extensive studies undertaken for the Wheatstone Project including studies on air quality, hydrology, soil and landforms, fauna, flora and vegetation. The proponent has a large amount of experience in the implementation, management and operation of power plants.

6.8 Objects of the Act, Policies, Guidelines, Procedures and Standards Against Which a Proposal can be Assessed

All relevant legislation, polices, guidelines, procedures and standards have been considered in the identification and assessment of potential impacts of this proposal. Relevant legislation has also been considered in pre-front end engineering design (FEED) documentation, and will continue to inform the detailed design prior to construction.

6.9 Presence of Strategic Planning Policy Framework

This item is not applicable to the proposal.

6.10 Presence of Other Statutory Decision-making Processes Which Regulate the Mitigation of the Potential Effects on the environment to meet the EPA's objectives and principles for EIA

As per the referral form itself, the following key statutory environmental approvals will be sought to implement this proposal:

- NVCP under Part V of the EP Act
- AH Act Section 18 Disturbance to Aboriginal heritage sites
- Works Approval Application under Part V of the EP Act.

6.11 Public Concern About the Likely Effect of the Proposal, if Implemented, on the Environment

Stakeholder consultation conducted to date has addressed minor concerns from key stakeholders. It is proposed that this consultation will continue during the approvals process. No issues have been raised to date that would necessitate the abandonment of this proposal.

6.12 Conclusion

Modelling conducted for the project has used conservative estimates including a higher power output. Potential environmental impacts from the project are not anticipated to present a significant environmental impact. The potential environmental impacts of the project can be adequately managed to meet EPA environmental objectives through the described management measures. In considering the significance test, the regulatory controls that can be applied to the project and the implementation of relevant management plans, the Proponent is of the view that the proposal does not require formal environmental impact assessment under Part IV of the EP Act but will be managed under other legislation including the Part V of the EP Act.

7 REFERENCES

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Biota Environmental Sciences. 2011. Wheatstone Rare Flora Survey – March 2011 (Unpublished Report) May 2011

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URS Australia. 2009. Survey for Migratory Waterbirds in the Wheatstone LNG Project Area, November 2008 and March 2009. (Unpublished Report September 2009

APPENDIX A

Desktop Review of the Proposed Onslow Micro-Siting Survey Area

Wheatstone Project

Title: Desktop Review of the Proposed Onslow Micro-Siting Survey Area

0	30-Apr-13	Final	Justin Fairhead (BIO)	PHMZ	HBLN
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Biota
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Sciences

Desktop Review of the Proposed Onslow Micro-Siting Survey Area

Prepared for Chevron Australia Pty Ltd

April 2013

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Desktop Review of the Proposed Onslow Micro-Siting Survey Area

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Figures

1.0 Introduction

1.1 Project Background

The State Development Agreement enacted by Chevron Australia Pty Ltd (Chevron) and the Government of Western Australia in September 2011 mandates that Chevron provide essential services to the town of Onslow. Lot 524 has been selected as the preferred location for the construction of the infrastructure necessary.

To provide these services to the town of Onslow, a supply facilities corridor will join Lot 524 with Onslow town, running services adjacent to the Onslow/Mt Stewart Road (see Figure 1.1). It is possible that this corridor may also be utilised by the Wheatstone Project for various works, such as a proposed fibre optic cable.

Chevron commissioned Biota Environmental Sciences (Biota) to undertake a review of biological information relevant to the area in which all utilities infrastructure is expected to be located. This is termed the Proposed Micro-Siting Desktop Ecology Survey Area (referred to in this report as the MS survey area).

1.2 Scope of this Report

This report comprises a desktop review of vegetation, flora and fauna values of the MS survey area. It has been completed in accordance with the following documents, where applicable:

- Environmental Protection Authority's (EPA) Position Statement No. 3, *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002);
- EPA Guidance Statement No. 51, *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004a); and
- EPA Guidance Statement No. 56, *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b).

The report is subject to a number of limitations, which are discussed in Section 2.4.

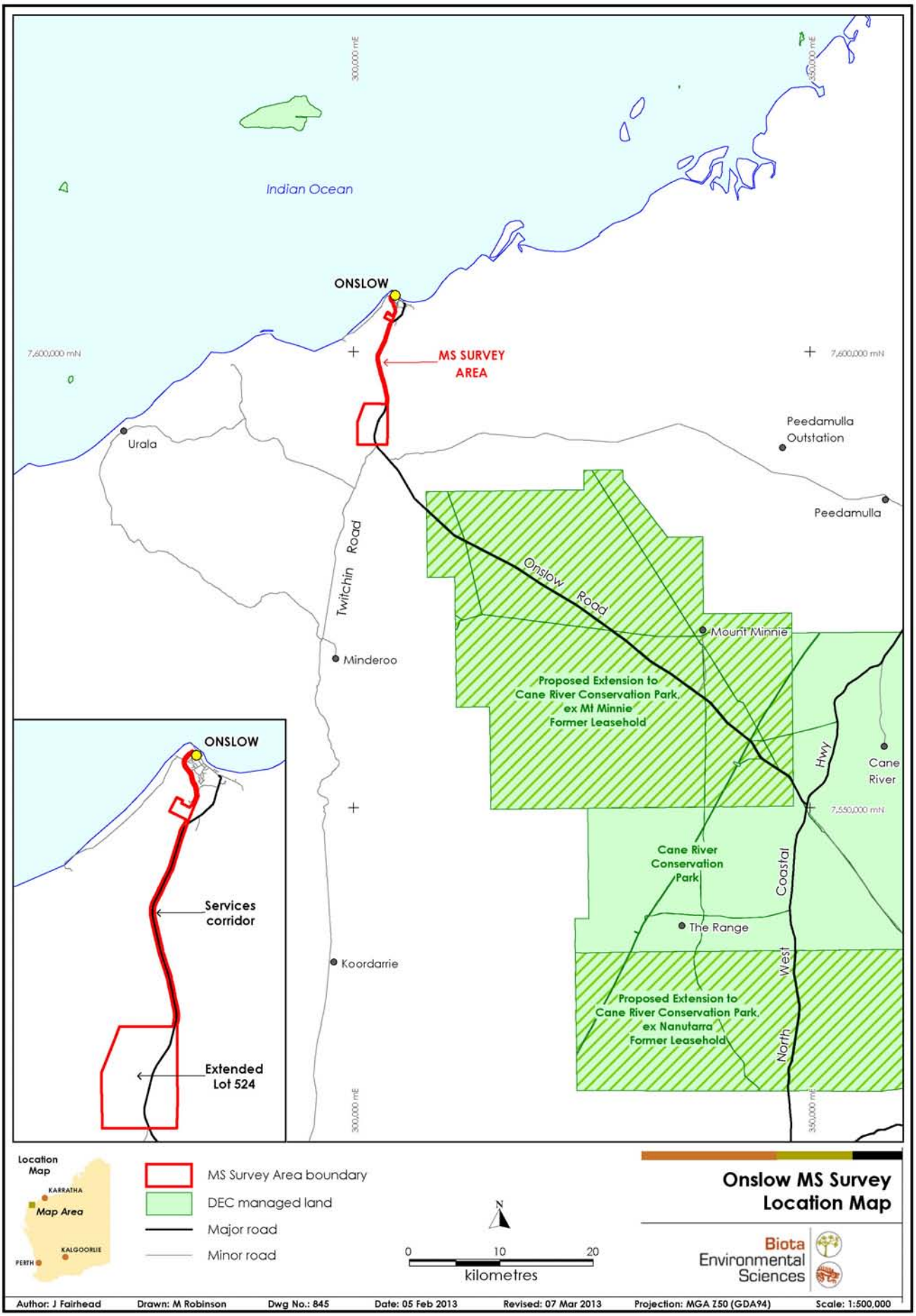

Figure 1.1: Location map of the MS survey area showing Lot 524 and Services corridor.

2.0 Methodology

2.1 Review of Existing Data

2.1.1 Previous Flora and Vegetation Sampling in the MS Survey Area

Previous flora and vegetation surveys in the area overlap 20.5% of the 1,669 ha of land encompassed by the MS survey area. The surveys were undertaken by several companies (Validus 2008, Astron 2009, RPS Australia 2009, Biota 2010a, Outback Ecology 2010, ENV 2011) and are outlined below:

- In March 2008,Validus Pty Ltd was commissioned to survey Chevron's proposed multi-phased gas pipeline and domestic gas (Domgas) processing plant in Onslow. This survey comprised two components: a pipeline route and two gas processing sites. Portions of this pipeline route and the southern proposed processing plant lie within the MS survey area (Figure 2.1).
- In November 2008, Astron Environmental Services was commissioned by URS Australia to undertake a flora and vegetation survey of BHP Billiton Limited's proposed Macedon Gas Development. This survey encompassed approximately 684 ha for a pipeline corridor and 196 ha for camps, plant and laydown areas. Portions of the pipeline corridor, the laydown area and one of the proposed plant sites lie within the MS survey area (Figure 2.1).
- In November 2008, RPS Australia was commissioned by Chevron to undertake a flora and vegetation survey of the proposed Ashburton North Pipeline Route Option 3 corridor. This survey covered a corridor encompassing approximately 1,000 ha and ran from the proposed Ashburton North processing facility to the Dampier to Bunbury Natural Gas Pipeline (RPS Australia 2009). This survey area lies completely within an area subsequently surveyed in 2009 by Biota (2010a) (Figure 2.1).
- In March and April 2009, Biota (2010a) conducted a flora and vegetation survey that assessed the locations for the Wheatstone plant site, camp site and Shared Infrastructure Corridor (SIC) as proposed at the time. This survey area overlaps the southern boundary of the MS survey area (Figure 2.1).
- In January 2010, Outback Ecology was commissioned to survey an area adjoining the Biota (2010a) survey area. The survey area encompassed three borrow sites and several construction roads (Outback Ecology 2010). One section of this survey area overlaps the southwestern end of the MS survey area (equivalent to the area shown as Biota (2010b) on Figure 2.1).
- In March 2011, Biota conducted a targeted rare flora survey in the locality of Chevron Australia's Wheatstone plant site, campsite and shared infrastructure corridor. Several of the Foot transverses undertaken as part of this survey pass though southern sections of MS survey area.
- In April 2011, LandCorp commissioned ENV Australia Pty Ltd, to undertake a Level Two flora and vegetation survey and a Level One fauna assessment of the Onslow Town Site Strategy study area. Covering approximately 333 ha, the survey area incorporated potential development areas such as infill sites, greenfield opportunities and a proposed bypass road. Portions of this study area overlap the MS survey area in the northern sections closest to the town of Onslow (Figure 2.1).

2.1.2 Previous Fauna Sampling in the MS Survey Area

In September 2008, Bamford Consulting Ecologists was commissioned by BHP Billiton Petroleum Pty Ltd to undertake a Level One fauna survey along a proposed pipeline corridor for the Macedon Gas Development project (Bamford et al. 2009). One small section of this survey area overlaps the southern boundary of the MS study area.

A single-phase systematic fauna survey was conducted in the locality by Biota in April 2009 as part of the Wheatstone project (Biota 2010d). This study area intersects the southwest corner of

the current survey area. One trapping site from this survey (WHT16) falls within the current survey area. All of the fauna data from the Wheatstone survey (Biota 2010d) has been considered for the current study.

2.1.3 Ephemeral Fauna of Claypan Systems

A three-phase ephemeral fauna survey of the claypan systems was conducted in the locality by Biota in 2009 as part of the Wheatstone project (Biota 2010b). Three of the sampling sites from this survey fall within the MS survey area (CWP03, CWP04, CWP05) (Biota 2010b).

2.1.4 Previous Sampling in the Locality

A number of other terrestrial fauna surveys have previously been completed in the locality as summarised by Biota (2010d). These include the:

- Onslow Solar Saltfield three-phase terrestrial fauna survey (1996, 2000 and 2005) (Biota 2005a);
- Western Australian Museum (WAM) terrestrial fauna survey at Tubridgi Point in 2005 (WAM database 2009);
- Department of Environment and Conservation (DEC) Cane River Conservation Park fauna surveys at Tubridgi Point in 2004 (WAM database 2009);
- Yannarie Salt Project fauna survey in 2004 (Biota 2005b);
- Chevron Domgas Project Onslow fauna assessment in 2008 (Validus 2008); and
- API Management Onslow Rail Corridor terrestrial fauna survey in 2008 (Biota 2009). This study area intersects the MS survey area.

Although conducted under different seasonal conditions, including additional habitats, and with varying sampling effort, these studies still provide useful contextual information for the current assessment.

No other publically available Flora and Vegetation surveys have been undertaken in the locality of the MS survey area.

2.1.5 Database Searches

2.1.5.1 Flora and Vegetation Database searches

Appendix 1 details the framework for ranking communities and species of conservation significance in WA. Searches for Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), Threatened and Priority flora species were conducted using the following databases:

- TEC and PEC database maintained by the DEC (completed on the 24/01/2013);
- DEC Threatened flora database (completed on the 23/01/2013);
- WA Herbarium database (completed on the 23/01/2013); and
- DEC Threatened and Priority flora species list (completed on the 23/01/2013).

The Threatened and Priority flora searches were conducted using a 20 km buffer around the survey area, while the TEC and PEC searches were conducted using a 35 km buffer around the survey area. The results of the database searches are discussed in Section 3.4.

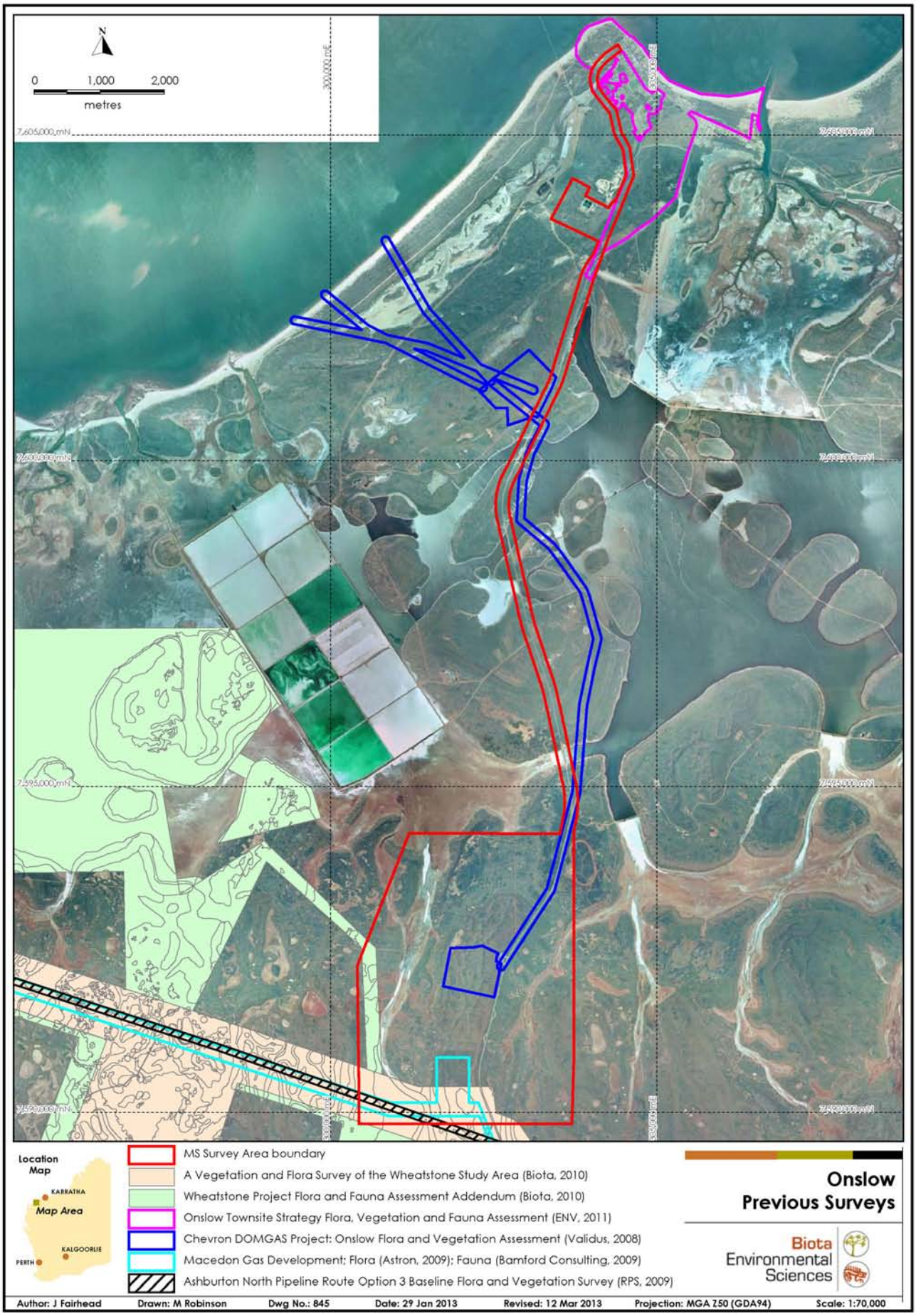

Figure 2.1: Location of the MS survey area in relation to previous survey work.

2.1.5.2 Fauna Database Searches

The following databases were searched on 22nd January 2013 to assist with the determination of the potential faunal assemblage of the MS survey area:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Database; and
- NatureMap database.

The search area comprised a 20 km radius around the coordinate 115°05`38" E, 21°42`25" S (WGS84 datum). Appendix 2 contains the EPBC Act Protected Matters Database search results, while Appendix 3 contains the NatureMap search results.

2.1.6 Regional Scale information

Various other regional-scale reports and datasets were reviewed to assess other biological factors of relevance to the current study area, including features of the Interim Biogeographic Regionalisation for Australia (IBRA) bioregions and subregions (SEWPaC 2012) (see Section 3.1), land systems (Payne et al. 1998, van Vreeswyk et al. 2004) (see Section 3.2), and Beard's vegetation mapping (Beard 1975) (see Section 3.3).

2.2 Extension of Vegetation Mapping for Unsurveyed Areas

Existing vegetation mapping covers 343.2 ha (20.5%) of the MS survey area (see Section 2.1.1 and Figure 2.1) (Validus 2008, Biota 2010a, Outback Ecology 2010, ENV 2011). Vegetation descriptions were based on the height and estimated cover of dominant species using Aplin's (1979) modification of the vegetation classification of Specht (1970) to include a hummock grassland category (see Appendix 4). The vegetation mapping units were generally defined at the level of vegetation sub-association as per the National Vegetation Information System[1].

There are two separate coding systems used for classifying vegetation within this review, a broad scale habitat code grouping vegetation units by their position within the landscape for example Coastal dunes = CD, Inland dunes = ID, and Coastal Sandplains = CS, and a fine scale vegetation coding system for the vegetation units incorporating the dominant flora species, organised from the tallest strata to lowest strata. Species names were abbreviated to capital letter(s) for genus, followed by lower case letter/s for species, with multiple letters used where necessary to avoid confusion (e.g. GsCRcTRzTe = dominant species *Grevillea stenobotrya, Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* and *Triodia epactia*).

Other point source datasets, such as locations of quadrats, weeds and flora of conservation significance, were displayed using MapInfo Professional Geographical Information System (GIS) v9 (MapInfo). These datasets were used to produce the vegetation maps contained in this report (Appendix 5). All maps were produced using MapInfo v9.

A total of 1,325.7 ha (79.5%) of the MS survey area had not been mapped by previous studies (see Section 2.1.1 and Figure 2.1). For these sections, vegetation mapping was extrapolated based on existing mapping from adjacent areas, in conjunction with interpretation of aerial photography signatures and site data. The units were then coded following the same protocol described above.

[1] See http://www.environment.gov.au/erin/nvis/publications/avam/section-2-1.html#hierarchy

2.3 Vegetation Conservation Significance Assessment

Vegetation communities of the highest conservation concern are listed as Threatened Ecological Communities (TECs) by the Western Australian DEC. Other communities of conservation significance are listed as Priority Ecological Communities (PECs). Though not recognized as either TEC's or PECs all vegetation has inherent value and each vegetation unit mapped in this study has been assigned a conservation significance of High, Medium or Low by taking into account the following information:

1. the land system/s (Van Vreeswyk et al. 2004) with which the vegetation units were most strongly associated. The distribution of the land systems through the north-west of WA was gauged as being either widespread (W) or restricted (R). Each section of these associated land systems were considered relative to the whole distribution of that land system, within the north-west, to determine if it might represent an outlier (O). Studies have shown that as the distance between sampling sites on the same land system increases, the assemblages became more different (Oliver et al. 2004). Vegetation units located on restricted land systems and/or isolated or outlying sections of a land system are considered to be of higher conservation concern due to the possibility that their floristic composition may vary significantly from those expected.
2. other features of the vegetation units defined for the study, including their extent within the study area, occurrence on restricted habitats, capacity to support rare or restricted flora, species richness and condition (health); and
3. reservation priorities of ecosystems as identified by DEC (Kendrick and Mau 2002).

The features, and the scores ascribed to each, are described in Table 2.1. As the DEC ecosystem reservation priorities (point 3 above) are assigned on the basis of Beard's mapping units, these could not always be linked to a specific vegetation unit. These priorities were therefore used in a more general sense to increase the conservation ranking of selected units. Larger scores were assigned to features considered to lend more conservation value (e.g. listed TEC/PEC status). Scores were cumulative where more than one listed feature was present (e.g. a unit with both DRF and Priority flora species present would score a total of +5 for the restricted flora category). On the basis of these parameters, vegetation types were assigned conservation significance assessments as follows: 'Very High' (10-11); 'High' (8-9); 'Moderate' (6-7); Low' (0-5); and 'No significance' (<0) (For a full break down of scores for each vegetation unit see Table 3.2).

Table 2.1: Explanation of features and codes used in the vegetation conservation assessment.

Regional Representation of Land System/s		**Score**
R,O	Restricted, and outlier - Land system is restricted to a particular section of the bioregion, and the study area occurs within an outlying occurrence of the land system or at one end of the mapped distribution of the land system	4
R	Restricted - Land system is restricted to a particular section of the bioregion	3
W,O	Widespread, but outlier - Land system is widespread in the bioregion, but the study area occurs within an outlying occurrence of the land system or at one end of the mapped distribution of the land system	2
W	Widespread - Land system occurs broadly across the bioregion	1
Other Key Attributes Increasing Conservation Value		**Score**
C	Significant physical feature (moderate-sized or larger creeklines or other drainage features, gorges, sand dunes) – likely to be at the level of land units within a land system	1
F	Known or probable habitat for restricted flora comprising: • DRF / EPBC Act 1999 listed species • Priority flora species • Other flora of interest	 3 2 1

A	Small area of extent, for example due to occurrence on a minor habitat (e.g. dunes)	1
S	High species richness	1
H	Very Good to Excellent condition stand of this vegetation	1
Other Key Attributes Decreasing Conservation Value		**Score**
D	Substantially degraded (eg. by weed invasion, dieback, clearing, heavy grazing)	-3

2.4 Limitations

Whilst part of the MS survey area has been subjected to flora and vegetation surveys (see Section 2.1.1 and Figure 2.1), 79.5% has not been surveyed. The following limitations therefore apply to this desktop review:

- Vegetation descriptions were based on associations recorded from comparable habitats during previous surveys in the study area and the broader locality. The various previous studies used different coding systems and descriptions for vegetation units. The vegetation descriptions in this report represent an integration of information from the different studies.
- Boundaries of vegetation units outside the existing vegetation mapping derived from existing reports have been extrapolated from aerial photography and have not been ground-truthed.

3.0 Vegetation

3.1 IBRA Bioregions and Subregions

The IBRA (SEWPaC 2012) currently recognises 89 bioregions for Australia. The MS survey area lies within the Carnarvon IBRA bioregion.

There are two biological subregions within the Carnarvon bioregion (Environment Australia 2000):

1. Cape Range: Rugged tertiary limestone ranges and extensive areas of red Aeolian dunefields, quaternary coastal dunes and mud flats. *Acacia* shrublands (*Acacia startii* or *A. bivenosa*) over *Triodia* on limestone and red dune fields. *Triodia* hummock grassland with sparse *Eucalyptus* trees and shrubs on the Cape Range. The Exmouth Gulf supports extensive mangroves in tidal mudflats and sheltered embayments, while the hinterland area supports a mosaic of samphire and saltbush low shrublands in saline alluvial plains.
2. Wooramel: Alluvial plains associated with downstream sections and deltas of the Gascoyne, Minilya and Wooramel rivers. *Acacia* shrublands (Mulga, Bowgada and *A. coriacea*) over bunch grasses on red sandy ridges and plains. Mangroves confined to small areas near Lake MacLeod and Carnarvon. Samphire and saltbush low shrublands on saline alluvial plains in near-coastal areas.

The MS survey area lies within the Cape Range subregion. For further discussion of this subregion, see Kendrick and Mau (2002).

3.2 Land Systems

Land systems mapping covering the MS survey area has been prepared by Agriculture Western Australia (Van Vreeswyk et al. 2004). Land systems are comprised of repeating patterns of topography, soils and vegetation (Christian and Stewart 1953) (i.e. a series of "land units" occur on characteristic physiographic units within the land system).

The land systems mapping for WA was primarily carried out to provide descriptions and locations of the biophysical resources of the state. The description of each land system includes an evaluation of soils and vegetation condition, susceptibility to erosion, fire effects and/or degradation by livestock. The mapping provides an indication of the spatial extent of each system and identifies systems with a small representation, which are more likely to support restricted vegetation units.

The MS survey area intersects three land systems: Dune, Littoral, and Onslow. The area of each land system intersected by the MS survey area represents 0.01% or less of each land system's total area in the Pilbara bioregion (Table 3.1).

Table 3.1: Area of land systems intersected by the MS survey area, and their proportion of the Pilbara bioregion total.

Land System	Total Area in the Bioregion (ha)	Total Area In Survey Area (ha)	% of total in Bioregion
Dune land system	49,302	544.0	0.01%
Littoral land system	337,551	195.9	<0.01%
Onslow land system	74,022	929.2	0.01%

Each land system intersected by the MS survey area is described in the following sections.

3.2.1 Dune Land System

This land system comprises dunefields supporting soft spinifex grasslands, mostly in Very Good condition (Van Vreeswyk et al. 2004). The Dune land system is distributed through near-coastal areas over a range of approximately 170 km, from the eastern side of the Exmouth Gulf to east of Onslow; predominantly in the Carnarvon bioregion, extending into the westernmost Pilbara bioregion.

3.2.2 Littoral Land System

This land system comprises bare coastal mudflats with mangroves of seaward fringes, *Tecticornia* (samphire) flats, sandy islands, coastal dunes and beaches. The vegetation of this land system is mostly in Good to Very Good condition (Van Vreeswyk et al. 2004). The Littoral land system is widespread over 650 km of coastline, stretching from the base of the Exmouth Gulf to east of Port Hedland; predominantly in the Carnarvon and Pilbara bioregions.

3.2.3 Onslow Land System

This land system comprises sandplains, dunes and claypans supporting soft spinifex grasslands and minor tussock grasslands; the vegetation is mostly in Good to Very Good condition (Van Vreeswyk et al. 2004). The Onslow land system is widespread towards the coast in both the Carnarvon and Pilbara bioregions, extending from the eastern side of the Exmouth Gulf to the Fortescue River.

3.3 Beards Vegetation Units

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The extent of this map sheet also covered the northern Carnarvon Basin region. The MS survey area lies within the Cape Yannarie Coastal Plain (CYCP), which is situated in the Carnarvon Botanical District of the Eremaean Botanical Province as defined by Beard (1975).

Three topographic/soils units are recognised from the CYCP:

- Pediplains and hills on siltstones and other marine rocks. Chief soils are hard alkaline red soils.
- Extensive plains with some occasional rocky hills in the inland parts, claypans in the coastal parts, and considerable sandy stretches with parallel sand dune formations. Chief soils of the dunes are red sands and the soils of the plains are acid, neutral and alkaline red earths, with non-cracking clays in the claypans.
- Salt flats, tidal swamps and coastal sand dunes on the seaward fringe. Chief soils are saline loams with shelly sands and small areas of calcareous and/or siliceous sands on coastal dunes. Saline clays or muds on slopes and flats submerged at high tide occur in the mangrove zone.

Due to the inaccessibility of the coastline of the Yannarie Coastal Plain during Beard's (1975) vegetation survey, the area was not visited and the vegetation community types identified at this time were interpreted from aerial photography.

Beard (1975) described three broad vegetation complexes in this area:

- Mangrove vegetation on the coastline and covering the intertidal zone, with *Avicennia marina* as the principal species and some *Rhizophora stylosa*.
- Behind the intertidal zone is a belt of bare hypersaline mud, which sometimes floods with spring tides. This zone is quite devoid of any vegetation, but some samphire communities occur locally (*Tecticornia* species).
- Behind the saline tidal mud flats area is a zone mapped as shrub steppe on sandhills with numerous small claypans. The shrub steppe is typically dominated by *Triodia* species (*T. epactia/pungens*) with *Acacia bivenosa, A. synchronicia, A. tetragonophylla* and *A. xiphophylla* being the most common shrub species present.

Beard (1975) mapped four finer-scale units within the MS survey area:

- CYCP 117: *Triodia pungens* open hummock grassland (t_1Hi); assigned a Medium reservation priority by DEC (Kendrick and Mau 2002);
- CYCP 127: Mud flats (fl); assigned a Low reservation priority by DEC (Kendrick and Mau 2002);
- CYCP 670: Mixed open shrubland over *Triodia basedowii* open hummock grassland (xSr.t_2Hi); assigned a Low reservation priority by DEC (Kendrick and Mau 2002); and
- CYCP 676: *Tecticornia* spp. low shrubland (k_3Ci); assigned a High reservation priority by DEC (Kendrick and Mau 2002).

Given the broad nature of Beard's (1975) mapping, these units are only broadly applicable to the vegetation occurring within the MS survey area (see Section 3.5). Beard's mapping is also offset from its true position, which should more closely mirror the land systems mapping boundaries (see Figure 3.1).

3.4 Vegetation of Conservation Significance Known from the Locality

Vegetation communities of the highest conservation concern are listed as Threatened Ecological Communities (TECs) by the Western Australian DEC. TECs are described by the DEC as biological assemblages occurring in a particular habitat, which are under threat of modification or destruction from various processes (DEC 2010a). TECs listed by the DEC are conservation significant at the State level and are protected as Environmentally Sensitive Areas under the *Environmental Protection Act 1986*. There are 69 TECs listed in western Australia, two of which are described from the Pilbara bioregion (DEC 2010b).

PECs are biological (flora and fauna) communities that are recognised to be of significance, but do not meet the criteria for a TEC. There are five categories of PECs, none of which are protected under legislation. Thirty PECs are listed for the Pilbara bioregion, while these communities do not have any legislative protection it is best practice environmental management to avoid disturbance to these areas. The framework for ranking communities of conservation significance is presented in Appendix 1.

A search of the DEC's database of TECs and PECs using a 35 km buffer around the study area as described in Section 2.1.5. found no occurrences of TECs or PECs within the buffered search area. The closest ecological community of conservation significance is the Priority 1 Peedamulla (Cane River) Swamp Community (SCP), which occurs approximately 50 km away.

Based on the vegetation mapping of the MS survey area, no TECs or PECs are expected to occur. Work undertaken in this area is therefore not expected to impact on any listed communities of conservation significance.

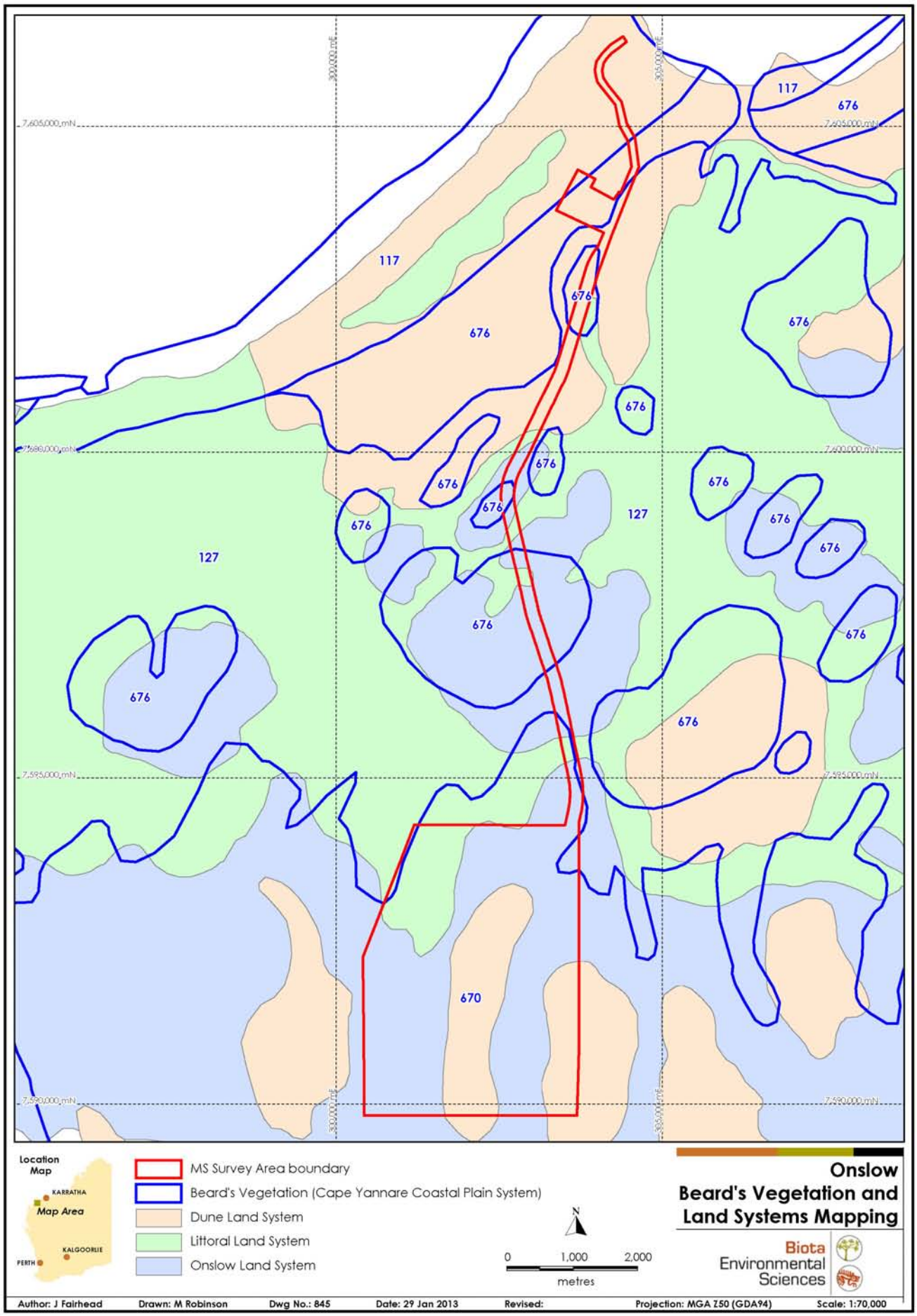

Figure 3.1: Distribution of land systems and Beard's (1975) vegetation units relative to the MS survey area.

3.5 Vegetation of the MS Survey Area

Based on inspection of current aerial photography, approximately 84 ha of the MS survey area has been disturbed. The remainder of the area intersects 15 vegetation units. These vegetation units include 14 of the 32 vegetation units identified as occurring in the broader Wheatstone study area by Biota (2010a, 2010c) and one vegetation unit (CP6: LvTeCEc) described by Validus (2008) in the Onslow Domgas survey.

Brief descriptions of each of the 15 vegetation units described for the MS survey area are presented below. With the exception of code CP6 (LvTeCEc), all codes correspond to codes described in Biota (2010a, 2010c). The "expected associated species" are those that would be expected to occur within each vegetation unit based on their presence in equivalent vegetation in the surrounding areas; these species have not necessarily been recorded from the sampling to date in the MS survey area. The area of each of the vegetation units in the MS survey area is summarised in Table 3.3, and displayed on the mapping in Appendix 5.

In addition to these areas, 84.3 ha (5%) of the survey area has been mapped as disturbed, and a further 20.1 ha (1.2%) has been mapped as unvegetated mudflat, which is subject to regular tidal inundation. Further disturbance is evident on the aerial photography of the area but was deemed to be at too fine a scale to warrant mapping for this review.

3.5.1 Vegetation of Tidal Mudflats and Tidal Creeks

Tidal mudflats in the MS survey area comprised "bare" mudflat, with only very scattered shrubs.

Unit Code	Description	Sub-association Code	Conservation Significance
T1:	*Tecticornia* spp. scattered low shrubs	mf	Low
Expected Associated Species: *Avicennia marina* (White Mangrove)			

3.5.2 Vegetation of Coastal Sand Dunes

Previous survey work (Biota 2010a, ENV 2011) mapped coastal dunes behind a narrow beach-front. The foredunes and near-coastal sand dunes were distinct from the red sand dunes further inland, as the foredunes and near-coastal sand dunes had an overstorey dominated by *Acacia coriacea* subsp. *coriacea*. In addition, the coastal foredunes had significant amounts of Beach Spinifex (*Spinifex longifolius*) in the understorey, which was replaced by Soft Spinifex (*Triodia epactia*) further inland. The dunes occurring in the MS survey area can be expected to follow a similar pattern. Two coastal sand dune units were mapped in the MS survey area.

Unit Code	Description	Sub-association Code	Conservation Significance
CD1:	*Acacia coriacea* subsp. *coriacea, Crotalaria cunninghamii* tall shrubland over *Spinifex longifolius, (*Cenchrus ciliaris*) open tussock grassland	AcCRcSXlCEc	Low
Expected Associated Species: *Adriana tomentosa* var. *tomentosa, Corynotheca pungens, Euphorbia myrtoides, Salsola australis, Scaevola spinescens, Sporobolus virginicus, Threlkeldia diffusa, Tribulus occidentalis* and *Trichodesma zeylanicum* var. *grandiflorum*.			
CD2:	*Acacia coriacea* subsp. *coriacea* tall shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* open tussock grassland	AcCRcTRzTeCEc	Low
Expected Associated Species: *Adriana tomentosa* var. *tomentosa, Cassytha capillaris, Corynotheca pungens, Euphorbia myrtoides, Indigofera colutea, Olearia dampieri* subsp. *dampieri, Quoya loxocarpa, Rhagodia eremaea, Rhynchosia minima, Salsola australis, Scaevola sericophylla, Sida rohlenae* subsp. *rohlenae, Solanum lasiophyllum, Threlkeldia diffusa* and *Tribulus occidentalis*.			

3.5.3 Vegetation of Inland Sand Dunes

There were numerous low linear sand dunes within the surrounding study areas (Validus 2008, Biota 2010a, Outback Ecology 2010), and the vegetation units defined for these habitats were relatively consistent in terms of dominant species. Two vegetation units were identified by Biota (2010a), discriminated broadly by the dominance of *Triodia epactia* versus *Triodia schinzii* in the hummock grassland understorey. Narrow swales between these dunes typically featured scattered tall shrubs of the dominant species from the dunes, along with a higher density of *Acacia stellaticeps* low shrubs.

A number of the plant species recorded from the inland sand dunes are restricted to sandy substrates. These species include the Priority 3 shrubs *Eremophila forrestii* subsp. *viridis* and *Triumfetta echinata,* and the undescribed taxon *Aenictophyton* aff. *reconditum*. All of these species were recorded from a small number of inland sand dunes within the broader Wheatstone study area (Biota 2010a), including both of the inland dune vegetation units, and were not noted in any other habitat (see Section 4.2).

Three vegetation units occurring on inland sand dunes were mapped in the MS survey area.

Unit Code	Description	Sub-association Code	Conservation Significance
ID1:	*Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland	GsCRcTRzTe	High
Expected associated species: *Acacia coriacea* subsp. *coriacea, Aristida holathera* var. *holathera, Bonamia rosea, Cassytha capillaris, Corynotheca pungens, Desmodium filiforme, Euphorbia myrtoides, Evolvulus alsinoides* var. *decumbens, Grevillea eriostachya, Hakea stenophylla* subsp. *stenophylla, Indigofera colutea, Ipomoea muelleri, I. polymorpha, Olearia dampieri* subsp. *dampieri, Quoya loxocarpa, Q. paniculata, Rhagodia eremaea, Rhynchosia minima, Scaevola sericophylla, Sida rohlenae* subsp. *rohlenae, Solanum lasiophyllum, Tephrosia rosea* var. *clementii, T.* sp. Carnarvon (J.H. Ross 2681) and *Urochloa holosericea* subsp. *velutina.*			
ID2:	*Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Hibiscus brachychlaenus* open shrubland over *Triodia schinzii, (T. epactia)* open hummock grassland	GsCRcHBbTsTe	High
Expected associated species: *Acacia coriacea* subsp. *coriacea*, *Aristida holathera* var. *holathera, Bonamia linearis, B. rosea, Bulbostylis barbata, Cassytha capillaris, Cucumis variabilis, Cullen martinii, Desmodium filiforme, Grevillea eriostachya, Scaevola sericophylla, Sida rohlenae* subsp. *rohlenae, Solanum lasiophyllum, Tephrosia* sp. Carnarvon (J.H. Ross 2681), *Trianthema pilosa, Tribulus occidentalis, Trichodesma zeylanicum* var. *grandiflorum* and *Urochloa holosericea* subsp. *velutina.*			
ID3:	*Acacia stellaticeps* shrubland over *Triodia epactia* hummock grassland	AstTe	Low
Expected associated species: *Acacia coriacea* subsp. *coriacea*, *A. tetragonophylla, Bonamia rosea, Cassytha capillaris, Diplopeltis eriocarpa, Grevillea eriostachya, Indigofera boviperda* subsp. *boviperda, I. colutea, Quoya loxocarpa* and *Solanum lasiophyllum*.			

3.5.4 Vegetation of Coastal Sand Plains

Approximately half of the habitat occurring within the MS survey area was mapped as flat to gently undulating sandy inland plains. Previous surveys (Validus 2008, Biota 2010a, Outback Ecology 2010) indicate that these areas are broadly dominated by Soft Spinifex (*Triodia epactia*) hummock grasslands with a varying degree of invasion by introduced perennial grasses (**Cenchrus* species). Four of the previous coastal sand plain vegetation units (Biota 2010a) were mapped in the current MS survey area.

Unit Code	Description	Sub-association Code	Conservation Significance
CS1:	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland	AteTe	Low
Expected associated species: *Acacia synchronicia, Bulbostylis barbata, Crotalaria medicaginea* var. *neglecta, Desmodium filiforme, Evolvulus alsinoides* var. *decumbens* and var. *villosicalyx, Fimbristylis dichotoma, Goodenia forrestii, Indigofera colutea, I. linifolia, Ipomoea polymorpha, Pluchea dunlopii, Polygala* aff. *isingii, Rhynchosia minima, Scaevola spinescens, Solanum lasiophyllum, Trichodesma zeylanicum* var. *grandiflorum* and **Vachellia farnesiana*.			
CS2:	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland with **Cenchrus ciliaris* open tussock grassland	AteTeCEc	Low
Expected associated species: *Acacia synchronicia, Atriplex bunburyana, Bulbostylis barbata, Cassytha capillaris, Crotalaria medicaginea* var. *neglecta, Cyperus bulbosus, Dactyloctenium radulans, Eulalia aurea, Evolvulus alsinoides* var. *villosicalyx, Fimbristylis dichotoma, Indigofera colutea, I. linifolia, I. linnaei, I. trita, Ipomoea polymorpha, Lawrencia viridigrisea, Neobassia astrocarpa, Polygala* aff. *isingii, Rhynchosia minima, Sclerolaena uniflora, Solanum lasiophyllum, Trianthema turgidifolia, Trichodesma zeylanicum* var. *grandiflorum* and **Vachellia farnesiana*.			
Unit Code	**Description**	**Sub-association Code**	**Conservation Significance**
CS3:	*Acacia tetragonophylla* scattered shrubs over *Scaevola pulchella, Indigofera monophylla* low open shrubland over *Triodia epactia* hummock grassland	AteSCpImTe	Low
Expected associated species: *Cassytha capillaris, Crotalaria medicaginea* var. *neglecta, Diplopeltis eriocarpa, Evolvulus alsinoides* var. *villosicalyx, Ptilotus nobilis* subsp. *nobilis, Rhynchosia minima* and *Solanum lasiophyllum*.			
CS4:	**Prosopis pallida, Acacia tetragonophylla, A. synchronicia* scattered tall shrubs over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland	PRpAteAsyTeCEc	Low
Expected associated species: *Atriplex codonocarpa, Crotalaria medicaginea* var. *neglecta, Cullen cinereum, Dactyloctenium radulans, Dichanthium sericeum* subsp. *humilius, Eulalia aurea, Indigofera colutea, I. linifolia, I. trita, Lawrencia viridigrisea, Neobassia astrocarpa, Polygala* aff. *isingii, Rhynchosia minima, Sclerolaena uniflora* and *Trianthema triquetra*.			

3.5.5 Vegetation of Claypans

Claypan areas were scattered throughout the MS survey area. These claypan areas ranged in size and degree of connectivity with tidal areas (connected and seasonally inundated; or isolated). Previous survey work (Biota 2010a, 2010b) found that the clay pans varied in the degree of permeability of the substrate, causing some to hold water for several weeks, while others of similar size were dry. The degree of vegetative cover on these claypans varied, but most were fringed by a narrow band of ephemeral grasses, sedges and herbs, including species such as *Calotis plumulifera, Centipeda minima* subsp. *macrocephala, Dysphania plantaginella* and *Eragrostis leptocarpa*.

Three claypan units were mapped in the MS survey area.

Unit Code	Description	Sub-association Code	Conservation Significance
C1:	Bare claypan	cp	Low
Expected associated species: *Dactyloctenium radulans, Eragrostis pergracilis*, *Atriplex codonocarpa, A. semilunaris, Swainsona pterostylis*, *Trianthema triquetra*, *Calandrinia ptychosperma, Fimbristylis dichotoma, Indigofera linifolia, Marsilea hirsuta and Polygala* aff. *isingii.*			
C3:	*Tecticornia* spp.[2] low shrubland	TECspp	High
Expected associated species: *Chloris pumilio, Crotalaria medicaginea* var. *neglecta, Cullen cinereum, Cyperus bulbosus, C. rigidellus, C. squarrosus, Eragrostis pergracilis, Frankenia ambita*, *Lawrencia viridigrisea, Marsilea hirsuta, Mimulus gracilis, Neobassia astrocarpa*, *Pluchea rubelliflora, Sesbania cannabina, Sporobolus mitchellii, S. virginicus* (Marine Couch), *Streptoglossa bubakii* and *Trianthema turgidifolia.*			
C4	**Prosopis pallida, Atriplex bunburyana* open shrubland over *Triodia epactia* open hummock grassland and **Cenchrus ciliaris* open tussock grassland.	PRpATbTeCEc	Low
Expected associated species: *Goodenia lamprosperma* and *Sporobolus mitchellii.*			

3.5.6 Vegetation of Clayey Plains

Some broad areas of clayey plain appear to occur in the study area on the basis of inspection of aerial photography. These would likely support tussock grasslands of various native species. Other small pockets of clayey substrate may occur in and around drainage depressions, and these would be expected to support tall shrublands of Mesquite (**Prosopis pallida*) and/or native species over tussock grasslands of native and/or introduced species.

Two vegetation units of clayey plains were mapped in the MS survey area.

Unit Code	Description	Sub-association Code	Conservation Significance
CP1:	*Sporobolus mitchellii, Eriachne* aff. *benthamii, E. benthamii, Eulalia aurea* tussock grassland	SPmERIbEUa	Moderate
Expected associated species: *Acacia synchronicia, A. tetragonophylla, Atriplex bunburyana, Centipeda minima* subsp. *macrocephala, Chloris pumilio, Crotalaria medicaginea* var. *neglecta, Cucumis variabilis, Cullen cinereum, Cyperus rigidellus*, *C. squarrosus, Dactyloctenium radulans, Dichanthium sericeum* subsp. *humilius, Eragrostis pergracilis, Leptochloa fusca* subsp. *muelleri, Marsilea hirsuta, Panicum decompositum, Pluchea rubelliflora, Scaevola spinescens*, *Sesbania cannabina, Streptoglossa bubakii* and **Vachellia farnesiana*,.			
CP6:	*Lawrencia viridigrisea* low open shrubland over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* open tussock grassland	LAvTeCEc	Low
Expected associated species: *Amaranthus undulatus, Cyperus bulbosus, Eragrostis falcata, Nicotiana occidentalis* subsp. *occidentalis* and *Trianthema turgidifolia.*			

[2] Numerous specimens of *Tecticornia* were collected from the Wheatstone study area, and a number of different taxa were identified (Biota 2010a). However, many of the specimens were sterile and could not be identified to species level. Given this, Biota (2010a) considered it most appropriate to define vegetation units dominated by samphires only as containing "*Tecticornia* spp.", to indicate that various species may be present. This approach has been retained for the current report.

3.6 Conservation Significance of the Vegetation Units

Using the ranking systems outlined in Section 2.3 and largely based on the findings of Biota (2010a), three vegetation units of High conservation significance and one of Moderate significance were identified in the MS survey area. The vegetation units C4 (PRpATbTeCEc) and CP6 (LAvTeCEc), which were originally described by Outback Ecology (2010) and Validus (2008), were assessed during this review based on the suite of species present, vegetation condition and weed invasion or other disturbance.

High Significance

- The inland sand dune vegetation units (ID1 and ID2) potentially support Priority flora (*Eremophila forrestii* subsp. *viridis* and *Triumfetta echinata*), as well as other species of interest (*Aenictophyton* aff. *reconditum*), while the dune landform is particularly susceptible to erosion and weed invasion following disturbance to the soil profile (Biota 2010a).
- The samphire shrublands (C3) may contain a number of poorly recognised *Tecticornia* species whose distributions in the region are also difficult to determine. This vegetation unit has the potential to contain the Priority flora species *Eleocharis papillosa*, which is listed as Vulnerable under the EPBC Act (Biota 2010a).

Moderate Significance

- The cracking clay grasslands (CP1) support species specific to this substrate (Biota 2010a). The cracking clay grasslands occurring in the MS survey area are expected to be in Very Good condition.

Low Significance

- The remainder of the vegetation units would be considered to be of Low conservation significance as they are likely to be representative of vegetation units that are widespread in the locality or are substantially invaded by Buffel Grass (**Cenchrus ciliaris*).

A full breakdown of the assessment of each vegetation unit in the MS survey area is shown in Table 3.2.

Table 3.2: Conservation significance assessment of vegetation units in the MS survey area

Veg Code	Associated Land System/s (regional representation symbol)	Other Key Attributes Increasing Conservation Value	Other Key Attributes Decreasing Conservation Value	Score based on distribution of land system/s	Score from other attributes that increase conservation value	Score from other attributes that decrease conservation value	Overall Score	Perceived Relative Significance †
Maximum Possible Score for this Assessment				**4**	**7**	**0**	**11**	Very High
Minimum Possible Score for this Assessment				**1**	**0**	**-3**	**-2**	None
Tidal Mudflats and Tidal Creeks								
T1 (mf)	Littoral (W)	F (+1) H (+1)		1	2		3	Low
Coastal Sand Dunes								
CD1 (AcCRcSXlCEc)	Onslow(R)	C (+1)		3	1		4	Low
CD2 (AcCRcTRzTeCEc)	Onslow(R)	C (+1)	D (-3)	3	1	-3	1	Low
Inland Sand Dunes								
ID1 (GsCRcTRzTe)	Dune (R), Onslow (R)	C (+1), F (+2,+1), H (+1)		3	5		8	High
ID2 (GsCRcHBbTsTe)	Dune (R), Giralia (W,O)	C (+1), F (+2,+1), H (+1)		2.5	5		7.5	High*
ID3 (AstTe)	Dune (R)	A (+1), H (+1)		3	2		5	Low
Coastal Sand Plains								
CS1 (AteTe)	Dune (R), Onslow (R)	S (+1), H (+1)		3	2		5	Low
CS3 (AtSCpImTe)	Dune (R), Onslow (R)	S (+1), H (+1)		3	2		5	Low
CS4 (PRpAteAsyTeCEc)	Littoral (W), Minderoo (R), Onslow (R)		D (-3)	3		-3	0	Low
Claypans								
C1 (cp)	Minderoo (R), Onslow (R)	H (+1)		3	1		4	Low
C2 (ERIb)	Dune (R), Minderoo (R), Onslow (R)	H (+1)		3	1		4	Low
C3 (TECspp)	Littoral (W), Onslow (R)	F (+3,+1), S (+1), H (+1)		2	6		8	High
Clayey Plains								
CP1 (SPmERIbEUa)	Minderoo (R)	F (+1), S (+1), H (+1)		3	3		6	Moderate
CP6 (LAvTeCEc)	Onslow (R)		D (-3)	3			0	Low

Land system W=widespread, R=restricted, O=outlier / Other factors, C= significant physical feature, F= significant flora, A= restricted size, S = species richness, H = vegetation condition, D = disturbance

† **Very High**: overall score 10-11; **High**: overall score 8-9; **Moderate**: overall score 6-7; **Low**: overall score 0-5; **No signfiicance**: overall score <0.

• Where split land system association resulted in half scores, rankings were rounded up to the nearest whole number

Table 3.3: Area of extent of each vegetation unit in the MS survey area.

Unit Code	Description	Sub-association Code	Area in MS Survey Area (ha)
Vegetation of Tidal Mudflats and Tidal Creeks			
T1	*Tecticornia* spp. scattered low shrubs	mf	201.49
Vegetation of Coastal Sand Dunes			
CD1	*Acacia coriacea* subsp. *coriacea, Crotalaria cunninghamii* tall shrubland over *Spinifex longifolius, (*Cenchrus ciliaris)* open tussock grassland	AcCRcSXlCEc	6.90
CD2	*Acacia coriacea* subsp. *coriacea* tall shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* open tussock grassland	AcCRcTRzTeCEc	9.88
Vegetation of Inland Sand Dunes			
ID1	*Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland	GsCRcTRzTe	136.25 ha, plus 4.91 ha in Mosaic with unit ID2
ID2	*Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Hibiscus brachychlaenus* open shrubland over *Triodia schinzii, (T. epactia)* open hummock grassland	GsCRcHBbTsTe	4.91 ha, occurs only in mosaic with ID1.
ID3	*Acacia stellaticeps* shrubland over *Triodia epactia* hummock grassland	AstTe	106.65
Vegetation of Coastal Sand Plains			
CS1	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland	AteTe	319.98 ha, plus 202.99 ha in mosaic with unit CP1
CS2	*Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland with **Cenchrus ciliaris* open tussock grassland	AteTeCEc	63.62
CS3	*Acacia tetragonophylla* scattered shrubs over *Scaevola pulchella, Indigofera monophylla* low open shrubland over *Triodia epactia* hummock grassland	AteSCpImTe	26.57
CS4	**Prosopis pallida, Acacia tetragonophylla, A. synchronicia* scattered tall shrubs over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland	PRpAteAsyTeCEc	268.89
Vegetation of Claypans			
C1	Bare claypan	cp	11.86
C3	*Tecticornia* spp. low shrubland	TECspp	31.68
C4	**Prosopis pallida, Atriplex bunburyana* open shrubland over *Triodia epactia* open hummock grassland and **Cenchrus ciliaris* open tussock grassland	PRpATbTeCEc	17.62
Vegetation of Clayey Plains			
CP1	*Sporobolus mitchellii, Eriachne* aff. *benthamii, E. benthamii, Eulalia aurea* tussock grassland	SPmERIbEUa	139.83 ha, plus 202.99 ha in mosaic with unit CS1
CP6	*Lawrencia viridigrisea* low open shrubland over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* open tussock grassland	LAvTeCEc	15.58

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4.0 Flora

4.1 Overview of the Flora of the MS Survey Area and Broader Locality

A total of 206 taxa of native vascular flora from 107 genera and 37 families have been recorded from the MS survey area, together with seven weed species. These figures are derived from 23 quadrats[3] and three relevés[3] from previous flora and vegetation surveys that fall within the current MS survey area (see Section 2.1.1), in combination with unpublished data from Biota's internal database. The full species listing is provided in Appendix 6 and the location of quadrats and relevés within the MS survey area are displayed on the vegetation mapping in Appendix 5, the full raw data of the sampling sites used is listed in Appendix 7.

This number of taxa, genera and families of native vascular flora and the number of weed species recorded in the MS survey area are comparable to those recorded in surveys in the broader locality:

- 107 native taxa (from 67 genera and 28 families) and seven weed species (ENV 2011);
- 80 native taxa[4] (from 48 genera and 26 families) and six weed species recorded during the Wheatstone addendum survey by Outback Ecology (2010);
- 338 native taxa (from 141 genera and 53 families) and 12 weed species recorded during the Wheatstone Project surveys completed by Biota (2010a);
- 232 native taxa (from 130 genera and 50 families) and seven weed species recorded from the northern section of the Wheatstone plant study area by OEC (2008) and from the camp and shared infrastructure corridor (SIC) study area by OEC (2009);
- 105 native taxa (from 64 genera and 24 families) and six weed species recorded from 16 quadrats assessed by Astron (2009); and
- 66 native taxa from (46 genera and 21 families) and two weed species recorded from four quadrats assessed by RPS Australia (2009).

4.2 Flora of Conservation Significance

4.2.1 Threatened Flora

No Threatened flora listed under the EPBC Act or the *Wildlife Conservation Act 1950* have been recorded in the MS survey area. However, one flora species listed as "Vulnerable" under the EPBC Act was recorded in close proximity to the MS survey area by Biota (2010a, 2011):

- *Eleocharis papillosa* (Dwarf Desert Spike-rush) has been recorded from three distinct areas in the broader locality. One of the locations from which this species has been recorded is within 150 m of the southern boundary of the MS survey area.

Previous records suggest that this species occurs in a habitat comprised of samphire shrubland vegetation within a tidally influenced creek. While no such habitat occurs in the MS survey area, the close proximity of known populations mean that we cannot rule out the possibility that this species could occur within the MS survey area. For a more detailed discussion of the species' distribution and habitat preferences, see Biota (2011).

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3 Quadrats are bounded flora sampling sites; the standard size for a quadrat in the Pilbara is 50 m by 50 m. Relevés are unbounded flora sampling sites with a similar area to a quadrat.

4 Based on the species list contained in Appendix G of Outback Ecology (2010). Note that *Scaevola taccada* (a Kimberley species) and *Acacia sclerophylla* var. *sclerophylla* (a Southwest species) were excluded from this tally, as it is considered that the former is likely mis-determined, while the latter is likely a mis-entry of *A. sclerosperma* subsp. *sclerosperma*. *Indigofera trifoliata* (which occurs in the Kimberley) was similarly considered likely to be a mis-entry of *I. trita*, and has been treated as such in this report.

4.2.2 Priority Flora

Two priority species are known to occur in the MS survey area:

- ***Eremophila forrestii* subsp. *viridis* (Priority 3):** two records of this species occur within the upper section of Lot 524 area of the MS survey area (see Figure 4.1). Both of these records are from Biota's internal database and only listed as a presence record, this same area was surveyed during Biota's (2011) rare flora survey but no additional records where noted. For further discussion of these records, see Biota (2011). In the broader locality, a total of 117 individuals of *Eremophila forrestii* subsp. *viridis* were recorded from four locations in the Wheatstone addendum area (Outback Ecology 2010). This subspecies was found to be intermixed with the more common subspecies *E. forrestii* subsp. *hastieana*, and Outback Ecology (2010) noted that only minor taxonomic differences separate the two. Subspecies *viridis* was also recorded seven times from the broader locality by Biota (2010a). Mr. Andrew Brown (DEC Kensington, pers. comm. 2009) has advised that he suspects this taxon is restricted to the Onslow locality. A more detailed discussion of this subspecies' taxonomy and distribution are provided in Biota (2011).
- ***Triumfetta echinata* (Priority 3):** 14 records of this species occur within the MS survey area (see Figure 4.1). One record is from the Biota (2010a) survey of the Wheatstone area, 12 records are from the Biota (2011) rare flora survey and the remaining record is unpublished data from the internal Biota database. A more detailed discussion of the distribution of this species in the broader locality is provided in Biota (2011).

Based on searches of the DEC and WA Herbarium databases conducted for this review (see Section 2.1.5) and the survey work completed in the Onslow area to date (see Section 2.1.1), a number of Priority flora species are known to occur in the locality. Each species is discussed below, along with an assessment of the likelihood that it would occur in the MS survey area:

- ***Abutilon uncinatum* (Priority 1):** This prostrate low shrub species is known from three locations south of the Peedamulla/Onslow Road intersection near Onslow. The closest record is 8.5 km south of the MS survey area. During the 2009 survey work completed by Biota (2010a), this species was recorded from a single location within the Wheatstone pipeline corridor, 10.7 km southeast of the Peedamulla Station turn-off along the Onslow Road. A subsequent rare flora survey by Biota (2011) found two additional populations of this species 10.7 km and 7 km south of the Peedamulla/Onslow Road intersection. The habitat from which this species was recorded comprised a loamy plain supporting a shrubland of *Acacia synchronicia* and *A. bivenosa* over an open hummock grassland of *Triodia epactia*. This species is unlikely to occur within the MS survey area due to a lack of suitable habitat.
- ***Carpobrotus* sp. Thevenard Island (M. White 050) (Priority 2):** This species is only currently known from white sand dunes on islands off the Pilbara coast. This species would not occur in the MS survey area as no suitable habitat is present.
- ***Atriplex flabelliformis* (Priority 3):** This species was recorded from five locations in the southern Wheatstone plant study area by Astron (2009), with all records associated with samphire and grassland vegetation on clayey plains (vegetation units C3 [TECspp] and CP1 [SPmERIbEUa]). This represents a very substantial range extension for this species, with the nearest known population some 430 km east-southeast of the MS survey area in the Fortescue Marsh. The 2011 rare flora survey (Biota 2011) conducted targeted searches for this species but was unable to locate any further records or confirm the locations recorded from Astron (2009). Confirmation of the Astron ID has not been possible due to the lack of suitable voucher material. While it is possible that these records may represent a mis-identification, the presence of suitable habitats means that the possibility still exists for this species to occur in the study area. For further discussion of this species see Biota (2011).
- ***Eleocharis papillosa* (Priority 3):** see Section 4.2.1.

While not formally listed, numerous other taxa described from the Onslow locality are considered to be of conservation interest for various reasons (e.g. they represent apparently new (undescribed) taxa, are poorly collected, or the record represents a considerable range extension; see Section 6.2.5 in Biota 2010a).

The species most relevant to the MS survey area comprise:

- ***Abutilon* aff. *dioicum*:** This undescribed species of *Abutilon* was recorded 15 times in the MS survey area and over 50 records are known from the broader Onslow locality. This species appears to be common within its preferred habitat of red sand dunes, often occurring as one continuous population over the length of a sand dune system (see Figure 4.1). For further discussion of this species and its distribution in the Onslow locality, see Biota (2011).
- ***Aenictophyton* aff. *reconditum*:** This undescribed species of *Aenictophyton* has been recorded seven times in the MS survey area (Validus 2008, Biota 2010a) and twice in the broader locality (Onshore 2008, Biota 2010a). No new populations of this species were recorded during the rare flora survey conducted by Biota (2011). This species was recorded on sand dunes and is considered to be associated with early seral stage vegetation (Biota 2011).
- ***Vigna* sp. Hamersley clay (A.A. Mitchell PRP 113):** This undescribed species was recorded from numerous locations on the sandy coastal plains of the Wheatstone study area (see Biota 2010a). This taxon appears to have a broad distribution through the Pilbara and could potentially occur on the coastal plains in the MS survey area.

4.3 Weeds

Seven weed species have been recorded in the MS survey area. The distributions of introduced species are shown in Figure 4.2 and listed in Appendix 8. Each of the weed species is discussed below:

- ***Aerva javanica* (Kapok):** Kapok is found in various habitats and vegetation units and can be a significant weed of loose sandy substrates in coastal areas. This short-lived perennial shrub is common throughout the Pilbara and Kimberley regions.
- ***Cenchrus ciliaris* (Buffel Grass) and *Cenchrus setiger* (Birdwood Grass):** Buffel Grass and Birdwood Grass are tufted perennial grasses which were introduced to the Pilbara as fodder species. Buffel Grass has demonstrated allelopathic capacities, whereby it releases chemicals that inhibit the growth of other plants, and it is an aggressive and effective competitor with native flora species. This perennial grass forms dense tussock grasslands, particularly along creeklines, floodplains and in sandy coastal areas of the Pilbara. Birdwood Grass tends to be less abundant but is often found intermixed with Buffel Grass through the same areas.
- ***Flaveria trinervia* (Speedy Weed):** Speedy Weed is an annual daisy, commonly occurring in drainage lines and other mesic habitats in the northwest of WA. This species was previously listed as the native *F. australasica*.
- ***Prosopis glandulosa* and *Prosopis pallida* (Mesquite):** All *Prosopis* species are Declared Plants under the *Western Australian Agriculture and Related Resources Protection Act 1976,* being listed as P1 (movement of plants or their seeds prohibited) for the State, and P2 (eradicate infestation to destroy and prevent propagation each year until no plants remain) for the Onslow locality. *Prosopis* is also listed as a "Weed of National Significance" by Thorp and Lynch (2000).
- ***Tribulus terrestris* (Caltrop):** Caltrop is a prostrate spreading annual herb with pinnate leaves, which is widespread in the Kimberly and arid zones and is also found in the southwest of WA on road verges.
- ***Vachellia farnesiana* (Mimosa Bush):** Mimosa Bush is a spreading, thorny shrub to 4 m high, which is widespread from the Kimberley to near Perth, typically occurring along drainage systems and in adjacent low-lying areas. It has dark grey bark, pinnate leaves and yellow flowers that are visible in winter.

Though not recorded in any of the sites within the MS survey area, there are a number of weed species that are considered likely to occur within the area. These include:

- ***Malvastrum americanum* (Spiked Malvastrum):** Spiked Malvastrum is a common weed of Mulga vegetation, hillsides, floodplains and drainage lines. This species is widespread throughout the Kimberley, Pilbara, Gascoyne and Carnarvon bioregions. Spiked Malvastrum

was recorded seven times in the broader Wheatstone locality (Biota 2010a) and may occur in the MS survey area.

- ***Cucumis melo* subsp. *agrestis* (Ulcardo Melon):** Ulcardo Melon is a widespread weed throughout the Kimberley, Pilbara and Gascoyne bioregions. This trailing annual herb was recorded from eight locations in the broader Wheatstone area (Biota 2010a). This species may occur in the MS survey area.
- ***Portulaca oleracea* (Purslane):** Purslane is a succulent, prostrate to decumbent annual herb and is a very common weed of clayey and stony plains in the Pilbara, but does not appear to compete with native species. This species was recorded numerous times in the broader Wheatstone locality (Biota 2010a) and would be expected to occur in the MS survey area.

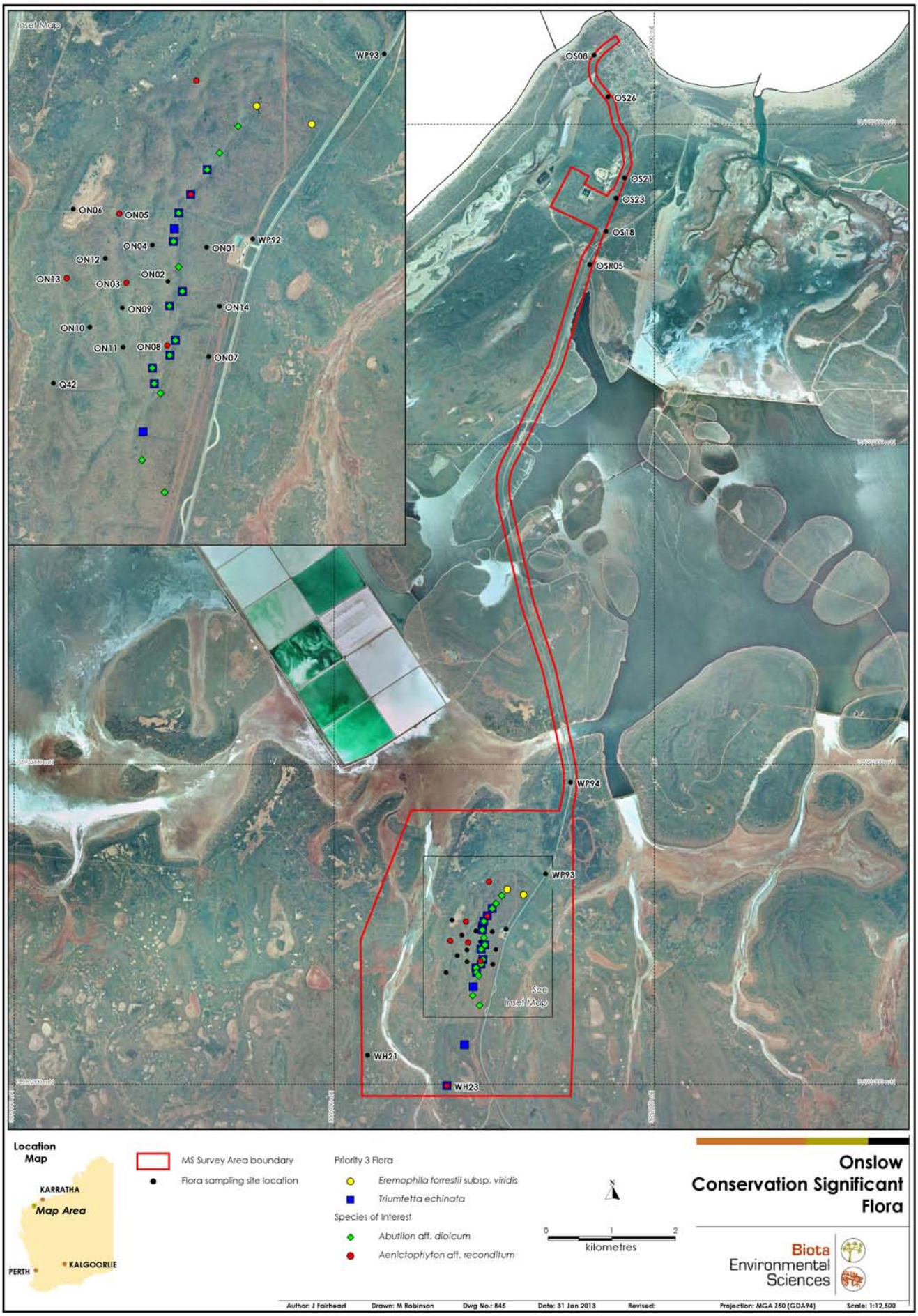

Figure 4.1: Known locations of Priority flora and other species of conservation interest in the MS survey area.

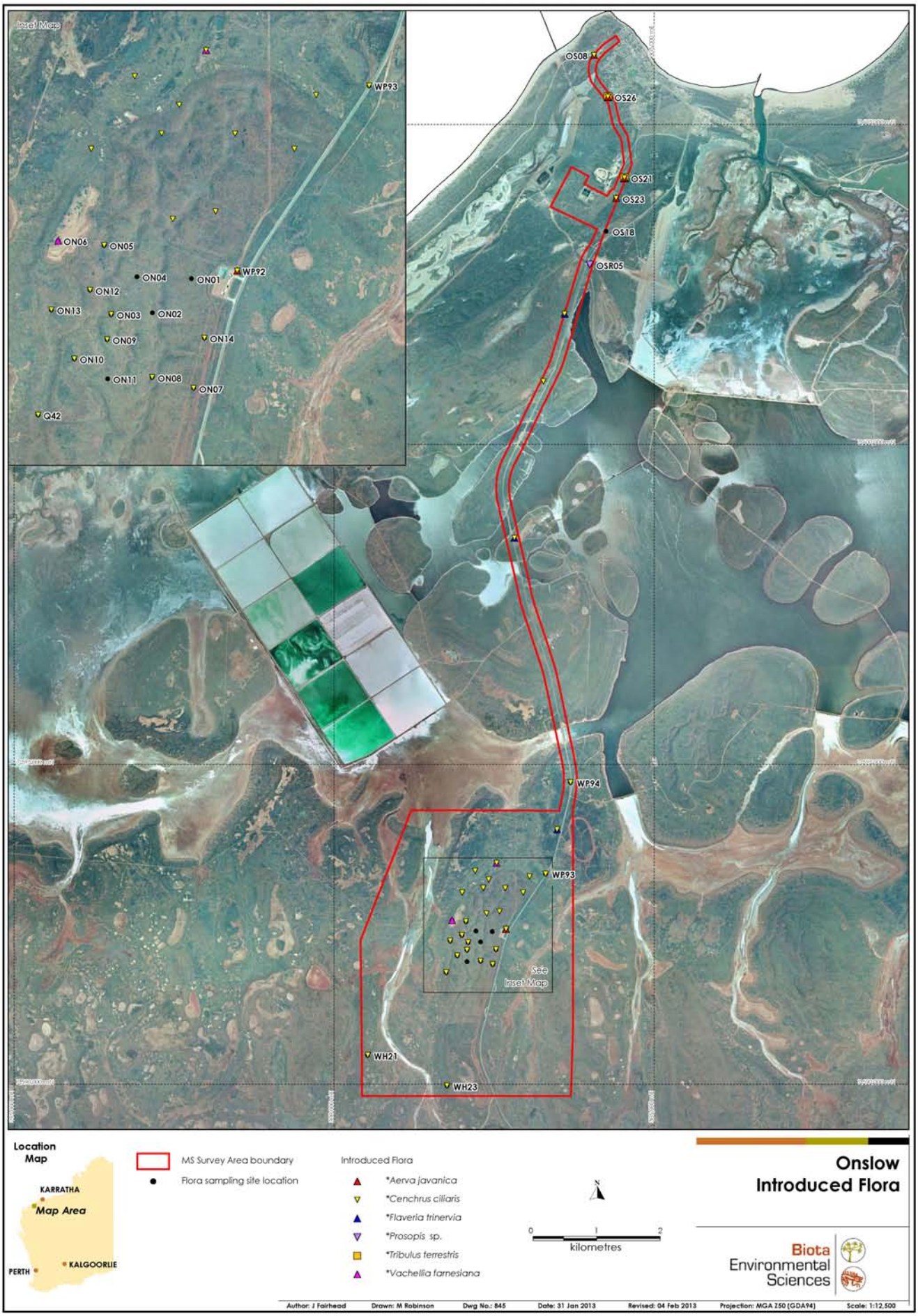

Figure 4.2: Known locations of introduced flora in the MS survey area.

5.0 Fauna

5.1 Terrestrial Fauna

5.1.1 Fauna Habitats

Based on inspection of aerial photography and review of the vegetation units present, the MS survey area was assessed as containing six of the seven primary fauna habitats identified from the overall Wheatstone study area by Biota (2010d). These are:

- Coastal Dune: *Acacia coriacea* tall shrubland over *Spinifex longifolius* open tussock grassland on coastal dune system;
- Inland Dune: *Triodia epactia* dominated hummock grassland on inland dune system;
- Sand/Loam Plain: *Acacia* sp. scattered shrubs over *Triodia epactia* hummock grassland on sand/loam plain;
- Buffel on clay: Buffel Grass tussock grassland on clay plain;
- Samphire: Samphire claypan; and
- Tussock on clay: Tussock grassland on heavy clay plain.

No new or substantially different habitats appear to be present in the MS survey area based on the available vegetation mapping and inspection of aerial photography.

5.1.2 Vertebrate Fauna Potentially Occurring in the Study Area

The Wheatstone Project fauna survey conducted by Biota in 2009 yielded a combined total of 128 vertebrate species, comprising 51 herpetofauna species, 60 avifauna species and 17 mammals (Biota 2010d). The assemblage recorded during the Biota (2010d) study is considered representative of the likely terrestrial fauna assemblage of the MS survey area, given that:

- the MS survey area is very close to the Wheatstone study area; and
- the MS survey area contains six of the seven primary habitat types identified for the Wheatstone study area (Biota 2010d).

5.1.3 Vertebrate Fauna of Conservation Significance Potentially Occurring in the Study Area

The likelihood of conservation significant species occurring within the MS survey area is detailed in Table 5.1, Table 5.2 and Table 5.3. No schedule listed species have been recorded during previous surveys from sites in the Onslow locality (Biota 2010d). Based on reviews of habitats and known fauna distributions it is considered unlikely that any listed Schedule 1 species would occur within the MS survey area.

Three Priority listed species have been recorded in the vicinity by Biota (2010d):

- Little Northern Freetail-bat (*Mormopterus loriae cobourgensis*; Priority 1);
- Western Pebble-mound Mouse (*Pseudomys chapmani*; Priority 4); and
- Australian Bustard (*Ardeotis australis;* Priority 4).

The Western Pebble-mound Mouse is unlikely to occur in the MS survey area due to a lack of suitable stony substrate required for mound building (Table 5.2). However, the Little Northern Freetail-bat (Table 5.2) and the Australian Bustard are considered likely to be present (Table 5.1).

In addition, *Lerista planiventralis maryani* (Priority 1) may potentially occur in the northern part of the MS survey area, as it has been previously recorded at Onslow (NatureMap records; Table 5.3). Similarly, the Priority 4 Short-tailed Mouse (*Leggadina lakedownensis*) may also occur in the MS survey area, as there is some suitable habitat (cracking clay) and it has been recorded previously

in the vicinity (Table 5.2). The Priority 4 Bush Stone-curlew (*Burhinus grallarius*) and Eastern Curlew (*Numenius madagascariensis*) may also be found in coastal sections of the study area near Onslow. The Schedule 4 Peregrine Falcon (*Falco peregrinus*) may also occur in the study area (Table 5.1).

The project is not expected to affect the conservation status of any of these species, as only a small proportion of local habitat for the taxa would be cleared relative to their distribution in the wider region (Biota 2010d).

Thirty-three Migratory species listed under the EPBC Act may be found in the coastal areas within or adjacent to the MS survey area (Table 5.1). The proposed development is not expected to affect the conservation status of these Migratory species, as only a small proportion of local habitat suitable for the taxa would be cleared relative to their distribution in the wider region (Biota 2010d). In addition, habitat containing any breeding colonies is absent from the study area.

No additional conservation significant species were recorded during the Bamford Level One fauna survey in the section of the survey area that overlaps with the MS study area (Bamford et al. 2009).

Table 5.1: Conservation significant bird species recorded within 20 km of the MS survey area.

Common Name	Species Name	Status		NatureMap Search (<20 km)	EPBC Search (<20 km)	Biota (2010d)	Preferred Habitat	Likelihood of Occurrence	Notes on Likelihood
		Federal	State						
Flock Bronzewing	*Phaps histrionica*		P4	✓			Arid-zone grassy plains.	Low	No suitable habitat in survey area.
Fork-tailed Swift	*Apus pacificus*	M		✓	✓	✓	Prefers arid areas, also found over coasts.	Medium/High	Recorded during Wheatstone survey (Biota 2010d).
Southern Giant-Petrel	*Macronectes giganteus*	EN	T		✓		Almost exclusively aerial.	Low	Unlikely to occur, as distribution occurs significantly south of the survey area.
Eastern Great Egret	*Ardea modesta*	M			✓		Shallow standing freshwater.	Medium	May occur in survey area.
Cattle Egret	*Ardea ibis*	M			✓		Grasslands, woodlands and wetlands.	Medium	May occur in survey area.
Eastern Reef Egret	*Egretta sacra*	M		✓			Intertidal zone.	Medium	May occur in coastal parts of survey area near Onslow.
Eastern Osprey	*Pandion cristatus*	M			✓		Mangroves, rivers and estuaries, inshore seas, coastal islands.	Medium	May occur in coastal parts of survey area near Onslow.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	M			✓	✓	Coastal seas, islands.	Medium/High	Recorded during Wheatstone survey (Biota 2010d).
Peregrine Falcon	*Falco peregrinus*		S4	✓			Forest, woodlands, wetlands and open country.	Medium	Three records nearby.
Australian Bustard	*Ardeotis australis*		P4	✓		✓	Open to lightly wooded grasslands including *Triodia* sandplains and flats.	Medium/High	Recorded on four occasions at a single site within the Wheatstone study area (Biota 2010d). Records from previous studies demonstrate this bird is relatively common.
Bush Stone-curlew	*Burhinus grallarius*		P4	✓			Sparsely grassed, lightly timbered forest or woodland.	Medium	May occur in survey area.
Grey Plover	*Pluvialis squatarola*	M		✓			Beaches, mudflats.	Medium	May occur in coastal parts of survey area.
Lesser Sand Plover	*Charadrius mongolus*	M		✓			Coastal.	Medium	May occur in coastal parts of survey area.

Common Name	Species Name	Status		NatureMap Search (<20 km)	EPBC Search (<20 km)	Biota (2010d)	Preferred Habitat	Likelihood of Occurrence	Notes on Likelihood
		Federal	State						
Greater Sand Plover	*Charadrius leschenaultii*	M		✓			Coastal.	Medium	May occur in coastal parts of survey area.
Oriental Plover	*Charadrius veredus*	M			✓		Sparsely vegetated plains.	Medium	May occur in coastal parts of survey area.
Bar-tailed Godwit	*Limosa lapponica*	M		✓			Tidal flats.	Medium	May occur in coastal parts of survey area.
Little Curlew	*Numenius minutus*	M		✓			Open plains, grasslands.	Medium	May occur in coastal parts of survey area.
Whimbrel	*Numenius phaeopus*	M		✓			Coastal estuaries, mudflats, mangroves.	Medium	May occur in coastal parts of survey area.
Eastern Curlew	*Numenius madagascariensis*	M	P4	✓			Tidal mudflats and sandy beaches.	Medium	May occur in coastal parts of survey area.
Common Sandpiper	*Actitis hypoleucos*	M		✓			Sandy beaches.	Medium	May occur in coastal parts of survey area.
Grey-tailed Tattler	Tringa brevipes	M		✓			Estuaries, mangroves.	Medium	May occur in coastal parts of survey area.
Common Greenshank	*Tringa nebularia*	M		✓			Estuaries.	Medium	May occur in coastal parts of survey area.
Wood Sandpiper	*Tringa glareola*	M		✓			Mainly on fresh water.	Medium	May occur in coastal parts of survey area.
Ruddy Turnstone	*Arenaria interpres*	M		✓			Rocky shores with seaweed.	Medium	May occur in coastal parts of survey area.
Great Knot	*Calidris tenuirostris*	M		✓			Tidal sands, mudflats.	Medium	May occur in coastal parts of survey area.
Red Knot	*Calidris canutus*	M		✓			Tidal sands, mudflats.	Medium	May occur in coastal parts of survey area.
Sanderling	*Calidris alba*	M		✓			Sandy coastal beaches.	Medium	May occur in coastal parts of survey area.
Red-necked Stint	*Calidris ruficollis*	M		✓			Coastal and estuarine inland shores.	Medium	May occur in coastal parts of survey area.
Sharp-tailed Sandpiper	*Calidris acuminata*	M		✓			Coastal.	Medium	May occur in coastal parts of survey area.
Curlew Sandpiper	*Calidris ferruginea*	M		✓			Coastal, mudflats.	Medium	May occur in coastal parts of survey area.
Oriental Pratincole	*Glareola maldivarum*	M		✓	✓		Grassy flats and mudflats.	Medium	May occur in coastal parts of survey area.

Common Name	Species Name	Status		NatureMap Search (<20 km)	EPBC Search (<20 km)	Biota (2010d)	Preferred Habitat	Likelihood of Occurrence	Notes on Likelihood
		Federal	State						
Fairy Tern	*Sternula nereis*	M		✓			Coasts, estuaries.	Medium	May occur in coastal parts of survey area.
Caspian Tern	*Hydroprogne caspia*	M		✓			Coastal.	Medium	May occur in coastal parts of survey area.
White-winged Black Tern	*Chlidonias leucopterus*	M		✓			Estuaries, coastal seas.	Medium	May occur in coastal parts of survey area.
Roseate Tern	*Sterna dougallii*	M		✓			Oceanic.	Medium	May occur in coastal parts of survey area.
Common Tern	*Sterna hirundo*	M		✓			Oceanic.	Medium	May occur in coastal parts of survey area.
Lesser Crested Tern	*Thalasseus bengalensis*	M		✓	✓		Coastal areas.	Medium	May occur in coastal parts of survey area.
Night Parrot	*Pezoporus occidentalis*		T	✓			Dense low vegetation.	Low	A single, moderately certain record of this species was recorded near Onslow in 1967. This species is unlikely to occur in the survey area.
Rainbow Bee-eater	*Merops ornatus*	M			✓	✓	Lightly wooded vegetation.	Medium/High	Several records in the vicinity and suitable habitat.
Barn Swallow	*Hirundo rustica*	M			✓		Open, low vegetation with nearby water.	Low	Too far south for distribution.

Table 5.2: Conservation significant mammal species potentially occurring in the MS survey area.

Common Name	Species Name	Status		NatureMap Search (<20 km)	EPBC Search (<20 km)	Biota (2010d)	Preferred Habitat	Likelihood of Occurrence	Notes on Likelihood
		Federal	State						
Northern Quoll	*Dasyurus hallucatus*	EN	T	✓	✓		Breakaways adjacent and boulder outcrops.	Low	No denning habitat available within the survey area.
Bilby	*Macrotis lagotis*	VU	T		✓		Spinifex grasslands and *Acacia* shrublands.	Low	Little suitable habitat.
Little Northern Freetail-bat	*Mormopterus loriae cobourgensis*		P1			✓	Mangrove forest and adjacent areas.	Medium/High	Recorded via echolocation calls in Wheatstone survey (Biota 2010d).
Orange Leaf-nosed Bat	*Rhinonicteris aurantius*	VU			✓		Breakaways adjacent to large drainage lines.	Low	No cave habitat available within the survey area.
Short-tailed Mouse	*Leggadina lakedownensis*		P4	✓			Cracking clay and surrounding habitat.	Medium	Not recorded in the Wheatstone survey (Biota 2010d) but has been recorded in the vicinity.
Western Pebble-mound Mouse	*Pseudomys chapmani*		P4	✓		✓	Scree slopes and stony plains.	Low	No scree habitat available and lacks degree of stones usually found in suitable habitat.
Western Barred Bandicoot	*Perameles bougainville*	EN	T	✓			Restricted to Bernier, Dorre and Faure Islands.	Low	No longer found on the mainland.

Table 5.3: Conservation significant herpetofauna species potentially occurring in the MS survey area.

Common Name	Species Name	Status		NatureMap Search (<20 km)	EPBC Search (<20 km)	Biota (2010d)	Preferred Habitat	Likelihood of Occurrence	Notes on Likelihood
		Federal	State						
Pilbara Olive Python	*Liasis olivaceus barroni*	VU		✓			Rocky habitats near water, particularly rock pools.	Low	No suitable habitat present in survey area.
–	*Lerista planiventralis maryani*		P1	✓			Sandy areas.	Medium	Recorded at Onslow. May be found in sand dunes.
–	*Pogona minor minima*		T	✓			Woodlands and shrublands on Houtman Abrolhos Islands.	Low	Found only on Houtman Abrolhos Islands.

5.1.4 Potential Short Range Endemic Fauna

No confirmed Short Range Endemic (SRE) taxa were collected during the Biota (2010d) survey at Wheatstone, despite systematic sampling and targeted searches. The only fauna belonging to potential SRE groups collected were two pseudoscorpion taxa, which proved to be known morphotypes with wider regional distributions and hence not considered to be SREs (Biota 2010d).

The habitats and general landscape setting of the MS survey area is essentially the same as that of the adjoining and overlapping Wheatstone study area of Biota (2010d). It is therefore considered unlikely that any SRE taxa are present in the MS survey area.

5.2 Ephemeral Fauna of Claypan Systems

As the overall Wheatstone study had the potential to directly affect claypan systems and their faunal communities, Biota (2010b) conducted a survey of these ephemeral habitats. A combined total of 141 taxa of zooplankton and macro-invertebrates were recorded during that study, with 12 classes and 21 orders represented amongst the collected fauna (Biota 2010b). Claypans containing clear water habitats were generally found to be more diverse than the turbid claypans.

Inspection of aerial photography suggests that the claypan units present in the MS survey area are likely to be of the turbid rather than clear water type, suggesting their diversity is likely to be lower than clear-water habitats in the locality. The analysis carried out by Biota (2010b) of the larger dataset also indicated a low risk of small-scale isolation of ephemeral faunal species, consistent with the broad-scale connections of these habitats during major flood events. On this basis, it is considered unlikely that the claypan faunal communities of the MS survey area would vary substantially from those sampled in the overall Wheatstone study area (Biota 2010b).

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6.0 Summary and Conclusions

6.1 Vegetation and Flora of the MS Survey Area

Extensive flora and vegetation survey work completed in the Onslow locality has allowed for a detailed desktop assessment of the MS survey area. The Lot 524 section at the southern end of the MS survey area has been partially covered by four flora and vegetation surveys (Validus 2008, Biota 2010a, 2010c, Outback Ecology 2010), allowing this area to be mapped with a high level of confidence. Rare flora searches within and around the area (including Biota 2011) provide a sound understanding of the habitats most likely to support population of Threatened or Priority flora, and the identification of vegetation units of elevated conservation significance.

Flora and vegetation survey coverage of the services corridor extending from the Lot 524 area to the town of Onslow is less comprehensive than that of the Lot 524 area, however the ENV (2011) survey does overlap the northern end of the corridor (see Figure 2.1), while the Validus (2008) Domgas corridor passes in close proximity. This allowed vegetation units to be extrapolated and mapped within this section of the MS survey area with reasonable confidence. The services corridor has also been subject to the highest level of disturbance: the Onslow/Mt Stewart Road runs the length of the area, several sections are subject to tidal inundation, and there is evidence of historical quarrying activity in several areas.

Three vegetation units within the MS survey area are considered to have High conservation significance: the two inland sand dune vegetation units ID1 (GsCRcTRzTe) and ID2 (GsCRcHBbTsTe), and the claypan vegetation unit C3 (TECspp.). These units have the potential to support Priority flora species or other species of potential conservation significance (see Section 3.6). These units cover 172.8 ha (10.36%) of the MS survey area.

A total of 206 taxa of native flora have been recorded within the MS survey area. No Threatened species listed at the state level would occur in the MS survey area: all of the Threatened species listed for the Carnarvon and Pilbara bioregions occur several hundred kilometers inland. The only EPBC Act listed flora species which could potentially occur within the MS survey area is *Eleocharis papillosa*, which was recorded from an area within 150 m of the southern boundary of the MS survey area. The broader distribution of this species in the locality has been discussed in Biota (2011). Two Weeds of National Significance (**Prosopis glandulosa* and **Prosopis pallida*) have been recorded in the MS survey area, and will need to be taken into consideration when undertaking any work in the area.

6.2 Fauna of the MS Survey Area

From the desktop review, it appears that the terrestrial fauna and the ephemeral claypan fauna habitats of the MS survey area are essentially equivalent to those of the previously surveyed, adjacent Wheatstone study area (Biota 2010d). These results are therefore relevant to the survey area and may be used in conjunction with database searches to infer the likely fauna values of the MS survey area.

The available data indicate a low likelihood of Schedule 1 fauna occurring in the MS survey area. Only a small number of Priority fauna, as well as the Schedule 4 species Peregrine Falcon (*Falco peregrinus*), may potentially occur in the study area (Section 5.1.3). There are also a number of Migratory listed species that may occur in coastal parts of the MS survey area (Section 5.1.3). The proposed development is not expected to affect the conservation status of any of these species, as only a small proportion of local habitat for the taxa would be cleared relative to their distribution in the wider region (Biota 2010d). Moreover, habitat containing any breeding colonies is absent from the study area.

While claypan habitats occur in the MS survey area, they appear similar to the less diverse units sampled in the Biota (2010b) survey, and have a low likelihood of supporting restricted taxa.

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7.0 Glossary

*	Used prior to a species name to denote a weed species.
Annual (plant)	A plant that lives for only one year.
Conservation Significant	A plant or species assemblage (vegetation unit) that is recognised to be rare, unusual, new or poorly sampled; may have a formally assigned conservation ranking (see Appendix 1 for more on the WA conservation framework).
DEC	Department of Environment and Conservation.
Dominant species	The species that occurred most abundantly in an area or vegetation stratum.
EPA	Environmental Protection Authority of Western Australia.
EPBC Act	The Federal *Environment Protection and Biodiversity Conservation Act 1999*.
Ephemeral	A plant that lives a very short time; less than one year or, usually, less than six months.
Ground-truth	The on-ground/site study of an area to confirm vegetation patterns suggested by aerial photography.
IBRA	Interim Biogeographical Regionalisation for Australia.
Perennial	A plant that lives for more than two growing seasons.
PEC	Priority Ecological Community (see Appendix 1 for more on the WA conservation framework).
Population	Discrete groups of individuals of a particular taxon. The definition from DEC (2010a) has been used in this report in relation to Priority flora populations, with individuals greater than 500 m apart considered to represent separate populations.
Priority flora	Flora listed by the DEC as requiring additional information to properly evaluate their conservation significance; see Appendix 1 for more on the WA conservation framework.
Quadrat	A bounded sample area of uniform vegetation in which all species present are recorded; the standard quadrat size for the Pilbara is 50m by 50m, or an equivalent area (2,500 m^2).
Relevé	An unbounded flora sampling site, with a similar area to a quadrat, in which most species present are recorded.
Taxon (plural: taxa)	An entity at species level or below.
TEC	Threatened Ecological Community (see Appendix 1 for more on the WA conservation framework).
Threatened flora	Flora protected by legislation, either listed under the EPBC Act or the Western Australian *Wildlife Conservation Act 1950* (species formerly known as Declared Rare Flora); see Appendix 1 for more on the WA conservation framework.

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Appendix 1

Framework for Listing the Conservation Status of Species and Communities in Western Australia

A. Definitions, Categories and Criteria for Threatened and Priority Ecological Communities

1. 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.

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 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.

An **assemblage** is a defined group of biological entities.

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 metres 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 is defined as follows:
"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

Community structure is defined as follows:
"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 of **Modification** and **Destruction** of an ecological community:

Modification: "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

Destruction: "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:
"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced micro-organisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities

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 or 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 very 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).

Endangered (EN)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its 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) The 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 or 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 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.

3. Definitions and Criteria for Priority Ecological Communities

PRIORITY ECOLOGICAL COMMUNITY LIST
Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. 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 One: Poorly-known ecological communities
Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. 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 Two: Poorly-known ecological communities
Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat 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 Three: 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 of habitat destruction or degradation or:

(ii) communities known from a 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, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, 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 Four: 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 Five: Conservation Dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Reference: Department of Environment and Conservation 2007.

B. Threatened Flora Statutory Framework

In Western Australia, all native flora species are protected under the *Wildlife Conservation Act 1950-1979,* making it an offence to remove or harm native flora species without approval. In addition to this basic level of statutory protection, a number of plant species are assigned an additional level of conservation significance based on the fact that there are a limited number of known populations, some of which may be under threat.

Species of the highest conservation significance are designated Declared Rare Flora (DRF), either extant or presumed extinct:

- **X: Declared Rare Flora - Presumed Extinct**: taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee;
- **R: Declared Rare Flora - Extant**: taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee (Atkins 2008). *(= Threatened Flora = Endangered + Vulnerable)*

Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories:

- **P1: Priority One - Poorly Known**: taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
- **P2: Priority Two - Poorly Known**: taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
- **P3: Priority Three - Poorly Known**: taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
- **P4: Priority Four - Rare**: taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.

Note that of the above classifications, only 'Declared Rare Flora' has statutory standing. The Priority flora classifications are employed by the Department of Environment and Conservation to manage and classify their database of species considered potentially rare or at risk, but these categories have no legislative status. Note also that proposals that appear likely to affect DRF require formal written approval from the Minister for the Environment under Section 23(f) of the *Wildlife Conservation Act 1950-1979* in addition to the requirements of the *Environmental Protection (Native Vegetation Clearing) Regulations 2004*.

References:

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Appendix 2

EPBC Act Protected Matters Database Search Results

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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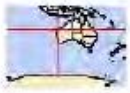

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	26

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	57
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	3
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hydrophis ornatus a seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Coastal Margin Exmouth Gulf to Cape Preston	WA	Indicative Place
Islands Exmouth Gulf and Rowley Shelf	WA	Registered
Historic		
Old Onslow Townsite	WA	Indicative Place

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Coordinates

-21.70722 115.09389

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 3

NatureMap Search Results

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Jessica Cairnes on 22/01/2013

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°05' 38" E,21°42' 25" S
Buffer 20km
Group By Family

Family	Species	Records
Acanthizidae	3	5
Accipitridae	16	90
Aegothelidae	1	3
Agamidae	14	259
Aizoaceae	2	2
Alaudidae	2	44
Amaranthaceae	8	11
Ambassidae	2	10
Anadyomenaceae	1	2
Anatidae	5	23
Anhingidae	1	1
Antennariidae	2	2
Aploactinidae	3	5
Apodidae	1	4
Apogonidae	1	1
Araliaceae	1	4
Ardeidae	8	13
Arecaceae	1	1
Ariidae	1	1
Artamidae	4	40
Asteraceae	18	30
Atherinidae	4	7
Aulopodidae	1	1
Bathysauridae	1	1
Batrachoididae	2	3
Belonidae	2	4
Blenniidae	2	6
Boidae	4	88
Bonnemaisoniaceae	1	1
Boraginaceae	8	14
Bovidae	1	5
Brassicaceae	3	3
Burhinidae	1	3
Callionymidae	1	1
Campephagidae	2	35
Canidae	2	2
Caprimulgidae	1	5
Carangidae	11	19
Carphodactylidae	3	97
Casuariidae	1	8
Caulerpaceae	6	13
Centropodidae	1	1
Centropomidae	1	2
Cepolidae	1	1
Ceramiaceae	2	3
Chaetodontidae	1	1
Chanidae	1	1
Charadriidae	6	27
Cheloniidae	2	8
Chenopodiaceae	15	31
Chirocentridae	1	2
Ciconiidae	1	1
Cinclosomatidae	1	3
Cladophoraceae	1	3
Clupeidae	13	25
Columbidae	8	85
Convolvulaceae	5	8
Corvidae	2	30
Cracticidae	3	9
Crocodylidae	1	1
Cuculidae	2	6
Cynoglossidae	1	1
Cyperaceae	7	7
Cystoseiraceae	2	5
Dasyuridae	6	42
Delphinidae	1	1
Dicruridae	3	65
Dictyotaceae	7	26
Diplodactylidae	7	320
Dugongidae	1	2
Echeneidae	1	1
Elapidae	12	198
Eleotridae	1	1
Elopidae	1	1
Engraulidae	6	17
Ephippidae	3	10
Estrilidae	3	143

Euphorbiaceae	4	14
Fabaceae	37	81
Falconidae	6	65
Felidae	1	15
Fistulariidae	1	1
Frankeniaceae	1	1
Galaxauraceae	1	4
Gekkonidae	6	612
Gentianaceae	1	1
Geraniaceae	1	1
Gerreidae	4	12
Glareolidae	1	1
Gobiidae	7	62
Gobioididae	1	1
Goodeniaceae	8	14
Gracilariaceae	1	3
Gruidae	1	6
Gyrostemonaceae	2	3
Haematopodidae	2	13
Haemulidae	5	7
Halcyonidae	3	21
Halimedaceae	2	8
Haloragaceae	2	2
Hemerocallidaceae	2	4
Hemigaleidae	2	2
Hemiramphidae	2	4
Hirundinidae	4	27
Holocentridae	2	2
Hylidae	3	438
Juncaginaceae	1	1
Labridae	4	4
Lamiaceae	2	9
Laridae	9	17
Latidae	1	1
Lauraceae	1	1
Leiognathidae	1	4
Leporidae	1	1
Lethrinidae	1	2
Limnodynastidae	3	652
Lutjanidae	5	9
Macropodidae	2	39
Maluridae	2	66
Malvaceae	10	15
Megalopidae	1	1
Meliphagidae	10	171
Menidae	1	1
Meropidae	1	43
Molluginaceae	1	1
Molossidae	2	4
Monacanthidae	1	1
Motacillidae	1	5
Mugilidae	5	19
Muraenesocidae	1	1
Muraenidae	1	4
Muridae	6	57
Myrtaceae	4	6
Nemipteridae	1	1
Onagraceae	1	1
Ophichthidae	2	2
Orobanchaceae	1	1
Ostraciidae	2	6
Otididae	1	17
Pachycephalidae	3	6
Paralichthyidae	2	2
Pardalotidae	1	4
Pegasidae	1	1
Pelecanidae	1	15
Peramelidae	1	1
Phalacrocoracidae	4	19
Phasianidae	2	3
Phrymaceae	1	1
Phyllanthaceae	1	2
Plantaginaceae	2	3
Platycephalidae	3	4
Plotosidae	2	4
Plumbaginaceae	1	1
Poaceae	24	54
Podicipedidae	1	3
Polygalaceae	1	1
Polynemidae	2	4
Pomacanthidae	1	1
Pomacentridae	2	10
Pomatomidae	1	4
Pomatostomidae	2	16
Portulacaceae	1	1
Primulaceae	1	3
Proteaceae	5	12
Psettodidae	1	2
Pseudochromidae	2	2
Psittacidae	6	82
Pteropodidae	1	3
Pygopodidae	5	375
Rachycentridae	1	2
Rallidae	1	1
Recurvirostridae	2	8
Rhamnaceae	1	1
Rhizophyllidaceae	1	5
Rhodomelaceae	7	9
Rhodymeniaceae	2	2
Sapindaceae	1	2
Sargassaceae	2	3
Scatophagidae	1	1
Sciaenidae	1	1
Scincidae	22	2380
Scolopacidae	16	72

Scombridae	3	13
Scorpaenidae	4	6
Scrophulariaceae	3	5
Scyliorhinidae	1	1
Serranidae	11	16
Siganidae	1	3
Sillaginidae	5	22
Siphonocladaceae	4	5
Solanaceae	2	3
Sparassidae	1	1
Sparidae	2	14
Sphacelariaceae	1	1
Sphyraenidae	1	1
Strigidae	1	3
Surianaceae	1	1
Sylviidae	2	30
Synanceiidae	1	1
Syngnathidae	2	2
Tachyglossidae	1	2
Terapontidae	8	18
Tetraodontidae	5	12
Threskiornithidae	1	5
Thymelaeaceae	1	1
Triacanthidae	1	1
Turnicidae	1	18
Typhlopidae	4	68
Tytonidae	1	2
Udoteaceae	1	1
Urodacidae	1	1
Valoniaceae	1	1
Varanidae	8	296
Zosteropidae	2	9
Zygophyllaceae	3	6
TOTAL	**705**	**8238**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	25531	*Gerygone levigaster (Mangrove Gerygone)*			
2.	24276	*Gerygone tenebrosa (Dusky Gerygone)*			
3.	30948	*Smicrornis brevirostris (Weebill)*			
Accipitridae					
4.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
5.	25536	*Accipiter fasciatus (Brown Goshawk)*			
6.	24285	*Aquila audax (Wedge-tailed Eagle)*			
7.	25538	*Aquila morphnoides (Little Eagle)*			
8.	24288	*Circus approximans (Swamp Harrier)*			
9.	24289	*Circus assimilis (Spotted Harrier)*			
10.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
11.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
12.	25541	*Haliastur indus (Brahminy Kite)*			
13.	24294	*Haliastur indus subsp. girrenera*			
14.	24295	*Haliastur sphenurus (Whistling Kite)*			
15.	24297	*Hamirostra melanosternon (Black-breasted Buzzard)*			
16.	25542	*Milvus migrans (Black Kite)*			
17.	24298	*Milvus migrans subsp. affinis*			
18.	25543	*Pandion haliaetus (Osprey)*			
19.	24299	*Pandion haliaetus subsp. cristatus*			
Aegothelidae					
20.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
Agamidae					
21.	30833	*Amphibolurus longirostris*			
22.	25458	*Ctenophorus caudicinctus (Ring-tailed Dragon)*			
23.	24865	*Ctenophorus caudicinctus subsp. caudicinctus*			
24.	24872	*Ctenophorus femoralis (Dune Dragon)*			
25.	25459	*Ctenophorus isolepis (Crested Dragon)*			
26.	24875	*Ctenophorus isolepis subsp. gularis (Central Military Dragon)*			
27.	24876	*Ctenophorus isolepis subsp. isolepis*			
28.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
29.	24885	*Ctenophorus rubens (Red Dragon)*			
30.	24887	*Ctenophorus rufescens (Red Rock Dragon)*			
31.	24900	*Diporiphora winneckei (Blue-lined Dragon)*			
32.	25510	*Pogona minor*			
33.	24905	*Pogona minor subsp. minima (Dwarf Bearded Dragon (Houtman Abrolhos Is.))*		T	
34.	24907	*Pogona minor subsp. minor*			
Aizoaceae					
35.	2829	*Trianthema pilosa*			
36.	2833	*Trianthema turgidifolia*			
Alaudidae					
37.	25545	*Mirafra javanica (Horsfield's Bushlark)*			
38.	24302	*Mirafra javanica subsp. horsfieldii*			
Amaranthaceae					
39.	2646	*Aerva javanica (Kapok Bush)*	Y		
40.	2694	*Ptilotus appendiculatus*			
41.	2699	*Ptilotus axillaris (Mat Mulla Mulla)*			
42.	2738	*Ptilotus latifolius (Tangled Mulla Mulla)*			
43.	2741	*Ptilotus macrocephalus (Featherheads)*			
44.	2746	*Ptilotus nobilis (Tall Mulla Mulla)*			
45.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
46.	2766	*Ptilotus villosiflorus*			
Ambassidae					
47.	-16605	*Ambassis agassizi*			
48.	-17936	*Ambassis gymnocephalus*			
Anadyomenaceae					
49.	35872	*Anadyomene plicata*			
Anatidae					
50.	24312	*Anas gracilis (Grey Teal)*			
51.	24316	*Anas superciliosa (Pacific Black Duck)*			
52.	24318	*Aythya australis (Hardhead)*			
53.	24321	*Chenonetta jubata (Australian Wood Duck)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.	24322	*Cygnus atratus (Black Swan)*			
Anhingidae					
55.	25553	*Anhinga melanogaster (Darter)*			
Antennariidae					
56.	-15651	*Lophiocharon trisignatus*			
57.	-16588	*Tathicarpus butleri*			
Aploactinidae					
58.	-15316	*? ?*			
59.	-17151	*Adventor elongatus*			
60.	-16766	*Peristrominous dolosus*			
Apodidae					
61.	25554	*Apus pacificus (Fork-tailed Swift)*		IA	
Apogonidae					
62.	-16558	*Apogon rueppellii*			
Araliaceae					
63.	19053	*Trachymene pilbarensis*			
Ardeidae					
64.	25556	*Ardea alba (Great Egret)*			
65.	25557	*Ardea garzetta (Little Egret)*			
66.	25559	*Ardea intermedia (Intermediate Egret)*			
67.	24340	*Ardea novaehollandiae (White-faced Heron)*			
68.	24341	*Ardea pacifica (White-necked Heron)*			
69.	25560	*Ardea sacra (Eastern Reef Egret, Eastern Reef Heron)*		IA	
70.	25561	*Butorides striatus (Striated Heron)*			
71.	24346	*Butorides striatus subsp. stagnatilis*			
Arecaceae					
72.	1042	*Phoenix dactylifera (Date Palm)*	Y		
Ariidae					
73.	-18640	*Netuma thalassina*			Y
Artamidae					
74.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
75.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
76.	25567	*Artamus leucorynchus (White-breasted Woodswallow)*			
77.	24356	*Artamus personatus (Masked Woodswallow)*			
Asteraceae					
78.	7822	*Angianthus acrohyalinus (Hook-leaf Angianthus)*			
79.	7832	*Angianthus milnei (Cone-spike Angianthus)*			
80.	7870	*Brachyscome cheilocarpa*			
81.	7906	*Calotis plumulifera*			
82.	19762	*Centipeda minima subsp. macrocephala*			
83.	7958	*Decazesia hecatocephala*			
84.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
85.	7988	*Gnephosis arachnoidea (Cobwebby-headed Gnephosis)*			
86.	17925	*Myriocephalus oldfieldii*			
87.	15449	*Olearia dampieri subsp. dampieri*			
88.	8168	*Pluchea rubelliflora*			
89.	19790	*Pluchea sp. B Kimberley Flora (K.F. Kenneally 9526A)*			
90.	8192	*Pterocaulon sphacelatum (Apple Bush)*			
91.	13297	*Rhodanthe psammophila*			
92.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
93.	8238	*Streptoglossa liatroides*			
94.	8239	*Streptoglossa macrocephala*			
95.	8252	*Tridax procumbens (Tridax)*	Y		
Atherinidae					
96.	-19007	*Atherinid sp.*			
97.	-18383	*Atherinomorus endrachtensis*			
98.	-16740	*Atherinomorus vaigiensis*			
99.	-18635	*Craterocephalus capreoli*			
Aulopodidae					
100.	-18763	*Aulopus purpurissatus*			
Bathysauridae					
101.	-16205	*Saurida nebulosa*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Batrachoididae					
102.	-16454	*Halophryne diemensis*			
103.	-15453	*Halophryne ocellatus*			
Belonidae					
104.	-18661	*Ablennes hians*			
105.	-16940	*Strongylura strongylura*			
Blenniidae					
106.	-18147	*Istiblennius meleagris*			
107.	-17900	*Omobranchus punctatus*			
Boidae					
108.	25448	*Antaresia stimsoni (Stimson's Python)*			
109.	25241	*Antaresia stimsoni subsp. stimsoni*			
110.	25320	*Aspidites melanocephalus (Black-headed Python)*			
111.	25238	*Liasis olivaceus subsp. barroni (Pilbara Olive Python)*		T	
Bonnemaisoniaceae					
112.	26486	*Asparagopsis taxiformis*			
Boraginaceae					
113.	14301	*Ehretia saligna var. saligna*			
114.	17301	*Heliotropium chrysocarpum*			
115.	6705	*Heliotropium crispatum*			
116.	6707	*Heliotropium curassavicum (Smooth Heliotrope)*			
117.	6712	*Heliotropium heteranthum*			
118.	17309	*Heliotropium pachyphyllum*			
119.	6727	*Trichodesma zeylanicum (Camel Bush)*			
120.	13559	*Trichodesma zeylanicum var. grandiflorum*			
Bovidae					
121.	24251	*Bos taurus (European Cattle)*	Y		
Brassicaceae					
122.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
123.	3032	*Lepidium muelleri-ferdinandii*			
124.	3039	*Lepidium platypetalum (Slender Peppercress)*			
Burhinidae					
125.	24359	*Burhinus grallarius (Bush Stone-curlew)*		P4	
Callionymidae					
126.	-16730	*Dactylopus dactylopus*			
Campephagidae					
127.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
128.	24367	*Lalage tricolor (White-winged Triller)*			
Canidae					
129.	25454	*Canis lupus*			
130.	24040	*Vulpes vulpes (Red Fox)*	Y		
Caprimulgidae					
131.	24368	*Eurostopodus argus (Spotted Nightjar)*			
Carangidae					
132.	-16568	*Alectis indica*			
133.	-15566	*Caranx ignobilis*			
134.	-16866	*Caranx sexfasciatus*			
135.	-17132	*Megalaspis cordyla*			
136.	-15575	*Parastromateus niger*			
137.	-16632	*Scomberoides commersonnianus*			
138.	-18174	*Scomberoides lysan*			
139.	-16961	*Scomberoides lysan?*			Y
140.	-17164	*Scomberoides tol*			
141.	-17924	*Selaroides leptolepis*			
142.	-18628	*Trachinotus baillonii*			
Carphodactylidae					
143.	25497	*Nephrurus levis*			
144.	24968	*Nephrurus levis subsp. occidentalis*			
145.	24969	*Nephrurus levis subsp. pilbarensis*			
Casuariidae					
146.	24470	*Dromaius novaehollandiae (Emu)*			
Caulerpaceae					

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147.	35158	*Caulerpa corynephora*			
148.	26567	*Caulerpa lanuginosa*			
149.	26568	*Caulerpa lentillifera*			
150.	26573	*Caulerpa racemosa*			
151.	26576	*Caulerpa serrulata*			
152.	26577	*Caulerpa sertularioides*			
Centropodidae					
153.	25600	*Centropus phasianinus (Pheasant Coucal)*			
Centropomidae					
154.	-15409	*Hypopterus macropterus*			
Cepolidae					
155.	-18198	*Acanthocepola abbreviata*			
Ceramiaceae					
156.	26587	*Centroceras clavulatum*			
157.	27310	*Spyridia filamentosa*			
Chaetodontidae					
158.	-16854	*Coradion chrysozonus*			
Chanidae					
159.	-16712	*Chanos chanos*			
Charadriidae					
160.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		IA	
161.	24372	*Charadrius leschenaultii subsp. leschenaultii (Greater Sand Plover)*		IA	
162.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
163.	25576	*Charadrius mongolus (Lesser Sand Plover)*		IA	
164.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
165.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
Cheloniidae					
166.	25336	*Chelonia mydas (Green Turtle)*		T	
167.	25344	*Natator depressus (Flatback Turtle)*		T	
Chenopodiaceae					
168.	2451	*Atriplex bunburyana (Silver Saltbush)*			
169.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
170.	2476	*Atriplex semilunaris (Annual Saltbush)*			
171.	2502	*Dysphania kalpari (Rat's Tail)*			
172.	2504	*Dysphania plantaginella*			
173.	2573	*Neobassia astrocarpa*			
174.	11240	*Rhagodia preissii subsp. obovata*			
175.	30434	*Salsola australis*			
176.	11650	*Sclerolaena bicornis var. bicornis (Goathead Burr)*			
177.	2633	*Sclerolaena uniflora (Two-spined Saltbush)*			
178.	2638	*Suaeda arbusculoides*			
179.	33236	*Tecticornia halocnemoides (Shrubby Samphire)*			
180.	33317	*Tecticornia indica*			
181.	33319	*Tecticornia indica subsp. bidens*			
182.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
Chirocentridae					
183.	-18366	*Chirocentrus dorab*			
Ciconiidae					
184.	24387	*Ephippiorhynchus asiaticus subsp. australis*			
Cinclosomatidae					
185.	24390	*Psophodes occidentalis (Western Wedgebill)*			
Cladophoraceae					
186.	35865	*Cladophora catenata*			
Clupeidae					
187.	-18476	*Escualosa thoracata*			Y
188.	-17024	*Herklotsichthys blackburni*			
189.	-18579	*Herklotsichthys collettei*			
190.	-15437	*Herklotsichthys collettei?*			Y
191.	-18058	*Herklotsichthys koningsbergeri*			
192.	-16874	*Herklotsichthys quadrimaculatus*			Y
193.	-15874	*Hilsa kelee?*			Y
194.	-15544	*Nematalosa come*			
195.	-15366	*Nematalosa sp.*			

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196.	-18636	*Nematalosa vlaminghi*			
197.	-17705	*Pellona ditchela*			
198.	-16556	*Sardinella albella*			Y
199.	-16917	*Sardinella gibbosa*			
Columbidae					
200.	24399	*Columba livia (Domestic Pigeon)*	Y		
201.	24401	*Geopelia cuneata (Diamond Dove)*			
202.	24402	*Geopelia humeralis (Bar-shouldered Dove)*			
203.	25585	*Geopelia striata (Peaceful Dove)*			
204.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
205.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
206.	24409	*Phaps chalcoptera (Common Bronzewing)*			
207.	24411	*Phaps histrionica (Flock Bronzewing)*		P4	
Convolvulaceae					
208.	11167	*Bonamia erecta*			
209.	19565	*Cressa australis*			
210.	6624	*Ipomoea costata (Rock Morning Glory)*			
211.	11312	*Ipomoea pes-caprae subsp. brasiliensis*			
212.	6638	*Ipomoea quamoclit (Cupid's Flower)*	Y		
Corvidae					
213.	24416	*Corvus bennetti (Little Crow)*			
214.	25593	*Corvus orru (Torresian Crow)*			
Cracticidae					
215.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
216.	-15151	*Cracticus tibicen subsp. longirostris*			Y
217.	25596	*Cracticus torquatus (Grey Butcherbird)*			
Crocodylidae					
218.	24859	*Crocodylus porosus (Salt-water Crocodile)*		S	
Cuculidae					
219.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
220.	24434	*Chrysococcyx osculans (Black-eared Cuckoo)*			
Cynoglossidae					
221.	-18128	*Paraplagusia bilineata*			
Cyperaceae					
222.	750	*Bulbostylis barbata*			
223.	777	*Cyperus bulbosus (Bush Onion)*			
224.	808	*Cyperus pygmaeus*			
225.	809	*Cyperus rigidellus*			
226.	814	*Cyperus squarrosus*			
227.	962	*Schoenoplectus dissachanthus*			
228.	16257	*Schoenoplectus subulatus*			
Cystoseiraceae					
229.	26731	*Cystoseira trinodis*			
230.	26946	*Hormophysa cuneiformis*			
Dasyuridae					
231.	24091	*Dasykaluta rosamondae (Little Red Kaluta)*			
232.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
233.	24095	*Ningaui timealeyi (Pilbara Ningaui)*			
234.	24101	*Planigale ingrami (Long-tailed Planigale)*			
235.	24116	*Sminthopsis macroura (Stripe-faced Dunnart)*			
236.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			
Delphinidae					
237.	30954	*Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)*			
Dicruridae					
238.	24443	*Grallina cyanoleuca (Magpie-lark)*			
239.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
240.	24457	*Rhipidura phasiana (Mangrove Grey Fantail)*			
Dictyotaceae					
241.	35220	*Canistrocarpus cervicornis*			
242.	26764	*Dictyopteris australis*			
243.	26775	*Dictyota ciliolata*			
244.	27043	*Lobophora variegata*			
245.	27113	*Padina australis*			
246.	27282	*Spatoglossum macrodontum*			

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247.	27317	*Stoechospermum polypodioides*			
Diplodactylidae					
248.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
249.	30936	*Lucasium squarrosus*			
250.	30933	*Lucasium stenodactylum*			
251.	24982	*Rhynchoedura ornata (Beaked Gecko)*			
252.	24932	*Strophurus jeanae*			
253.	24941	*Strophurus rankini*			
254.	24946	*Strophurus strophurus*			
Dugongidae					
255.	24084	*Dugong dugon (Dugong)*		S	
Echeneidae					
256.	-15693	*Echeneis naucrates*			
Elapidae					
257.	25243	*Acanthophis pyrrhus (Desert Death Adder)*			
258.	25355	*Aipysurus laevis*			
259.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
260.	25295	*Demansia psammophis subsp. cupreiceps*			
261.	25359	*Disteira major*			
262.	25301	*Furina ornata (Moon Snake)*			
263.	-19561	*Hydrophis ornatus*			
264.	25261	*Pseudechis australis (Mulga Snake)*			
265.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
266.	25264	*Pseudonaja nuchalis (Gwardar)*			
267.	25305	*Simoselaps anomalus (Desert Banded Snake)*			
268.	25307	*Suta punctata (Spotted Snake)*			
Eleotridae					
269.	-18117	*Butis amboinensis*			
Elopidae					
270.	-16432	*Elops hawaiensis*			
Engraulidae					
271.	-18642	*Engraulis australis?*			Y
272.	-15756	*Stolephorus carpentariae*			
273.	-15930	*Stolephorus commersonii*			
274.	-16522	*Thryssa mystax?*			
275.	-18747	*Thryssa scratchleyi?*			
276.	-15456	*Thryssa setirostris*			
Ephippidae					
277.	-16446	*Drepane punctata*			
278.	-16788	*Platax teira*			
279.	-16793	*Zabidius novemaculeatus*			
Estrilidae					
280.	24631	*Emblema pictum (Painted Finch)*			
281.	25685	*Neochmia ruficauda (Star Finch)*			
282.	30870	*Taeniopygia guttata (Zebra Finch)*			
Euphorbiaceae					
283.	17422	*Adriana tomentosa var. tomentosa*			
284.	4629	*Euphorbia hirta (Asthma Plant)*	Y		
285.	4635	*Euphorbia myrtoides*			
286.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
Fabaceae					
287.	3214	*Acacia ancistrocarpa (Fitzroy Wattle)*			
288.	3241	*Acacia bivenosa*			
289.	17013	*Acacia colei var. colei*			
290.	13500	*Acacia coriacea subsp. coriacea*			
291.	14088	*Acacia cyperophylla var. cyperophylla*			
292.	3356	*Acacia gregorii (Gregory's Wattle)*			
293.	13078	*Acacia sclerosperma subsp. sclerosperma*			
294.	20819	*Acacia sp. Ripon Hills (B.R. Maslin 8460)*			
295.	19456	*Acacia stellaticeps*			
296.	3577	*Acacia tetragonophylla (Kurara)*			
297.	3579	*Acacia trachycarpa (Minni Ritchi)*			
298.	3603	*Acacia wiseana*			
299.	39780	*Aenictophyton reconditum subsp. reconditum*			
300.	3774	*Crotalaria cunninghamii (Green Birdflower)*			

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301.	20175	*Crotalaria cunninghamii subsp. sturtii*			
302.	20179	*Crotalaria medicaginea var. neglecta*			
303.	17117	*Cullen cinereum*			
304.	17116	*Cullen martinii*			
305.	3973	*Indigofera colutea (Sticky Indigo)*			
306.	3974	*Indigofera georgei (Bovine Indigo)*			
307.	3980	*Indigofera linifolia*			
308.	3981	*Indigofera linnaei (Birdsville Indigo)*			
309.	3982	*Indigofera monophylla*			
310.	3613	*Leucaena leucocephala (Leucaena)*	Y		
311.	4061	*Lotus cruentus (Redflower Lotus)*			
312.	3673	*Parkinsonia aculeata (Parkinsonia)*	Y		
313.	3620	*Prosopis pallida (Mesquite)*	Y		
314.	4191	*Rhynchosia minima (Rhynchosia)*			
315.	4196	*Sesbania cannabina (Sesbania Pea)*			
316.	4198	*Sesbania formosa (White Dragon Tree)*			
317.	4242	*Swainsona pterostylis*			
318.	19531	*Tephrosia rosea var. clementii*			
319.	15947	*Tephrosia sp. B Kimberley Flora (C.A. Gardner 7300)*			
320.	39422	*Tephrosia sp. Onslow (K.R. Newbey 10571)*			
321.	30716	*Vachellia farnesiana (Mimosa Bush)*	Y		
322.	31391	*Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)*			
323.	20671	*Vigna sp. central (M.E. Trudgen 1626)*		P2	
Falconidae					
324.	25621	*Falco berigora (Brown Falcon)*			
325.	25622	*Falco cenchroides (Australian Kestrel)*			
326.	24472	*Falco cenchroides subsp. cenchroides*			
327.	25623	*Falco longipennis (Australian Hobby)*			
328.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
329.	24476	*Falco subniger (Black Falcon)*			
Felidae					
330.	24041	*Felis catus (Cat)*	Y		
Fistulariidae					
331.	-16506	*Fistularia petimba*			
Frankeniaceae					
332.	5188	*Frankenia ambita*			
Galaxauraceae					
333.	26835	*Galaxaura rugosa*			
Gekkonidae					
334.	24952	*Gehyra australis*			
335.	24956	*Gehyra pilbara*			
336.	24958	*Gehyra punctata*			
337.	24957	*Gehyra purpurascens*			
338.	24959	*Gehyra variegata*			
339.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
Gentianaceae					
340.	41660	*Schenkia australis*			
Geraniaceae					
341.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Gerreidae					
342.	-16395	*Gerres filamentosus*			
343.	-18711	*Gerres oyena*			
344.	-16412	*Gerres sp.*			
345.	-15570	*Gerres subfasciatus*			
Glareolidae					
346.	24481	*Glareola maldivarum (Oriental Pratincole)*		IA	
Gobiidae					
347.	-17339	*Acentrogobius viridipunctatus*			
348.	-18023	*Bathygobius cocosensis*			
349.	-16373	*Bathygobius fuscus*			
350.	-15378	*Drombus triangularis*			
351.	-17212	*Parachaeturichthys polynema*			
352.	-17041	*Periophthalmus argentilineatus*			
353.	-16444	*Yongeichthys nebulosus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Gobioididae					
354.	-17178	*Ctenotrypauchen microcephalus*			
Goodeniaceae					
355.	7501	*Goodenia corynocarpa*			
356.	7526	*Goodenia microptera*			
357.	12571	*Goodenia pascua*			
358.	7595	*Scaevola anchusifolia*			
359.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
360.	12584	*Scaevola pulchella*			
361.	7643	*Scaevola sericophylla*			
362.	7644	*Scaevola spinescens (Currant Bush)*			
Gracilariaceae					
363.	26873	*Gracilaria salicornia*			
Gruidae					
364.	24484	*Grus rubicunda (Brolga)*			
Gyrostemonaceae					
365.	2778	*Codonocarpus cotinifolius (Native Poplar)*			
366.	2784	*Gyrostemon ramulosus (Corkybark)*			
Haematopodidae					
367.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
368.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
Haemulidae					
369.	-18002	*Plectorhinchus flavomaculatus*			
370.	-18630	*Plectorhinchus gibbosus*			
371.	-18722	*Plectorhinchus polytaenia*			
372.	-18422	*Pomadasys argenteus*			
373.	-15870	*Pomadasys kaakan*			
Halcyonidae					
374.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
375.	24304	*Dacelo leachii subsp. leachii*			
376.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Halimedaceae					
377.	26891	*Halimeda cylindracea*			
378.	26898	*Halimeda velasquezii*			
Haloragaceae					
379.	6174	*Haloragis gossei*			
380.	23464	*Haloragis gossei var. inflata*			
Hemerocallidaceae					
381.	1284	*Corynotheca flexuosissima*			
382.	1286	*Corynotheca pungens*			
Hemigaleidae					
383.	-18609	*Hemigaleus microstoma*			
384.	-18656	*Hemigaleus sp.*			
Hemiramphidae					
385.	-18244	*Arrhamphus sclerolepis*			
386.	-17910	*Hemiramphus robustus*			
Hirundinidae					
387.	24488	*Cheramoeca leucosternus (White-backed Swallow)*			
388.	24489	*Hirundo ariel (Fairy Martin)*			
389.	24491	*Hirundo neoxena (Welcome Swallow)*			
390.	25629	*Hirundo nigricans (Tree Martin)*			
Holocentridae					
391.	-19197	*Sargocentron praslin*			
392.	-18032	*Sargocentron rubrum*			
Hylidae					
393.	25375	*Cyclorana maini (Sheep Frog)*			
394.	25380	*Litoria caerulea (Green Tree Frog)*			
395.	25392	*Litoria rubella (Little Red Tree Frog)*			
Juncaginaceae					
396.	145	*Triglochin hexagona (Six-point Arrowgrass)*			
Labridae					
397.	-16751	*Bodianus frenchii*			

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398.	-16368	*Choerodon cyanodus*			
399.	-18403	*Coris aygula*			
400.	-15757	*Xyrichtys sp.*			
Lamiaceae					
401.	41063	*Quoya loxocarpa*			
402.	41061	*Quoya paniculata*			
Laridae					
403.	25637	*Larus novaehollandiae (Silver Gull)*			
404.	24519	*Sterna (albifrons) sinensis (White-shafted Little Tern)*			
405.	24521	*Sterna bengalensis (Lesser Crested Tern)*		IA	
406.	24523	*Sterna caspia (Caspian Tern)*		IA	
407.	25640	*Sterna dougallii (Roseate Tern)*		IA	
408.	25642	*Sterna hirundo (Common Tern)*		IA	
409.	24529	*Sterna leucoptera (White-winged Black Tern)*		IA	
410.	24530	*Sterna nereis subsp. nereis (Fairy Tern)*		T	
411.	30949	*Sterna nilotica (Gull-billed Tern)*			
Latidae					
412.	-17064	*Psammoperca waigiensis*			
Lauraceae					
413.	12073	*Cassytha aurea var. aurea*			
Leiognathidae					
414.	-18105	*Leiognathus equulus*			
Leporidae					
415.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
Lethrinidae					
416.	-18003	*Lethrinus sp.*			
Limnodynastidae					
417.	25422	*Neobatrachus aquilonius (Northern Burrowing Frog)*			
418.	25424	*Neobatrachus fulvus (Tawny Trilling Frog)*			
419.	25430	*Notaden nichollsi (Desert Spadefoot)*			
Lutjanidae					
420.	-16719	*Lutjanus argentimaculatus*			
421.	-16802	*Lutjanus erythropterus*			
422.	-16870	*Lutjanus fulviflamma*			
423.	-15694	*Lutjanus malabaricus*			
424.	-15875	*Lutjanus russelli*			Y
Macropodidae					
425.	25489	*Macropus robustus (Euro)*			
426.	24136	*Macropus rufus (Red Kangaroo)*			
Maluridae					
427.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
428.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
Malvaceae					
429.	4895	*Abutilon lepidum*			
430.	4907	*Alyogyne pinoniana (Sand Hibiscus)*			
431.	18414	*Corchorus sidoides subsp. vermicularis*			
432.	4910	*Gossypium australe (Native Cotton)*			
433.	4913	*Gossypium hirsutum (Upland Cotton)*	Y		
434.	17782	*Hannafordia quadrivalvis subsp. recurva*			
435.	4960	*Lawrencia viridigrisea*			
436.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
437.	18149	*Sida rohlenae subsp. rohlenae*			
438.	17524	*Triumfetta echinata*		P3	
Megalopidae					
439.	-18140	*Megalops cyprinoides*			
Meliphagidae					
440.	24563	*Certhionyx niger (Black Honeyeater)*			
441.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
442.	24568	*Epthianura aurifrons (Orange Chat)*			
443.	24570	*Epthianura tricolor (Crimson Chat)*			
444.	24575	*Lichenostomus keartlandi (Grey-headed Honeyeater)*			
445.	24578	*Lichenostomus penicillatus (White-plumed Honeyeater)*			
446.	24581	*Lichenostomus virescens (Singing Honeyeater)*			

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447.	25661	*Lichmera indistincta (Brown Honeyeater)*			
448.	24582	*Lichmera indistincta subsp. indistincta*			
449.	24583	*Manorina flavigula (Yellow-throated Miner)*			
Menidae					
450.	-16936	*Mene maculata*			
Meropidae					
451.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Molluginaceae					
452.	2835	*Glinus lotoides (Hairy Carpet Weed)*			
Molossidae					
453.	24181	*Chaerephon jobensis (Northern Freetail-bat)*			
454.	24185	*Tadarida australis (White-striped Freetail-bat)*			
Monacanthidae					
455.	-18346	*Colurodontis paxmani*			
Motacillidae					
456.	25670	*Anthus australis (Australian Pipit)*			
Mugilidae					
457.	-18597	*Liza melinoptera*			
458.	-16090	*Liza sp.*			
459.	-18034	*Liza subviridis*			
460.	-16384	*Liza vaigiensis*			
461.	-15523	*Mugil cephalus*			
Muraenesocidae					
462.	-16804	*Muraenesox cinereus*			
Muraenidae					
463.	-15571	*Gymnothorax undulatus*			
Muridae					
464.	24217	*Leggadina lakedownensis (Short-tailed Mouse, Lakeland Downs Mouse, Kerakenga)*		P4	
465.	24223	*Mus musculus (House Mouse)*	Y		
466.	24224	*Notomys alexis (Spinifex Hopping-mouse)*			
467.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse, Ngadji)*		P4	
468.	24235	*Pseudomys desertor (Desert Mouse)*			
469.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
Myrtaceae					
470.	17084	*Corymbia zygophylla*			
471.	14548	*Eucalyptus victrix*			
472.	15592	*Eucalyptus xerothermica*			
473.	6081	*Verticordia forrestii (Forrest's Featherflower)*			
Nemipteridae					
474.	-16512	*Pentapodus vitta*			
Onagraceae					
475.	16347	*Oenothera laciniata*	Y		
Ophichthidae					
476.	-17192	*Ophichthus cephalozona*			
477.	-16951	*Pisodonophis cancrivorus*			
Orobanchaceae					
478.	7047	*Buchnera linearis (Blackrod)*			
Ostraciidae					
479.	-15518	*Lactoria cornuta*			
480.	-18328	*Lactoria diaphana*			
Otididae					
481.	24610	*Ardeotis australis (Australian Bustard)*		P4	
Pachycephalidae					
482.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
483.	24618	*Oreoica gutturalis (Crested Bellbird)*			
484.	24620	*Pachycephala lanioides (White-breasted Whistler)*			
Paralichthyidae					
485.	-15878	*Pseudorhombus argus*			
486.	-17920	*Pseudorhombus arsius*			
Pardalotidae					

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487.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
Pegasidae					
488.	-18229	*Eurypegasus draconis*			
Pelecanidae					
489.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
Peramelidae					
490.	25504	*Perameles bougainville (Western Barred Bandicoot, Marl)*		T	
Phalacrocoracidae					
491.	25697	*Phalacrocorax carbo (Great Cormorant)*			
492.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
493.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
494.	25699	*Phalacrocorax varius (Pied Cormorant)*			
Phasianidae					
495.	24671	*Coturnix pectoralis (Stubble Quail)*			
496.	25701	*Coturnix ypsilophora (Brown Quail)*			
Phrymaceae					
497.	7082	*Mimulus gracilis*			
Phyllanthaceae					
498.	4711	*Sauropus trachyspermus*			
Plantaginaceae					
499.	7098	*Stemodia grossa (Marsh Stemodia)*			
500.	17295	*Stemodia sp. Onslow (A.A. Mitchell 76/148)*			
Platycephalidae					
501.	-17607	*Cymbacephalus staigeri?*			
502.	-18717	*Platycephalus indicus*			
503.	-15408	*Platycephalus sp.*			
Plotosidae					
504.	-16442	*Paraplotosus albilabris*			
505.	-16865	*Plotosus lineatus*			
Plumbaginaceae					
506.	6490	*Muellerolimon salicorniaceum*			
Poaceae					
507.	12063	*Aristida holathera var. holathera*			
508.	233	*Avena barbata (Bearded Oat)*	Y		
509.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
510.	273	*Chrysopogon fallax (Golden Beard Grass)*			
511.	311	*Digitaria ciliaris (Summer Grass)*	Y		
512.	340	*Echinopogon ovatus (Hedgehog Grass)*			
513.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
514.	381	*Eragrostis falcata (Sickle Lovegrass)*			
515.	403	*Eriachne benthamii (Swamp Wanderrie)*			
516.	408	*Eriachne flaccida (Claypan Grass)*			
517.	409	*Eriachne gardneri*			
518.	11011	*Eulalia aurea*			
519.	459	*Iseilema eremaeum*			
520.	503	*Panicum decompositum (Native Millet)*			
521.	11232	*Paractaenum novae-hollandiae subsp. novae-hollandiae*			
522.	514	*Paractaenum refractum*			
523.	619	*Sorghum plumosum (Plume Canegrass)*			
524.	625	*Spinifex longifolius (Beach Spinifex)*			
525.	635	*Sporobolus virginicus (Marine Couch)*			
526.	13131	*Triodia epactia*			
527.	689	*Triodia lanigera*			
528.	706	*Triraphis mollis (Needle Grass)*			
529.	11321	*Urochloa holosericea subsp. velutina*			
530.	728	*Whiteochloa cymbiformis*			
Podicipedidae					
531.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
Polygalaceae					
532.	4572	*Polygala isingii*			
Polynemidae					
533.	-15553	*Polydactylus multiradiatus*			
534.	-17086	*Polydactylus plebius*			

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Pomacanthidae					
535.	-15657	*Chaetodontoplus duboulayi*			
Pomacentridae					
536.	-16575	*Abudefduf bengalensis*			
537.	-18891	*Neopomacentrus filamentosus*			
Pomatomidae					
538.	-15685	*Pomatomus saltatrix*			
Pomatostomidae					
539.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
540.	24684	*Pomatostomus temporalis subsp. rubeculus*			
Portulacaceae					
541.	2860	*Calandrinia polyandra (Parakeelya)*			
Primulaceae					
542.	14027	*Samolus sp. Millstream (M.I.H. Brooker 2076)*			
Proteaceae					
543.	2001	*Grevillea eriostachya (Flame Grevillea)*			
544.	19570	*Grevillea pyramidalis subsp. leucadendron*			
545.	2096	*Grevillea stenobotrya*			
546.	19137	*Hakea lorea subsp. lorea*			
547.	16897	*Hakea stenophylla subsp. stenophylla*			
Psettodidae					
548.	-16672	*Psettodes erumei*			
Pseudochromidae					
549.	-18582	*Assiculus punctatus*			
550.	-15698	*Blennodesmus scapularis*			
Psittacidae					
551.	25715	*Cacatua roseicapilla (Galah)*			
552.	25716	*Cacatua sanguinea (Little Corella)*			
553.	24736	*Melopsittacus undulatus (Budgerigar)*			
554.	24742	*Nymphicus hollandicus (Cockatiel)*			
555.	24743	*Pezoporus occidentalis (Night Parrot)*		T	
556.	25721	*Platycercus zonarius (Australian Ringneck)*			
Pteropodidae					
557.	24173	*Pteropus scapulatus (Little Red Flying-fox)*			
Pygopodidae					
558.	25000	*Delma haroldi*			
559.	25001	*Delma nasuta*			
560.	25004	*Delma tincta*			
561.	25005	*Lialis burtonis*			
562.	25009	*Pygopus nigriceps*			
Rachycentridae					
563.	-18258	*Rachycentron canadus*			
Rallidae					
564.	24769	*Porzana fluminea (Australian Spotted Crake)*			
Recurvirostridae					
565.	25734	*Himantopus himantopus (Black-winged Stilt)*			
566.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
Rhamnaceae					
567.	4847	*Ziziphus mauritiana (Zornia)*	Y		
Rhizophyllidaceae					
568.	27186	*Portieria hornemannii*			
Rhodomelaceae					
569.	26441	*Acanthophora spicifera*			
570.	35868	*Acrocystis nana*			
571.	26628	*Chondria armata*			
572.	26782	*Digenea simplex*			
573.	26998	*Laurencia brongniartii*			
574.	38021	*Palisada concreta*			Y
575.	27335	*Tolypiocladia calodictyon*			
Rhodymeniaceae					
576.	26686	*Coelarthrum opuntia*			

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577.	26845	*Gelidiopsis intricata*			
Sapindaceae					
578.	4745	*Diplopeltis eriocarpa (Hairy Pepperflower)*			
Sargassaceae					
579.	35873	*Sargassum myriocystum*			
580.	27345	*Turbinaria gracilis*			
Scatophagidae					
581.	-17137	*Selenotoca multifasciata*			
Sciaenidae					
582.	-16967	*Austronibea oedegenys?*			Y
Scincidae					
583.	25032	*Ctenotus calurus*			
584.	25462	*Ctenotus grandis*			
585.	25043	*Ctenotus grandis subsp. titan*			
586.	25044	*Ctenotus hanloni*			
587.	25046	*Ctenotus iapetus*			
588.	25053	*Ctenotus maryani*			
589.	25463	*Ctenotus pantherinus (Leopard Ctenotus)*			
590.	25064	*Ctenotus pantherinus subsp. ocellifer*			
591.	25066	*Ctenotus quattuordecimlineatus*			
592.	25069	*Ctenotus rufescens*			
593.	25073	*Ctenotus saxatilis (Rock Ctenotus)*			
594.	25074	*Ctenotus schomburgkii*			
595.	25108	*Eremiascincus fasciolatus (Narrow-banded Sand Swimmer)*			
596.	25124	*Lerista baynesi*			
597.	25125	*Lerista bipes*			
598.	30928	*Lerista clara*			
599.	25133	*Lerista elegans*			
600.	25158	*Lerista onsloviana*			
601.	25164	*Lerista planiventralis subsp. maryani (Keeled Slider (NW coast Onslow to Barradale), skink)*		P1	
602.	25184	*Menetia greyii*			
603.	25194	*Morethia ruficauda subsp. ruficauda*			
604.	25202	*Tiliqua multifasciata (Central Blue-tongue)*			
Scolopacidae					
605.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
606.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
607.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
608.	24780	*Calidris alba (Sanderling)*		IA	
609.	24783	*Calidris canutus subsp. rogersi (Red Knot)*		IA	
610.	24784	*Calidris ferruginea (Curlew Sandpiper)*		IA	
611.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
612.	24790	*Calidris tenuirostris (Great Knot)*		IA	
613.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
614.	24796	*Limosa lapponica subsp. menzbieri (Bar-tailed Godwit)*		IA	
615.	24798	*Numenius madagascariensis (Eastern Curlew)*		P4	
616.	24799	*Numenius minutus (Little Curlew)*		IA	
617.	25742	*Numenius phaeopus (Whimbrel)*		IA	
618.	24803	*Tringa brevipes (Grey-tailed Tattler)*		IA	
619.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
620.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Scombridae					
621.	-18750	*Scomberomorus commerson*			
622.	-16884	*Scomberomorus queenslandicus*			
623.	-17349	*Scomberomorus semifasciatus*			
Scorpaenidae					
624.	-18106	*Apistus carinatus*			
625.	-18163	*Inimicus sinensis*			
626.	-18380	*Pterois antennata*			
627.	-17952	*Pterois volitans*			
Scrophulariaceae					
628.	17177	*Eremophila forrestii subsp. viridis*		P3	
629.	16696	*Eremophila fraseri subsp. fraseri*			
630.	17158	*Myoporum montanum (Native Myrtle)*			
Scyliorhinidae					

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631.	-16528	*Atelomycterus fasciatus*			
Serranidae					
632.	-16810	*Epinephelus amblycephalus*			
633.	-18478	*Epinephelus corallicola*			
634.	-18479	*Epinephelus lanceolatus*			
635.	-18481	*Epinephelus malabaricus*			
636.	-16976	*Epinephelus multinotatus*			
637.	-18347	*Epinephelus quoyanus*			
638.	-17712	*Epinephelus rankini (invalid)*			Y
639.	-15667	*Epinephelus rivulatus*			
640.	-16696	*Epinephelus sexfasciatus*			
641.	-15865	*Epinephelus sp.*			
642.	-15692	*Epinephelus tauvina*			
Siganidae					
643.	-16443	*Siganus fuscescens*			
Sillaginidae					
644.	-18090	*Sillago analis*			
645.	-15472	*Sillago burrus*			
646.	-17063	*Sillago ingenuua?*			Y
647.	-15359	*Sillago lutea*			
648.	-18715	*Sillago sihama*			
Siphonocladaceae					
649.	26507	*Boergesenia forbesii*			
650.	26508	*Boodlea composita*			
651.	26771	*Dictyosphaeria versluysii*			
652.	27359	*Ventricaria ventricosa*			
Solanaceae					
653.	11856	*Nicotiana occidentalis subsp. occidentalis*			
654.	7018	*Solanum lasiophyllum (Flannel Bush)*			
Sparassidae					
655.	-14741	*Holconia westralia*			
Sparidae					
656.	-18445	*Acanthopagrus latus*			
657.	-15879	*Acanthopagrus palmaris*			
Sphacelariaceae					
658.	27293	*Sphacelaria rigidula*			
Sphyraenidae					
659.	-17134	*Sphyraena barracuda*			
Strigidae					
660.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
Surianaceae					
661.	3182	*Stylobasium spathulatum (Pebble Bush)*			
Sylviidae					
662.	24833	*Cincloramphus cruralis (Brown Songlark)*			
663.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
Synanceiidae					
664.	-15700	*Synanceia horrida*			
Syngnathidae					
665.	-16960	*Hippocampus sp.*			
666.	-16601	*Hippocampus tuberculatus*			
Tachyglossidae					
667.	24207	*Tachyglossus aculeatus (Echidna)*			
Terapontidae					
668.	-16609	*Amniataba caudavittata*			
669.	-16560	*Amniataba percoides*			
670.	-15877	*Amniataba percoides?*			Y
671.	-18109	*Pelates octolineatus*			
672.	-15900	*Terapon jarbua*			
673.	-18503	*Terapon puta*			
674.	-18710	*Terapon thaeraps*			Y
675.	-16642	*Terapon theraps*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Tetraodontidae					
676.	-18697	*Arothron manilensis*			
677.	-16691	*Canthigaster coronata*			
678.	-15483	*Chelonodon patoca*			
679.	-18604	*Feroxodon multistriatus*			
680.	-17502	*Leiognathus decorus*			
Threskiornithidae					
681.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
Thymelaeaceae					
682.	5230	*Pimelea ammocharis*			
Triacanthidae					
683.	-18605	*Triacanthus biaculeatus*			
Turnicidae					
684.	24851	*Turnix velox (Little Button-quail)*			
Typhlopidae					
685.	25270	*Ramphotyphlops ammodytes*			
686.	25277	*Ramphotyphlops grypus*			
687.	25279	*Ramphotyphlops hamatus*			
688.	25315	*Ramphotyphlops pilbarensis*			
Tytonidae					
689.	25762	*Tyto alba (Barn Owl)*			
Udoteaceae					
690.	27348	*Udotea argentea*			
Urodacidae					
691.	-14413	*Urodacus varians*			
Valoniaceae					
692.	27357	*Valoniopsis pachynema*			
Varanidae					
693.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
694.	25210	*Varanus brevicauda (Short-tailed Pygmy Monitor)*			
695.	25211	*Varanus caudolineatus*			
696.	25212	*Varanus eremius (Pygmy Desert Monitor)*			
697.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
698.	25524	*Varanus panoptes (Yellow-spotted Monitor)*			
699.	25223	*Varanus panoptes subsp. rubidus*			
700.	25526	*Varanus tristis (Racehorse Monitor)*			
Zosteropidae					
701.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			
702.	24857	*Zosterops luteus (Yellow White-eye)*			
Zygophyllaceae					
703.	4377	*Tribulus hirsutus*			
704.	4378	*Tribulus hystrix*			
705.	4380	*Tribulus occidentalis (Perennial Caltrop)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 4

Vegetation Structural Classification and Condition Ranking Scale

Vegetation Structural Classes*

Stratum	Canopy Cover (%)				
	70-100%	30-70%	10-30%	2-10%	<2%
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / bunch grassland / sedgeland / herbland	Tussock grassland / bunch grassland / sedgeland / herbland	Open tussock grassland / bunch grassland / sedgeland / herbland	Very open tussock grassland / bunch grassland / sedgeland / herbland	Scattered tussock grasses / bunch grasses / sedges / herbs

* Based on Muir (1977), and Aplin's (1979) modification of the vegetation classification system of Specht (1970): Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). *Environment and Science*. University of Western Australia Press; Muir B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve. *Records of the Western Australian Museum*, Suppl. No. 3; Specht R.L. (1970). Vegetation. In: *The Australian Environment*. 4th edn (Ed. G.W. Leeper). Melbourne.

Vegetation Condition Scale Used in this Report*

E = Excellent (=Pristine of BushForever) Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
VG = Very Good (= Excellent of BushForever) Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as **Ursinia anthemoides* or **Briza* spp., or occasional vehicle tracks.
G = Good (= Very Good of BushForever) More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as **Ehrharta* spp.
P = Poor (= Good of BushForever) Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as **Ehrharta* spp.
VP = Very Poor (= Degraded of BushForever) Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.
D = Completely Degraded (= Completely Degraded of BushForever) Areas that are completely or almost completely without native species in the structure of their vegetation; ie. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

* Based on Trudgen M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

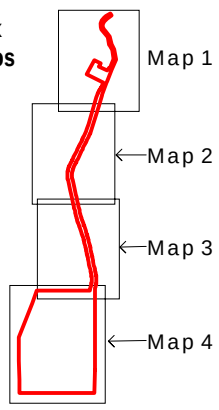
Appendix 5

Vegetation Mapping of the Micro-Siting Survey Area

303,000 mE
304,000 mE
305,000 mE
7,606,000 mN
7,605,000 mN
7,604,000 mN
7,603,000 mN
CD1
OS08
CD1
C3
T1
CD2
Disturbed
OS26
CD2
ID3
ID3
OS21
ID3
Disturbed
OS23
ID3
ID3
CD2
OS18
ID3
ID3
OSR05
CS3
C3
Inundated
T1
C3
CS3

Location Map

Index to Maps



- MS Survey Area boundary
- Quadrat location (Biota, 2010a)
- Quadrat location (Astron, 2009)
- Quadrat location (ENV, 2011)
- Relevé location (ENV, 2011)
- Quadrat location (Validus, 2008)
- Relevé location (Validus, 2008)
- Claypan sampling location (Biota, 2010b)
- Fauna trapping location (Biota, 2010d)

N

0 250 500
metres

Onslow Vegetation Mapping Map 1

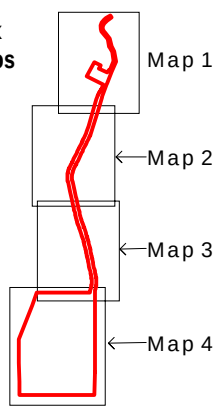
Biota Environmental Sciences

Author: J Fairhead	Drawn: M Robinson	Dwg No.: 845	Date: 31 Jan 2013	Revised: 05 Mar 2013	Projection: MGA Z50 (GDA94)	Scale: 1:12,500

Onslow Vegetation Mapping Map 2

Location Map

Index to Maps



- MS Survey Area boundary
- Quadrat location (Biota, 2010a)
- Quadrat location (Astron, 2009)
- Quadrat location (ENV, 2011)
- Relevé location (ENV, 2011)
- Quadrat location (Validus, 2008)
- Relevé location (Validus, 2008)
- Claypan sampling location (Biota, 2010b)
- Fauna trapping location (Biota, 2010d)

N

0 250 500
metres

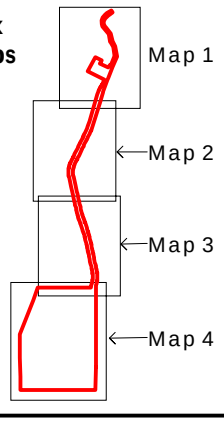
Biota Environmental Sciences

Author: J Fairhead | Drawn: M Robinson | Dwg No.: 845 | Date: 31 Jan 2013 | Revised: 05 Mar 2013 | Projection: MGA Z50 (GDA94) | Scale: 1:12,500

Onslow Vegetation Mapping Map 3

Location Map

Index to Maps



- MS Survey Area boundary
- Quadrat location (Biota, 2010a)
- Quadrat location (Astron, 2009)
- Quadrat location (ENV, 2011)
- Relevé location (ENV, 2011)
- Quadrat location (Validus, 2008)
- Relevé location (Validus, 2008)
- Claypan sampling location (Biota, 2010b)
- Fauna trapping location (Biota, 2010d)

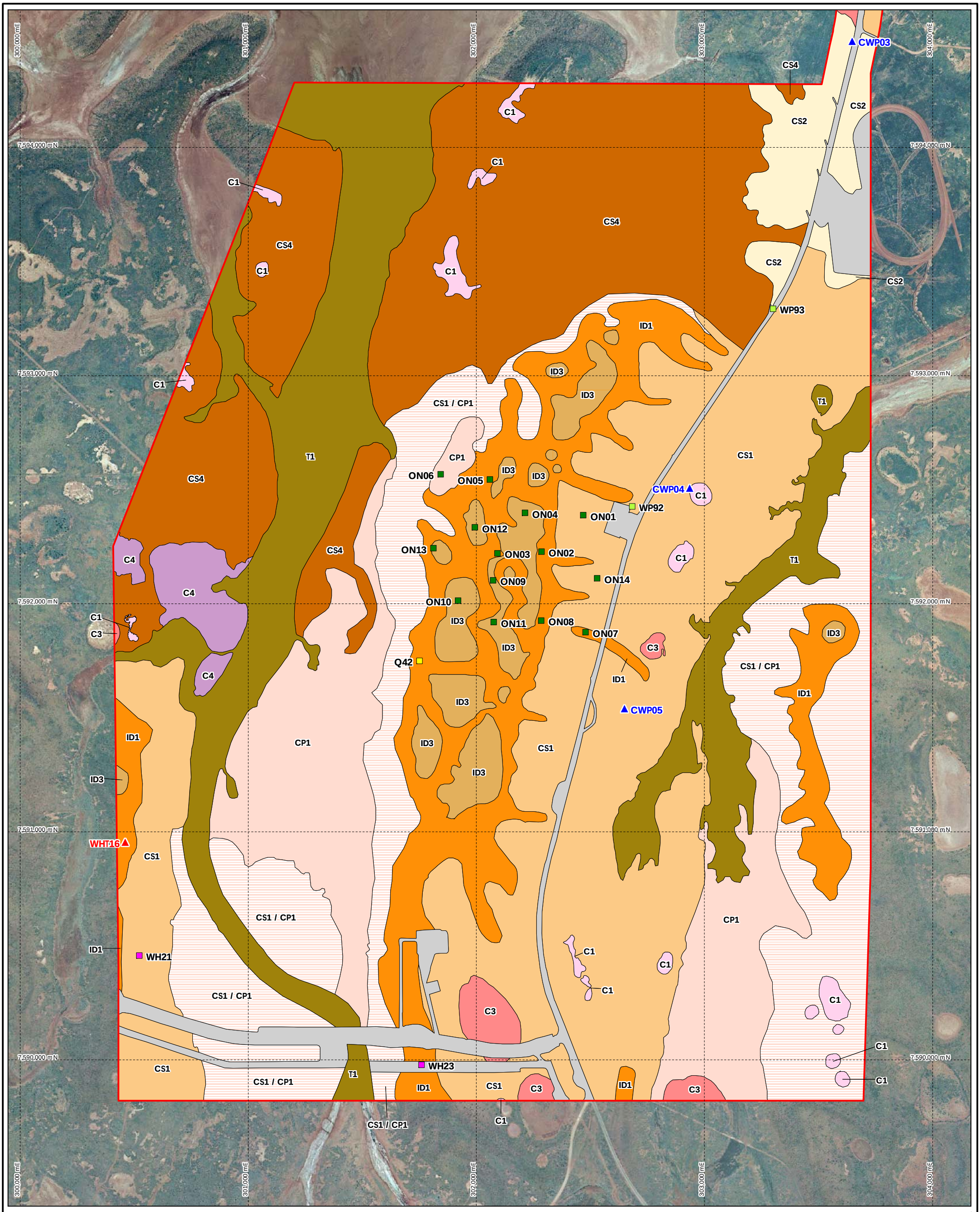
N

0 250 500
metres

Biota Environmental Sciences

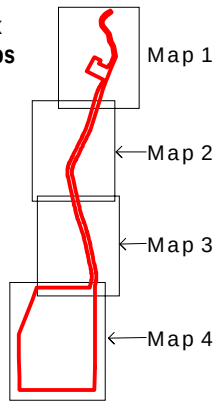
Author: J Fairhead | Drawn: M Robinson | Dwg No.: 845 | Date: 31 Jan 2013 | Revised: 05 Mar 2013 | Projection: MGA Z50 (GDA94) | Scale: 1:12,500

Onslow Vegetation Mapping Map 4



Location Map

Index to Maps



- MS Survey Area boundary
- Quadrat location (Biota, 2010a)
- Quadrat location (Astron, 2009)
- Quadrat location (ENV, 2011)
- Releve location (ENV, 2011)
- Quadrat location (Validus, 2008)
- Releve location (Validus, 2008)
- Claypan sampling location (Biota, 2010b)
- Fauna trapping location (Biota, 2010d)

N

0 250 500
metres

Biota Environmental Sciences

Author: J Fairhead | Drawn: M Robinson | Dwg No.: 845 | Date: 31 Jan 2013 | Revised: 05 Mar 2013 | Projection: MGA Z50 (GDA94) | Scale: 1:15,000

Vegetation of Onslow MS Survey Area

Vegetation of Tidal Mudflats

T1 — *Tecticornia* spp. scattered low shrubs

Vegetation of Coastal Sand Dunes

CD1 — *Acacia coriacea* subsp. *coriacea, Crotalaria cunninghamii* tall shrubland over *Spinifex longifolius,* (**Cenchrus ciliaris*) open tussock grassland

CD2 — *Acacia coriacea* subsp. *coriacea* tall shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* open tussock grassland

Vegetation of Inland Sand Dunes

ID1 — *Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland

ID1 / ID2 — Mosaic of ID1 and *Grevillea stenobotrya* tall open shrubland over *Crotalaria cunninghamii, Hibiscus brachychlaenus* open shrubland over *Triodia schinzii*, (*T. epactia*) open hummock grassland

ID3 — *Acacia stellaticeps* shrubland over *Triodia epactia* hummock grassland

Vegetation of Coastal Sand Plains

CS1 — *Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland

CS2 — *Acacia tetragonophylla* scattered shrubs over *Triodia epactia* hummock grassland with **Cenchrus ciliaris* open tussock grassland

CS3 — *Acacia tetragonophylla* scattered shrubs over *Scaevola pulchella, Indigofera monophylla* low open shrubland over *Triodia epactia* hummock grassland

CS4 — **Prosopis pallida, Acacia tetragonophylla, A. synchronicia* scattered tall shrubs over *Triodia epactia* very open hummock grassland and **Cenchrus ciliaris* open tussock grassland

CS1 / CP1 — Mosaic of CS1 and CP1

Vegetation of Onslow MS Survey Area

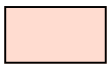
Vegetation of Claypans

C1 Bare claypan

C3 *Tecticornia* spp. low shrubland

C4 **Prosopis pallida, Atriplex bunburyana* open shrubland over *Triodia epactia* open hummock grassland and **Cenchrus ciliaris* open tussock grassland

Vegetation of Clayey Plains



CP1 *Sporobolus mitchellii, Eriachne* aff. *benthamii, E. benthamii, Eulalia aurea* tussock grassland

CP6 *Lawrencia viridigrisea* low open shrubland over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* open tussock grassland

Disturbed Area cleared or disturbed

Inundated Area inundated

Appendix 6

Species Listing for the Micro-Siting Survey Area

Comparison of *Cassia* vs. *Senna* nomenclature:

Cassia glutinosa	=	*Senna glutinosa* subsp. *glutinosa*
Cassia luerssenii	=	*Senna glutinosa* subsp. x *luerssenii*
Cassia notabilis	=	*Senna notabilis*
Cassia oligophylla	=	*Senna artemisioides* subsp. *oligophylla*
Cassia 'stricta'	=	*Senna stricta*

Family: Aizoaceae

Trianthema pilosa

Trianthema triquetra

Trianthema turgidifolia

Family: Amaranthaceae

**Aerva javanica*

Amaranthus undulatus

Ptilotus astrolasius

Ptilotus axillaris

Ptilotus macrocephalus

Ptilotus nobilis subsp. *nobilis*

Ptilotus polystachyus

Family: Araliaceae

Trachymene pilbarensis

Family: Asteraceae

Angianthus acrohyalinus

Brachyscome cheilocarpa

Calotis plumulifera

Centipeda minima subsp. *macrocephala*

**Flaveria trinervia*

Olearia dampieri subsp. *dampieri*

Pluchea dentex

Pluchea dunlopii

Pluchea rubelliflora

Pluchea sp. B Kimberley Flora (K.F. Kenneally 9526A)

Pterocaulon sphaeranthoides

Rhodanthe humboldtiana

Rhodanthe stricta

Streptoglossa bubakii

Streptoglossa decurrens

Streptoglossa liatroides

Streptoglossa macrocephala

Family: Boraginaceae

Heliotropium crispatum

Heliotropium cunninghamii

Heliotropium pachyphyllum

Trichodesma zeylanicum var. *grandiflorum*

Trichodesma zeylanicum var. *zeylanicum*

Family: Campanulaceae

Wahlenbergia tumidifructa

Family: Caryophyllaceae

Polycarpaea corymbosa var. *corymbosa*

Family: Chenopodiaceae

Atriplex bunburyana

Atriplex codonocarpa

Atriplex semilunaris

Dissocarpus paradoxus

Enchylaena tomentosa var. *tomentosa*

Maireana lanosa

Maireana lobiflora

Neobassia astrocarpa

Rhagodia eremaea

Rhagodia preissii subsp. *obovata*

Salsola australis

Sclerolaena uniflora

Tecticornia auriculata

Tecticornia halocnemoides (subsp. not determined)

Tecticornia halocnemoides subsp. *tenuis*

Tecticornia indica (subsp. not determined)

Tecticornia indica subsp. *leiostachya*

Tecticornia sp.

Threlkeldia diffusa

Family: Convolvulaceae

Bonamia alatisemina

Bonamia erecta

Bonamia linearis

Bonamia rosea

Evolvulus alsinoides (var. not determined)

Evolvulus alsinoides var. *decumbens*

Evolvulus alsinoides var. *villosicalyx*

Ipomoea muelleri

Ipomoea polymorpha

Family: Cucurbitaceae

Cucumis variabilis

Family: Cyperaceae

Bulbostylis barbata

Cyperus bulbosus

Cyperus rigidellus

Cyperus squarrosus

Fimbristylis dichotoma

Family: Elatinaceae

Bergia perennis

Bergia trimera

Family: Euphorbiaceae

Adriana tomentosa var. *tomentosa*
Euphorbia alsiniflora
Euphorbia boophthona
Euphorbia myrtoides
Euphorbia tannensis subsp. *eremophila*

Family: Fabaceae

Acacia bivenosa
Acacia colei var. *colei*
Acacia coriacea subsp. *coriacea*
Acacia gregorii
Acacia sclerosperma
Acacia sericophylla
Acacia stellaticeps
Acacia synchronicia
Acacia tetragonophylla
Acacia trachycarpa
Acacia trudgeniana
Aenictophyton aff. *reconditum* subsp. Onslow
Cassia glutinosa
Cassia glutinosa x *'stricta'*
Cassia luerssenii
Cassia notabilis
Cassia oligophylla
Cassia oligophylla (thinly sericeous MET 15,035)
Crotalaria cunninghamii subsp. *sturtii*
Crotalaria medicaginea var. *neglecta*
Cullen cinereum
Cullen lachnostachys
Cullen martinii
Cullen pogonocarpum
Desmodium filiforme
Indigofera boviperda subsp. *boviperda*
Indigofera colutea
Indigofera georgei
Indigofera linifolia
Indigofera linnaei
Indigofera monophylla
Indigofera trita
Isotropis atropurpurea
Lotus cruentus
**Prosopis glandulosa*
Rhynchosia minima
Sesbania cannabina
Swainsona kingii

Swainsona pterostylis
Tephrosia aff. *clementii*
Tephrosia rosea (var. not determined)
Tephrosia rosea var. *clementii*
Tephrosia aff. *supina*
Tephrosia sp. Carnarvon (J.H. Ross 2681)
**Vachellia farnesiana*

Family: Frankeniaceae
Frankenia ambita

Family: Gentianaceae
Schenkia australis

Family: Goodeniaceae
Goodenia forrestii
Goodenia lamprosperma
Goodenia microptera
Scaevola crassifolia
Scaevola pulchella
Scaevola sericophylla
Scaevola spinescens

Family: Gyrostemonaceae
Gyrostemon ramulosus

Family: Haloragaceae
Haloragis gossei

Family: Hemerocallidaceae
Corynotheca pungens
Tricoryne corynothecoides

Family: Lamiaceae
Quoya loxocarpa
Quoya paniculata

Family: Lauraceae
Cassytha capillaris
Cassytha racemosa

Family: Malvaceae
Abutilon cunninghamii
Abutilon dioicum
Abutilon aff. *dioicum*
Abutilon lepidum
Alyogyne pinoniana
Corchorus sidoides subsp. *vermicularis*
Corchorus tectus
Gossypium australe
Hannafordia quadrivalvis subsp. *recurva*
Hibiscus brachychlaenus
Hibiscus sturtii (var. not determined)
Hibiscus sturtii var. aff. *platychlamys*

Lawrencia viridigrisea
Melhania oblongifolia
Sida clementii
Sida aff. *fibulifera*
Sida rohlenae subsp. *rohlenae*
Triumfetta echinata

Family: Marsileaceae

Marsilea hirsuta

Family: Myrtaceae

Corymbia deserticola subsp. *deserticola*
Eucalyptus victrix

Family: Phrymaceae

Mimulus gracilis

Family: Poaceae

Aristida holathera var. *holathera*
**Cenchrus ciliaris*
**Cenchrus setiger*
Chloris pectinata
Chloris pumilio
Dactyloctenium radulans
Dichanthium sericeum subsp. *humilius*
Eragrostis cumingii
Eragrostis dielsii
Eragrostis eriopoda
Eragrostis falcata
Eragrostis leptocarpa
Eragrostis pergracilis
Eriachne aristidea
Eriachne benthamii
Eriachne flaccida
Eriachne mucronata
Eriachne obtusa
Eulalia aurea
Iseilema dolichotrichum
Leptochloa fusca subsp. *muelleri*
Panicum decompositum
Paractaenum refractum
Paraneurachne muelleri
Paspalidium tabulatum
Sorghum plumosum
Spinifex longifolius
Sporobolus mitchellii
Sporobolus virginicus
Triodia epactia
Triodia schinzii

Triraphis mollis
Urochloa holosericea subsp. *velutina*
Whiteochloa airoides
Yakirra australiensis var. *australiensis*

Family: Polygalaceae

Polygala aff. *isingii*

Family: Portulacaceae

Calandrinia ptychosperma

Family: Proteaceae

Grevillea eriostachya
Grevillea stenobotrya
Hakea lorea subsp. *lorea*
Hakea stenophylla subsp. *stenophylla*

Family: Santalaceae

Santalum lanceolatum

Family: Sapindaceae

Diplopeltis eriocarpa

Family: Scrophulariaceae

Eremophila forrestii subsp. *forrestii*
Eremophila forrestii subsp. *viridis*

Family: Solanaceae

Nicotiana occidentalis subsp. *occidentalis*
Solanum lasiophyllum

Family: Surianaceae

Stylobasium spathulatum

Family: Thymelaeaceae

Pimelea ammocharis

Family: Zygophyllaceae

Tribulus hirsutus
Tribulus hystrix
Tribulus occidentalis
**Tribulus terrestris*

Appendix 7

Raw Data from Quadrats and Relevés Sampled in the Micro-Siting Survey Area

Data collected by Validus (2008)

Chevron Domgas Project Onslow (Validus 2008) **Site** ON01
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302468 **mE** 7592388 **mN**
Habitat Lower slopes.
Soil Aeolian red sand (50 mm) over compacted layer.
Vegetation *Acacia colei* var. *colei* scattered shrubs over *Hakea stenophylla* subsp. *stenophylla, Grevillea eriostachya*, *Grevillea stenobotrya* and *Diplopeltis eriocarpa* low shrubland over *Triodia schinzii* and *Triodia epactia* hummock grassland over *Bonamia rosea* very open herbland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen	Notes
Acacia colei var. *colei*	1	150 -200	ON01.04	<2%
Acacia stellaticeps	0.1	<100	ON01.08	
Acacia tetragonophylla	0.1	150	ON01.14	
Alyogyne pinoniana	0.1	<50	ON01.02	
Bonamia erecta	0.1	<10	ON01.13	
Bonamia linearis	0.1	<20	ON01.09	
Bonamia rosea	0.1	<10	ON01.06	
Bonamia rosea	2	<50	ON01.06	
Cassytha capillaris	0.1	CL	ON01.10	
Diplopeltis eriocarpa	3	<50	ON01.01	
Eremophila forrestii subsp. *forrestii*	0.1	<100	ON01.12	
Grevillea eriostachya	4	<100	ON01.15	
Grevillea stenobotrya	3	<100	NC	
Hakea stenophylla subsp. *stenophylla*	8	<100	ON01.03	
Scaevola sericophylla	0.1	<100	ON01.05	
Triodia epactia	10	<100	ON01.11	
Triodia schinzii	40	<100	ON01.07	

Chevron Domgas Project Onslow (Validus 2008) **Site** ON02
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302286 **mE** 7592228 **mN**
Habitat Dune crest.
Soil Deep red sand.
Vegetation *Adriana tomentosa* var. *tomentosa* and *Grevillea stenobotrya* shrubland over *Bonamia rosea, Trichodesma zeylanicum*, *Scaevola sericophylla* and *Triumfetta echinata* low open shrubland over *Triodia schinzii* and *Triodia epactia* open hummock grassland over *Aristida holathera* var. *holathera, Eriachne benthamii* and *Paractaenum refractum* very open tussock grassland over *Tribulus occidentalis, Tephrosia* sp. Carnarvon (J.H. Ross 2681), *Trianthema pilosa* and *Hibiscus brachychlaenus* very open herbland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Adriana tomentosa var. *tomentosa*	10	150	ON02.08
Alyogyne pinoniana	0.1	<50	ON01.02
Aristida holathera var. *holathera*	3	<50	ON02.07
Bonamia linearis	0.1	<20	ON01.09
Bonamia rosea	6	<50	ON01.06
Bulbostylis barbata	0.1	<10	ON02.08B
Crotalaria cunninghamii subsp. *sturtii*	0.1	<30	ON02.02
Eriachne benthamii	1	<50	ON02.09
Euphorbia alsiniflora	0.1	<20	ON02.05
Grevillea stenobotrya	8	100-500	NC
Hakea stenophylla subsp. *stenophylla*	0.1	100-500	ON01.03
Heliotropium cunninghamii	0.1	<50	ON02.06
Hibiscus brachychlaenus	1	<100	ON02.16
Indigofera georgei	0.1	<50	ON02.15
Paractaenum refractum	1	<50	ON02.13
Ptilotus astrolasius	0.1	<50	ON02.01
Scaevola sericophylla	1	<100	ON02.12
Tephrosia sp. Carnarvon (J.H. Ross 2681)	1	<50	ON02.04
Trianthema pilosa	1	<10	ON02.03
Tribulus occidentalis	5	<10	ON02.10
Trichodesma zeylanicum var. *grandiflorum*	3	<100	ON02.11
Triodia epactia	5	<100	ON01.11
Triodia schinzii	10	<100	ON01.07
Triumfetta echinata	1	<50	ON03.02
Yakirra australiensis var. *australiensis*	0.1	<20	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON03
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302092 **mE** 7592221 **mN**
Habitat Dune crest.
Soil Red sand.
Vegetation *Grevillea stenobotrya* shrubland over *Trichodesma zeylanicum*, *Crotalaria cunninghamii* and *Adriana tomentosa* var. *tomentosa* low open shrubland over *Triodia epactia* and *Triodia schinzii* open hummock grassland over *Aristida holathera* var. *holathera* and **Cenchrus ciliaris* open tussock grassland over *Trianthema pilosa* very open herbland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	0.1	100-200	ON03.05
Adriana tomentosa var. *tomentosa*	1	<20	ON02.08
Adriana tomentosa var. *tomentosa*	0.1	150	ON02.08
Aenictophyton aff. *reconditum* subsp. *Onslow*	0.1	<50	ON03.08
Aristida holathera var. *holathera*	20	<50	ON02.07
Bonamia linearis	0.1	<50	ON01.09
Bonamia rosea	0.1	<50	ON01.06
Cassia luerssenii	0.1	150-200	ON03.09
Cenchrus ciliaris	2	<50	ON15.03
Crotalaria cunninghamii subsp. *sturtii*	1	<100	ON02.02
Euphorbia alsiniflora	0.1	<50	ON02.05
Grevillea stenobotrya	15	100-200	NC
Gyrostemon ramulosus	0.1	150	ON03.04
Hibiscus brachychlaenus	0.1	<150	ON02.16
Indigofera colutea	0.1	<30	ON03.10
Olearia dampieri subsp. *dampieri*	0.1	<100	ON03.06
Paractaenum refractum	0.1	<50	ON02.13
Scaevola spinescens	0.1	<100	ON10.01
Sida rohlenae subsp. *rohlenae*	0.1	150	ON03.03
Solanum lasiophyllum	0.1	<100	ON03.07
Tephrosia sp. Carnarvon (J.H. Ross 2681)	0.1	<100	ON02.04
Trianthema pilosa	2	<50	ON02.03
Tribulus occidentalis	5	<50	ON02.10
Trichodesma zeylanicum var. *grandiflorum*	3	<100	ON02.11
Triodia epactia	10	<100	ON01.11
Triodia schinzii	5	<100	ON01.07
Triraphis mollis	0.1	<50	ON03.01
Triumfetta echinata	0.1	<50	ON03.02
Triumfetta echinata	0.1	<20	ON03.02
Yakirra australiensis var. *australiensis*	0.1	<20	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON04
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302213 **mE** 7592398 **mN**
Habitat Swale.
Soil Very thin sheet of red sand over compacted loamy sand. Cracking in places.
Rock Type Aeolian red siliceous sand.
Vegetation *Acacia colei* var. *colei* scattered tall trees over *Santalum lanceolatum*, *Grevillea eriostachya* and *Grevillea stenobotrya* open shrubland over *Scaevola spinescens*, *Hakea stenophylla* subsp. *stenophylla, Streptoglossa macrocephala* and *Alyogyne pinoniana* low shrubland over *Triodia schinzii* and *Triodia epactia* open hummock grassland over *Indigofera georgei* scattered herbs.
Veg Condition Very good.
Fire Age Old.

Species	Cover	Height	Specimen
Acacia colei var. *colei*	<2	>200	ON01-04
Acacia sclerosperma	0.1	100-200	ON04-02
Acacia stellaticeps	0.1	<100	ON01-08
Alyogyne pinoniana	0.1	<50	ON04-05
Bonamia erecta	0.1	<50	ON04-08
Cassytha capillaris	0.1	CL	ON01-10
Corchorus sidoides subsp. *vermicularis*	0.1	<50	ON04-07
Diplopeltis eriocarpa	0.1	<50	ON01-01
Grevillea eriostachya	2	100-200	NC
Grevillea stenobotrya	2	100-150	ON01-15
Hakea stenophylla subsp. *stenophylla*	5	<100	ON01-03
Indigofera boviperda subsp. *boviperda*	1	<50	ON04-06
Indigofera georgei	1	<50	ON04-04
Santalum lanceolatum	2	100-200	ON04-01
Scaevola spinescens	12	<100	ON10-01
Streptoglossa macrocephala	1	<100	ON04-03
Triodia epactia	10	<100	ON01-11
Triodia schinzii	30	<100	ON01-07

Chevron Domgas Project Onslow (Validus 2008) **Site** ON05
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302059 **mE** 7592545 **mN**
Habitat Dune.
Soil Red sand.
Vegetation *Grevillea stenobotrya* open shrubland over *Trichodesma zeylanicum*, *Crotalaria cunninghamii* and *Bonamia rosea* low open shrubland over *Triodia epactia* and *Triodia schinzii* open hummock grassland over *Aristida holathera* var. *holathera, *Cenchrus ciliaris* and *Bulbostylis barbata* very open tussock grassland over *Euphorbia alsiniflora* scattered herbs
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Abutilon cunninghamii	0.1	<150	ON05.07
Adriana tomentosa var. *tomentosa*	0.1	<100	ON02.08
Aenictophyton aff. *reconditum* subsp. Onslow	0.1	<50	ON05.04
Aristida holathera var. *holathera*	5	<50	ON02.07
Bonamia rosea	1	<20	ON01.06
Bulbostylis barbata	1	<10	ON02.08B
Cassytha capillaris	0.1	CL	ON01.10
Cenchrus ciliaris	2	<50	NC
Corymbia deserticola subsp. *deserticola*	0.1	100-300	ON05.03
Crotalaria cunninghamii subsp. *sturtii*	2	<100	ON02.02
Desmodium filiforme	0.1	<50	ON05.05
Euphorbia alsiniflora	2	<30	ON02.05
Grevillea stenobotrya	9	100-250	NC
Gyrostemon ramulosus	0.1	100-150	ON03.04
Heliotropium cunninghamii	0.1	<50	ON02.06
Ipomoea polymorpha	0.1	<50	ON05.01
Pterocaulon sphaeranthoides	0.1	<100	ON05.06
Rhagodia eremaea	0.1	100-150	ON05.02
Sida rohlenae subsp. *rohlenae*	0.1	<100	ON03.03
Streptoglossa macrocephala	0.1	<100	ON04.03
Trianthema pilosa	2	<30	ON02.03
Trichodesma zeylanicum var. *grandiflorum*	6	<100	ON02.11
Triodia epactia	15	<50	ON01.11
Triodia schinzii	5	<100	ON01.07
Yakirra australiensis var. *australiensis*	0.1	<10	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON06
Described DB **Date** 29/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 301843 **mE** 7592567 **mN**
Habitat Salt pan.
Soil Cracking red, orange clays.
Vegetation **Vachellia farnesiana* high shrubland over *Acacia synchronicia* open shrubland over *Tecticornia indica* subsp. *leiostachya* low scattered shrubs over *Eulalia aurea* and *Sporobolus mitchellii* open tussock grassland.
Veg Condition Poor.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Acacia synchronicia	7	100-200	ON06.11
Acacia tetragonophylla	0.1	<150	ON01.14
Atriplex bunburyana	0.1	<150	ON06.16
Atriplex codonocarpa	0.1	<50	ON06.13
Chloris pectinata	0.1	**<30**	ON06.05
Cucumis variabilis	0.1	CL	ON06.15
Dactyloctenium radulans	0.1	<200	ON06.03
Eragrostis dielsii	0.1	**<50**	ON06.06
Eragrostis dielsii	0.1	**<50**	ON06.07
Eragrostis dielsii	0.1	**<50**	ON06.08
Eriachne flaccida	0.1	**<50**	ON06.04
Eucalyptus victrix	0.1	**<500**	ON06.14
Eulalia aurea	15	<100	ON06.09
Panicum decompositum	0.1	<50	ON06.18
Rhagodia eremaea	0.1	**<50**	ON06.02
Sporobolus mitchellii	5	<50	ON06.17
Tecticornia indica subsp. *leiostachya*	2	<50	ON06.01
Trianthema turgidifolia	0.1	**<30**	ON06.12
Vachellia farnesiana	15	200-800	ON06.10

Chevron Domgas Project Onslow (Validus 2008) **Site** ON07
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302478 **mE** 7591875 **mN**
Habitat Lower dune crest.
Soil Red sand.
Vegetation *Grevillea stenobotrya* shrubland over *Crotalaria cunninghamii* and *Trichodesma zeylanicum* low open shrubland over *Triodia schinzii* and *Triodia epactia* hummock grassland over *Aristida holathera* var. *holathera, *Cenchrus ciliaris, Eriachne benthamii, Yakirra australiensis* var. *australiensis, Bulbostylis barbata* and *Paractaenum refractum* very open grassland over *Trianthema pilosa* and *Euphorbia alsiniflora* very open herbland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	0.1	<100	ON03.05
Aristida holathera var. *holathera*	2	<50	ON02.07
Bonamia rosea	2	<50	ON01.06
Bulbostylis barbata	1	<10	ON02.08B
Cassytha capillaris	0.1	CL	ON01.10
Cenchrus ciliaris	2	<100	NC
Crotalaria cunninghamii subsp. *sturtii*	2	<100	ON02.02
Eriachne benthamii	2	<50	ON02.09
Euphorbia alsiniflora	1	<20	ON02.05
Evolvulus alsinoides var. *decumbens*	0.1	<30	ON07.01
Grevillea stenobotrya	15	1.5-200	NC
Hibiscus brachychlaenus	0.1	<100	ON07.02
Indigofera colutea	0.1	<20	ON03.10
Olearia dampieri subsp. *dampieri*	0.1	150	ON03.06
Paractaenum refractum	1	<50	ON02.13
Streptoglossa macrocephala	0.1	<100	ON04.03
Trianthema pilosa	1	<20	ON02.03
Trichodesma zeylanicum var. *grandiflorum*	2	<100	ON02.11
Triodia epactia	35	<50	ON01.11
Triodia schinzii	5	<50	ON01.07
Yakirra australiensis var. *australiensis*	1	<20	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON08
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302284 **mE** 7591926 **mN**
Habitat Dune crest.
Soil Red sand.
Vegetation *Grevillea stenobotrya* open shrubland over *Alyogyne pinoniana*, *Scaevola sericophylla, Aenictophyton* aff. *reconditum* subsp. Onslow, *Trichodesma zeylanicum* and *Crotalaria cunninghamii* low shrubland over *Triodia schinzii* and *Triodia epactia* open hummock grassland over **Cenchrus ciliaris, Aristida holathera* var. *holathera* and *Bulbostylis barbata* very open hummock grassland.
Veg Condition Very Good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	0.1	<100	ON03.05
Aenictophyton aff. *reconditum* subsp. Onslow	2	<50	ON05.04
Alyogyne pinoniana	5	<100	ON04.05
Aristida holathera var. *holathera*	2	<50	ON02.07
Bulbostylis barbata	1	<100	ON02.08B
Cassytha capillaris	0.1	CL	ON01.10
Cenchrus ciliaris	5	<100	NC
Crotalaria cunninghamii subsp. *sturtii*	1	<100	ON02.02
Euphorbia alsiniflora	0.1	<20	ON02.05
Evolvulus alsinoides (subsp. not determined)	0.1	<20	NC
Grevillea stenobotrya	5	150-200	NC
Gyrostemon ramulosus	0.1	150	ON03.04
Heliotropium cunninghamii	0.1	<50	ON02.06
Hibiscus brachychlaenus	0.1	<50	ON08.01
Hibiscus brachychlaenus	0.1	<100	ON07.02
Hibiscus sturtii (subsp. not determined)	0.1	<100	ON08.03
Indigofera boviperda subsp. *boviperda*	0.1	<50	ON04.06
Indigofera colutea	0.1	<30	ON03.10
Scaevola sericophylla	10	<100	ON02.12
Sida rohlenae subsp. *rohlenae*	0.1	<100	ON03.03
Tephrosia sp. Carnarvon (J.H. Ross 2681)	0.1	<100	ON02.04
Trianthema pilosa	0.1	<10	ON02.03
Tribulus occidentalis	0.1	<50	ON02.10
Trichodesma zeylanicum var. *grandiflorum*	1	<100	ON02.11
Triodia epactia	5	<50	ON01.11
Triodia schinzii	15	<50	ON01.07
Triraphis mollis	0.1	<50	ON03.01
Triumfetta echinata	0.1	<50	ON08.02
Yakirra australiensis var. *australiensis*	0.1	<30	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON09
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302073 **mE** 7592103 **mN**
Habitat Swale.
Soil Thin sheet of aeolian red siliceous sand over compacted loamy sand.
Vegetation *Hakea stenophylla* subsp. *stenophylla* and *Grevillea stenobotrya* high open shrubland over *Scaevola sericophylla, Trichodesma zeylanicum*, *Eremophila forrestii* subsp. *forrestii* and *Diplopeltis eriocarpa* low shrubland over *Triodia schinzii* and *Triodia epactia* hummock grassland over *Eragrostis eriopoda* and **Cenchrus ciliaris* very open grassland.
Veg Condition Very good.
Fire Age Very old.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	0.1	100-200	ON03.05
Acacia sclerosperma	0.1	100-200	ON04.02
Acacia stellaticeps	0.1	<100	ON01.08
Adriana tomentosa var. *tomentosa*	0.1	<150	ON02.08
Cassia luerssenii	0.1	<1.5m	ON03.09
Cenchrus ciliaris	1	<100	NC
Diplopeltis eriocarpa	1	<100	ON01.01
Eragrostis eriopoda	1	<50	ON09.02
Eremophila forrestii subsp. *forrestii*	1	<100	ON01.12
Eriachne obtusa	0.1	<100	ON09.03
Evolvulus alsinoides var. *decumbens*	0.1	<50	ON07.01
Grevillea eriostachya	0.1	<150	ON01.15
Grevillea stenobotrya	2	150-200	NC
Gyrostemon ramulosus	0.1	<150	ON03.04
Hakea stenophylla subsp. *stenophylla*	6	<100	ON01.03
Indigofera boviperda subsp. *boviperda*	2	<50	ON04.06
Olearia dampieri subsp. *dampieri*	0.1	<150	ON03.06
Scaevola sericophylla	20	<100	ON02.12
Sida rohlenae subsp. *rohlenae*	0.1	<150	ON03.03
Solanum lasiophyllum	0.1	<100	ON09.01
Trichodesma zeylanicum var. *grandiflorum*	1	<100	ON02.11
Triodia epactia	30	<100	ON01.11
Triodia schinzii	30	<100	ON01.07

Chevron Domgas Project Onslow (Validus 2008) **Site** ON10
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 301920 **mE** 7592013 **mN**
Habitat Broad swale.
Soil Red loamy sand with cracking clay crust.
Vegetation *Acacia stellaticeps, Grevillea stenobotrya, Grevillea eriostachya* and *Hakea stenophylla* subsp. *stenophylla* open shrubland over *Corchorus sidoides* subsp. *vermicularis* low open shrubland over *Triodia epactia* hummock grassland over **Cenchrus ciliaris, Sorghum plumosum*, *Eulalia aurea* and *Eriachne obtusa* very open tussock grassland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Acacia stellaticeps	6	<150	ON01.08
Acacia tetragonophylla	0.1	100-200	ON01.14
Adriana tomentosa var. *tomentosa*	0.1	<150	ON02.08
Bonamia linearis	0.1	<300	ON01.09
Cassia luerssenii	0.1	100-150	ON03.09
Cassytha capillaris	3	CL	ON01.10
Cenchrus ciliaris	5	<50	NC
Corchorus sidoides subsp. *vermicularis*	4	<50	ON10.03
Dactyloctenium radulans	0.1	<20	ON06.03
Eragrostis eriopoda	0.1	<50	ON10.06
Eragrostis eriopoda	0.1	<50	ON10.06
Eriachne obtusa	1	<50	ON09.03
Eulalia aurea	1	<150	ON06.09
Evolvulus alsinoides (subsp. not determined)	0.1	<30	NC
Goodenia microptera	0.1	<50	ON10.04
Grevillea eriostachya	1	<150	ON01.15
Grevillea stenobotrya	1	150	NC
Gyrostemon ramulosus	0.1	300	ON03.04
Hakea stenophylla subsp. *stenophylla*	2	100-150	ON01.03
Indigofera monophylla	0.1	<50	NC
Panicum decompositum	0.1	<150	ON10.05
Scaevola sericophylla	0.1	<100	ON02.12
Scaevola spinescens	0.1	<100	ON10.01
Solanum lasiophyllum	0.1	<50	ON03.07
Sorghum plumosum	1	200	ON10.02
Triodia epactia	60	<50	ON01.11

Chevron Domgas Project Onslow (Validus 2008) **Site** ON11
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302076 **mE** 7591919 **mN**
Habitat Upper dune swale (swale amongst dune crest).
Soil Thin sheet of aeolian red siliceous sand over compacted sand at depth
Vegetation *Grevillea stenobotrya* high open shrubland over *Hakea stenophylla* subsp. *stenophylla* and *Grevillea eriostachya* open shrubland over *Scaevola sericophylla* low open shrubland over *Triodia schinzii* and *Triodia epactia* hummock grassland over *Tephrosia rosea* (subsp. not determined) and *Bonamia erecta* very open herbland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Bonamia erecta	1	<200	ON11.02
Bonamia rosea	0.1	<50	ON01.06
Cassia luerssenii	0.1	100-150	ON03.09
Cassia oligophylla	0.1	<150	ON11.03
Evolvulus alsinoides (subsp. not determined)	0.1	<20	NC
Grevillea eriostachya	3	<150	ON01.15
Grevillea stenobotrya	9	150-200	NC
Hakea stenophylla subsp. *stenophylla*	3	<150	ON01.03
Santalum lanceolatum	0.1	100-150	ON04.01
Scaevola sericophylla	3	<100	ON02.12
Tephrosia rosea (subsp. not determined)	3	<50	ON11.01
Tephrosia sp. Carnarvon (J.H. Ross 2681)	0.1	<50	ON02.04
Triodia epactia	5	<50	ON01.11
Triodia schinzii	50	<50	ON01.07

Chevron Domgas Project Onslow (Validus 2008) **Site** ON12
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 301993 **mE** 7592335 **mN**
Habitat Swale.
Soil Thin sheet of aeolian red siliceous sand over compacted sand at
Vegetation *Grevillea stenobotrya* and *Hakea stenophylla* subsp. *stenophylla* shrubland over *Diplopeltis eriocarpa* and *Alyogyne pinoniana* low shrubland over *Triodia epactia* and *Triodia schinzii* hummock grassland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Abutilon cunninghamii	0.1	<100	ON12.01
Acacia coriacea subsp. *coriacea*	0.1	100-200	ON03.05
Acacia stellaticeps	0.1	<100	ON01.08
Acacia tetragonophylla	0.1	100-200	ON01.14
Alyogyne pinoniana	1	<100	ON04.05
Bonamia erecta	0.1	<200	ON04.08
Bonamia rosea	0.1	<50	ON01.06
Cassia luerssenii	0.1	100-200	ON03.09
Cassytha capillaris	0.1	CL	ON01.10
Cenchrus ciliaris	0.1	<100	NC
Corchorus sidoides subsp. *vermicularis*	0.1	<50	ON10.03
Corymbia deserticola subsp. *deserticola*	0.1	600	ON05.03
Desmodium filiforme	0.1	<20	ON05.05
Diplopeltis eriocarpa	15	<50	ON01.01
Eragrostis eriopoda	0.1	<50	ON10.06
Eriachne obtusa	0.1	<50	ON09.03
Grevillea eriostachya	0.1	<150	ON01.15
Grevillea stenobotrya	15	100-250	NC
Gyrostemon ramulosus	0.1	100-200	ON03.04
Hakea stenophylla subsp. *stenophylla*	4	100-150	ON01.03
Hibiscus brachychlaenus	0.1	<100	ON07.02
Scaevola sericophylla	0.1	<100	ON02.12
Solanum lasiophyllum	0.1	<100	ON03.07
Streptoglossa macrocephala	0.1	<50	ON04.03
Trichodesma zeylanicum var. *grandiflorum*	0.1	<100	ON02.11
Triodia epactia	55	<50	ON01.11
Triodia schinzii	5	<50	ON01.07

Chevron Domgas Project Onslow (Validus 2008) **Site** ON13
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 301812 **mE** 7592243 **mN**
Habitat Dune.
Soil Aeolian red siliceous sand.
Vegetation *Grevillea stenobotrya* open shrubland over *Crotalaria cunninghamii* and *Trichodesma zeylanicum* low open shrubland over *Triodia epactia* very open hummock grassland over *Aristida holathera* var. *holathera, *Cenchrus ciliaris, Bulbostylis barbata, Eriachne benthamii* and *Yakirra australiensis* var. *australiensis* open tussock grassland over *Euphorbia alsiniflora, Trianthema pilosa* and *Desmodium filiforme* very open herbland
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen
Abutilon cunninghamii	0.1	<100	ON05.07
Adriana tomentosa var. *tomentosa*	0.1	<150	ON02.08
Aenictophyton aff. *reconditum* subsp. Onslow	0.1	<50	ON05.04
Aristida holathera var. *holathera*	10	<50	ON02.07
Bonamia rosea	0.1	<50	ON01.06
Bulbostylis barbata	3	<10	ON02.08B
Cassytha capillaris	0.1	CL	ON01.10
Cenchrus ciliaris	5	<100	NC
Crotalaria cunninghamii subsp. *sturtii*	5	<50	ON02.02
Desmodium filiforme	2	<50	ON05.05
Eriachne benthamii	1	<50	ON13.02
Euphorbia alsiniflora	3	<50	ON02.05
Grevillea stenobotrya	12	150-200	NC
Gyrostemon ramulosus	0.1	150-200	ON03.04
Hibiscus brachychlaenus	0.1	<150	ON13.04
Indigofera linifolia	0.1	<20	ON13.01
Rhagodia eremaea	0.1	<150	ON06.02
Sida rohlenae subsp. *rohlenae*	0.1	<100	ON03.03
Tephrosia aff. *clementii*	0.1	<20	ON13.03
Trianthema pilosa	5	<50	ON02.03
Trichodesma zeylanicum var. *grandiflorum*	5	<50	ON02.11
Triodia epactia	2	<50	ON01.11
Yakirra australiensis var. *australiensis*	1	<10	ON02.14

Chevron Domgas Project Onslow (Validus 2008) **Site** ON14
Described DB **Date** 30/05/2008 **Type** Quadrat 50 m x 50 m
MGA Zone 50 302529 **mE** 7592111 **mN**
Habitat Lower eastern slopes of swale.
Soil Thin sheet of aeolian red siliceous sand over compacted sand at
Vegetation *Hakea stenophylla* subsp. *stenophylla, Grevillea eriostachya* shrubland over *Triodia schinzii* and *Triodia epactia* hummock grassland over **Cenchrus ciliaris* very open tussock grassland.
Veg Condition Very good.
Fire Age Old.

Species	Cover (%)	Height (cm)	Specimen	Notes
Acacia tetragonophylla	0.1	<150	ON01.14	
Alyogyne pinoniana	0.1	<150	ON04.05	
Aristida holathera var. *holathera*	0.1	<50	ON02.07	
Bonamia linearis	0.1	<50	ON14.01	
Bulbostylis barbata	0.1	<10	ON02.08B	
Cassia luerssenii	0.1	<150	ON03.09	
Cenchrus ciliaris	5	<100	NC	
Diplopeltis eriocarpa	0.1	<50	ON01.01	
Eremophila forrestii subsp. *forrestii*	0.1	<150	ON01.12	
Eriachne aristidea	0.1	<50	ON14.02	
Evolvulus alsinoides (subsp. not determined)	0.1	<20	NC	
Grevillea eriostachya	2	<150	ON01.15	
Gyrostemon ramulosus	0.1	150-200	ON03.04	
Hakea stenophylla subsp. *stenophylla*	13.5	100-150	ON01.03	12-15%
Heliotropium cunninghamii	0.1	<50	ON02.06	
Trianthema pilosa	0.1	<50	ON02.03	
Trichodesma zeylanicum var. *grandiflorum*	0.1	<100	ON02.11	
Triodia epactia	20	<50	ON01.11	
Triodia schinzii	45	<50	ON01.07	
Yakirra australiensis var. *australiensis*	0.1	<10	ON02.14	

Chevron Domgas Project Onslow (Validus 2008) **Site** WP92

Described DB **Date** **Type** Relevé

MGA Zone 50 302683 **mE** 7592426 **mN**

Habitat Sandy bank

Vegetation *Cassia luerssenii* and *Grevillea stenobotrya* scattered shrubs over *Acacia stellaticeps* low open shrubland over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Veg Condition Very Poor

Species	Cover (%)	Height (cm)	Specimen
Acacia stellaticeps	3	<100	
Acacia tetragonophylla	0.1		
Acacia trachycarpa	0.1	100-300	
Aerva javanica	0.1		
Cassia luerssenii	1	100-200	
Cenchrus ciliaris	65	<100	
Grevillea eriostachya	0.1		
Grevillea stenobotrya	1	100-200	
Hakea stenophylla subsp. *stenophylla*	0.1		
Ipomoea muelleri	0.1		
Scaevola spinescens	0.1		
Stylobasium spathulatum	0.1		
Triodia epactia	35	<50	

Chevron Domgas Project Onslow (Validus 2008) **Site** WP93
Described DB **Date** **Type** Relevé
MGA Zone 50 303301 **mE** 7593293 **mN**
Habitat Salt lake (samphire shrubland)
Vegetation *Tecticornia indica* subsp. *leiostachya* low open heath over **Cenchrus ciliaris* scattered tussock grasses

Species	Cover (%)	Height (cm)	Specimen
Amaranthus undulatus	0.1		
Cenchrus ciliaris	0.1	<100	
Cullen cinereum	0.1		
Cyperus bulbosus	0.1		
Dactyloctenium radulans	0.1		
Eragrostis falcata	0.1		
Goodenia microptera	0.1		
Lawrencia viridigrisea	0.1		
Sesbania cannabina	0.1		
Swainsona pterostylis	0.1		
Tecticornia auriculata	0.1		
Tecticornia indica subsp. *leiostachya*	35	<50	

Chevron Domgas Project Onslow (Validus 2008) **Site** WP94
Described DB **Date** **Type** Relevé
MGA Zone 50 303690 **mE** 7594721 **mN**
Habitat Sandy bank
Vegetation *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* tussock grassland
Veg Condition Completely degraded
Notes Change from salt lake vegetation onto sandy bank to the north

Species	Cover (%)	Height (cm)	Specimen
Acacia tetragonophylla	0.1		
Amaranthus undulatus	0.1		
Cenchrus ciliaris	60	<100	
Goodenia microptera	0.1		
Indigofera colutea	0.1		
Rhynchosia minima	0.1		
Scaevola spinescens	0.1		
Swainsona pterostylis	0.1		
Tecticornia auriculata	0.1		
Triodia epactia	20	<50	

Data collected by ENV (2011)

Onslow Townsite Strategy (ENV 2011) **Site** OS08

Described CG **Date** 13/05/2011 **Type** Quadrat 50 m x 50 m

MGA Zone 50 304061 **mE** 7606086 **mN**

Habitat Sand dune

Soil Light brown sand

Vegetation *Acacia coriacea* subsp. *coriacea* open shrubland over *Crotalaria cunninghamii* subsp. *sturtii, Trichodesma zeylanicum* var. *zeylanicum* and *Tephrosia* sp. Carnarvon (J.H. Ross 2681) low scattered shrubs over *Spinifex longifolius* very open hummock grassland over **Cenchrus cillaris* very open tussock grassland over *Euphorbia alsiniflora* very open herbland.

Veg Condition Very Good - Good

Fire Age No sign of recent fire

Notes Bare ground: 70%
Litter cover: + logs, 2% twigs, 10% lvs
Disturbance type: Clearing and presence of introduced species and rubbish.
Quadrat not permanently marked.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	7%	200	OS02-01=
Aerva javanica	+	50	
Cenchrus ciliaris	15%	40	
Crotalaria cunninghamii subsp. *sturtii*	2%	50	OS02-09=
Cullen martinii	+	100	OS08-01
Euphorbia alsiniflora	5%	30	OS02-04=
Rhagodia preissii subsp. *obovata*	+	100	OS08-04
Spinifex longifolius	5%	60	OS02-13=
Tephrosia sp. Carnarvon (J.H. Ross 2681)	1%	30	OS08-02
Threlkeldia diffusa	+	50	OS08-05
Trichodesma zeylanicum var. *zeylanicum*	1%	70	OS02/08=

Onslow Townsite Strategy (ENV 2011) **Site** OS18

Described CG **Date** 14/05/2011 **Type** Quadrat 50 m x 50 m

MGA Zone 50 304246 **mE** 7603332 **mN**

Habitat Sand plain

Soil Red- brown sandy loam

Vegetation *Acacia tetragonophylla* scattered shrubs over *Indigofera monophylla*, *Pimelea ammocharis, Ptilotus axillaris, Scaevola spinescens, Scaevola pulchella* low open shrubland over *Triodia epactia* hummock grassland over *Aristida holathera* var. *holathera, *Cenchrus cilliaris*, *Eriachne mucronata, Panicum decompositum* tussock grassland.

Veg Condition Very Good - Good.

Fire Age No signs of recent fire

Notes Bare ground: 30%**.** Litter cover: + logs, 1% twigs, 1% lvs
Disturbance type: Presence of introduced species, fencing and near a highway.
Quadrat not permanently marked.

Species	Cover (%)	Height (cm)	Specimen
Acacia bivenosa	0.1	150	
Acacia coriacea subsp. *coriacea*	0.1	100	OS02-01=
Acacia stellaticeps	0.1	40	
Acacia tetragonophylla	1	100	OS18-12
Acacia trudgeniana	0.1	250	OS18-02
Aerva javanica	0.1	60	
Aristida holathera var. *holathera*	30	50	OS18-04
Bonamia linearis	0.1	30	OS22-04=
Bonamia rosea	0.1	30	OS18-18
Cassia glutinosa	0.1	150	OS18-13
Cassia oligophylla	0.1	20	OS18-06
Cassytha capillaris	0.1	50	OS02-14=
Cenchrus ciliaris	10	40	
Eriachne mucronata	1	35	OS18-10
Euphorbia alsiniflora	0.1	30	OS02-04
Euphorbia boophthona	0.1	40	OS18-17
Evolvulus alsinoides var. *villosicalyx*	0.1	15	OS18-01
Goodenia microptera	0.1	30	OS12-12=
Gossypium australe	0.1	60	OS18-16
Hakea lorea subsp. lorea	0.1	100	OS18-19
Indigofera monophylla	2	50	OS12-02=
Indigofera trita	0.1	20	OS18-07
Melhania oblongifolia	0.1	25	OS18-09
Olearia dampieri subsp. *dampieri*	0.1	30	OS18-19
Panicum decompositum	1	70	OS18-03
Pimelea ammocharis	1	50	OS12-05=
Prosopis glandulosa	0.1	30	OSR06-01=
Pterocaulon sphaeranthoides	0.1	40	OS16-02=
Ptilotus axillaris	1	30	OSCS39
Ptilotus macrocephalus	0.1	70	OS18-14
Ptilotus nobilis subsp. *nobilis*	0.1	30	
Rhynchosia minima	0.1	20	OS16-03=
Scaevola pulchella	1	30	OS18-08
Scaevola spinescens	1	50	OS12-01=
Solanum lasiophyllum	0.1	30	OS10-03
Tribulus terrestris	0.1	20	OS02-05
Triodia epactia	40	40	OS18-11
Whiteochloa airoides	0.1	60	OS12-14
Yakirra australiensis var. *australiensis*	0.1	25	OS18-05

Onslow Townsite Strategy (ENV 2011) **Site** OS21

Described JS **Date** 14/05/2011 **Type** Quadrat 50 m x 50 m

MGA Zone 50 304533 **mE** 7604167 **mN**

Habitat Sand dune

Soil Red-brown sand

Vegetation *Acacia stellaticeps* low shrubland over *Triodia epactia* very open hummock grassland over **Cenchrus ciliaris* open tussock grassland over **Aerva javanica* scattered herbs.

Veg Condition Very Good

Fire Age No sign of recent fire

Notes Bare ground: 30%
Litter cover: - logs, + twigs, + lvs
Disturbance type: Presence of introduced species.
Quadrat not permanently marked.
Associated species: *Acacia coriacea* subsp. *coriacea*

Species	Cover (cm)	Height (%)	Specimen
Acacia stellaticeps	20	60	OS01-08=
Adriana tomentosa var. *tomentosa*	0.1	50	OS01-15=
Aerva javanica	1	60	
Aristida holathera var. *holathera*	0.1	30	OS21-03
Bonamia linearis	0.1	15	OS21-04
Cenchrus ciliaris	15	30	
Crotalaria cunninghamii subsp. *sturtii*	0.1	40	OS01-04=
Euphorbia myrtoides	0.1	20	OS13-05=
Indigofera boviperda subsp. *boviperda*	0.1	30	OS01-11=
Indigofera colutea	0.1	1	OS01-10=
Maireana lobiflora	0.1	60	OS13-01=
Rhagodia preissii subsp. *obovata*	0.1	20	OS01-09=
Salsola australis	0.1	20	OS21-02
Scaevola sericophylla	0.1	1	OS13-02=
Sida clementii	0.1	30	OS21-01
Solanum lasiophyllum	0.1	40	OS10-03=
Tribulus terrestris	0.1	20	OS01-05=
Trichodesma zeylanicum var. *zeylanicum*	0.1	40	OS01-02=
Triodia epactia	3	30	OS13-06=
Whiteochloa airoides	0.1	50	OS01-14=

Onslow Townsite Strategy (ENV 2011) **Site** OS23

Described JS **Date** 14/05/2011 **Type** Quadrat 50 m x 50 m

MGA Zone 50 304405 **mE** 7603846 **mN**

Habitat Sand plain

Soil Red- brown sand

Vegetation *Acacia coriacea* subsp. *coriacea, Adriana tomentosa* var. *tomentosa* scattered shrubs over *Hannafordia quadrivalvis* subsp. *recurva, Acacia stellaticeps, Crotalaria cunninghamii* subsp. *sturtii, Solanum lasiophyllum, Scaevola crassifolia, Scaevola sericophylla* open shrubland over *Triodia epactia* hummock grassland over **Cenchrus ciliaris* open tussock grassland

Veg Condition Very Good

Fire Age No sign of recent fire

Notes Bare ground: 30%
Litter cover: - logs, + twigs, + lvs
Disturbance type: Presence of introduced species
Quadrat not permanently marked.
Associated species: *Gyrostemon ramulosus*

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	1	150	OS05-01=
Acacia stellaticeps	2	50	OS01-08=
Adriana tomentosa var. *tomentosa*	1	100	OS01-15=
Aerva javanica	0.1	50	
Bonamia linearis	0.1	10	OS23-01
Cassytha capillaris	0.1	50	OS13-04=
Cenchrus ciliaris	10	40	
Crotalaria cunninghamii subsp. *sturtii*	1	70	OS01-04=
Euphorbia boophthona	0.1	40	OS23-06
Euphorbia myrtoides	0.1	20	OS01-03=
Hannafordia quadrivalvis subsp. *recurva*	50	30	OSJS12
Indigofera boviperda subsp. *boviperda*	0.1	30	OS01-11=
Indigofera colutea	0.1	20	OS01-10=
Indigofera trita	0.1	30	OS23-05
Pimelea ammocharis	0.1	60	OSJS09=
Pterocaulon sphaeranthoides	0.1	30	OS04-02=
Quoya loxocarpa	0.1	20	OS01-20=
Rhagodia preissii subsp. *obovata*	0.1	70	OS23-08
Rhynchosia minima	0.1	20	OS23-04
Salsola australis	0.1	40	OS23-03
Scaevola crassifolia	1	60	OS01-24=
Scaevola sericophylla	1	60	OS13-02=
Sida rohlenae subsp. *rohlenae*	0.1	40	OS23-07
Solanum lasiophyllum	1	60	OS10-03=
Trichodesma zeylanicum var. *zeylanicum*	0.1	30	OS01-02=
Tricoryne corynothecoides	0.1	50	OS01-18=
Triodia epactia	20	30	OS13-06=
Whiteochloa airoides	0.1	60	OS01-14=

Onslow Townsite Strategy (ENV 2011) **Site** OS26
Described JS **Date** 15/05/2011 **Type** Quadrat 50 m x 50 m
MGA Zone 50 304277 **mE** 7605432 **mN**
Habitat Sand dune
Soil Red- brown sand
Vegetation *Acacia coriacea* subsp. *coriacea* open shrubland over *Triodia epactia* open hummock grassland over **Cenchrus ciliaris* tussock grassland over **Aerva javanica* very open herbland.
Veg Condition Good
Fire Age No sign of recent fire
Notes Bare ground: 30%
Litter cover: - logs, + twigs, + lvs.
Disturbance type: Nearby track and presence of introduced species and rubbish.
Quadrat not permanently marked.

Species	Cover (%)	Height (cm)	Specimen
Acacia coriacea subsp. *coriacea*	5	200	OS26-02
Adriana tomentosa var. *tomentosa*	0.1	60	OS01-15=
Aerva javanica	2	60	
Cenchrus ciliaris	30	30	
Crotalaria cunninghamii subsp. *sturtii*	0.1	100	OS01-04=
Euphorbia myrtoides	0.1	10	OS01-03=
Indigofera boviperda subsp. *boviperda*	0.1	20	OS01-11=
Indigofera colutea	0.1	10	OS01-10=
Rhagodia preissii subsp. *obovata*	0.1	60	OS01-09=
Scaevola sericophylla	0.1	50	OS13-02=
Tephrosia rosea var. *clementii*	0.1	40	OSJS13=
Tribulus terrestris	0.1	20	OS01-05=
Trichodesma zeylanicum var. *zeylanicum*	0.1	100	OS01-02=
Tricoryne corynothecoides	0.1	30	OS01-18=
Triodia epactia	20	40	OS26-01

Onslow Townsite Strategy (ENV 2011) **Site** OSR05
Described CG **Date** 14/05/2011 **Type** Relevé
MGA Zone 50 303991 **mE** 7602809 **mN**
Habitat Salt flat
Soil Red- brown clay loam
Vegetation *Tecticornia auriculata, Tecticornia halocnemoides* subsp. *tenuis* low shrubland over *Eragrostis falcata* very open tussock grassland
Veg Condition Good - Poor
Fire Age No sign of recent fire
Notes Disturbance type: Presence of introduced species, rubbish and tracks.

Species	Cover (%)	Height (cm)	Specimen
Atriplex semilunaris	0.1	30	OSR05-06
Eragrostis falcata	6%	30	OSR05-05
Prosopis glandulosa	0.1	100	OSCS05=
Tecticornia auriculata	12%	40	OSR05-01
Tecticornia halocnemoides subsp. *tenuis*	2%	30	OSR05-02

Data collected by ASTRON (2008)

API data from Onslow (ASTRON 2008) **Site** Q42

Described **Date** 13/08/2008 **Type** Q 50m x 50m

MGA Zone 50 301750 **mE** 7591750 **mN**

Habitat Top of dune

Soil Fine red sand

Vegetation *Grevillea eriostachya, Gossypium australe* shrubland over *Triodia epactia* hummock grassland

Veg Condition Ranked as "Excellent" by Astron, but very small amount of Buffel present; would class as "Good". MM.

Fire Age Burnt ~5 years ago

Notes Heights not recorded; specimens not listed.

Species	Cover (%)	Height (cm)	Specimen
Aristida holathera var. *holathera*	0.5		
Bulbostylis barbata	0.5		
Cenchrus ciliaris	0.5		
Corchorus tectus	0.5		
Corynotheca pungens	0.5		
Cullen martinii	0.5		
Desmodium filiforme	0.5		
Euphorbia myrtoides	0.5		
Evolvulus alsinoides var. *villosicalyx*	0.5		
Gossypium australe	3		
Grevillea eriostachya	5		
Gyrostemon ramulosus	0.5		
Indigofera boviperda subsp. *boviperda*	0.5		
Ipomoea polymorpha	0.5		
Paspalidium tabulatum	0.5		
Ptilotus polystachyus	0.5		
Scaevola sericophylla	0.5		
Sida rohlenae subsp. *rohlenae*	0.5		
Tephrosia sp. Carnarvon (J.H. Ross 2681)	0.5		
Trianthema pilosa	0.5		
Trichodesma zeylanicum var. *grandiflorum*	5		
Triodia epactia	45		
Triodia schinzii	nc		

Data collected by Biota (2010)

Wheatstone Biological Survey (Biota 2010) **Site** WH21

Described JA/RB **Date** 7/04/2009 **Type** Quadrat 50 m x 50 m

MGA Zone 50 300498 **mE** 7590480 **mN**

Habitat Broad undulating plain bordered by steep hills to the west and salt lakes to the east

Soil Red-brown loamy sand

Vegetation *Acacia stellaticeps* open shrubland over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* very open tussock grassland

Veg Condition Good; 20+ individuals of **Cenchrus ciliaris*

Fire Age Burnt >3 yrs ago?

Species	Cover (%)	Height (cm)	Specimen
Abutilon aff. *dioicum*	0.1	30	WH21-07
Acacia stellaticeps	5	1.5m	
Acacia synchronicia	0.1	50	
Acacia tetragonophylla	0.1	1.1m	
Atriplex codonocarpa	0.1	12	
Bonamia alatisemina	0.1	20	
Bulbostylis barbata	0.1	15	
Calandrinia ptychosperma	0.1	7	
Cassytha capillaris	0.1	60	
Cenchrus ciliaris	5	50	
Chloris pumilio	0.1	10	WH21-06
Cullen martinii	0.1	25	
Cyperus squarrosus	0.1	5	
Dactyloctenium radulans	0.1	5	
Desmodium filiforme	0.1	40	-12
Enchylaena tomentosa var. *tomentosa*	0.1	25	WH21-02
Eulalia aurea	0.1	50	
Evolvulus alsinoides var. *villosicalyx*	0.1	25	
Fimbristylis dichotoma	0.1	20	
Goodenia forrestii	0.1	30	
Grevillea stenobotrya	0.1	1m	
Hibiscus brachychlaenus	0.1	55	WH21-03
Indigofera boviperda subsp. *boviperda*	0.1	80	WH21-05
Indigofera colutea	0.1	12	
Indigofera linifolia	0.1	20	
Pluchea dunlopii	0.1	50	WH21-01
Polycarpaea corymbosa var. *corymbosa*	0.1	10	
Polygala aff. isingii	0.1	12	
Pterocaulon sphaeranthoides	0.1	40	WH21-04
Scaevola spinescens	0.1	90	
Sida aff. fibulifera	0.1	20	WH21-11
Solanum lasiophyllum	0.1	95	
Streptoglossa macrocephala	0.1	25	WH21-08
Stylobasium spathulatum	0.1	2m	
Trachymene pilbarensis	0.1	5	WH21-10
Trianthema turgidifolia	0.1	25	
Trichodesma zeylanicum var. *grandiflorum*	0.1	80	
Triodia epactia	30	40	WH21-12
Urochloa holosericea subsp. *velutina*	0.1	45	WH21-09

Wheatstone Biological Survey **Site** WH23

Described JA/RB **Date** 7/04/2009 **Type** Q 50m x 50m

MGA Zone 50 301750 **mE** 7590011 **mN**

Habitat Crest and upper slopes of large (tall and wide) dune

Soil Red loamy sand

Vegetation *Crotalaria cunninghamii*, *Grevillea stenobotrya, Trichodesma zeylanicum* var. *grandiflorum* shrubland over *Triodia epactia* hummock grassland with **Cenchrus ciliaris* very open tussock grassland

Veg Condition Good; some patches of **Cenchrus*

Fire Age No sign of recent fire

Notes 11 individuals of *Triumfetta echinata*; all seem healthy

Species	Cover (%)	Height (cm)	Specimen	Notes
Abutilon aff. *dioicum*	1	170	WH23-02	
Acacia stellaticeps	0.1	90		
Bonamia rosea	0.1	25		
Bulbostylis barbata	0.1	20		
Cassia luerssenii	0.1	80		
Cassytha capillaris	0.1	creeper		
Cenchrus ciliaris	5	45		
Crotalaria cunninghamii subsp. *sturtii*	7	180		
Cucumis variabilis	0.1	climber		
Cullen martinii	0.1	1.4m		
Desmodium filiforme	0.1	20		
Euphorbia myrtoides	0.1	25		
Evolvulus alsinoides var. *decumbens*	0.1	25		
Grevillea stenobotrya	2	180		
Hibiscus brachychlaenus	0.1	140	WH23-03	
Indigofera colutea	0.1	20		
Ipomoea muelleri	0.1	climber		
Ipomoea polymorpha	0.1	7		
Pterocaulon sphaeranthoides	0.1	55	WH23-01	
Sida rohlenae subsp. *rohlenae*	0.1	1.5m		
Solanum lasiophyllum	0.1	35		
Trianthema pilosa	0.1	20		
Trichodesma zeylanicum var. *grandiflorum*	20	150		
Triodia epactia	35	40		
Triumfetta echinata	0.1	40		11 individuals

Appendix 8

Locations of Flora of Conservation Significance in the Micro-Siting Survey Area

Priority Flora Locations in the Micro-Siting Survey Area

Species	Easting	Northing
Eremophila forrestii subsp. *viridis*	302702	7593049
	302960	7592964
Triumfetta echinata	301759	7589980
	302317	7592474
	302321	7591951
	302337	7592548
	302354	7592181
	302470	7592751
	302171	7591523
	302213	7591821
	302222	7591748
	302294	7592112
	302295	7591881
	302312	7592414
	302036	7590620
	302392	7592635

Other Flora of Potential Conservation Significance in the Micro-Siting Survey Area

Species	Easting	Northing
Abutilon aff. *dioicum*	302312	7592414
	302321	7591951
	302337	7592295
	302337	7592548
	302354	7592181
	302470	7592751
	302528	7592830
	302616	7592954
	302165	7591389
	302213	7591821
	302222	7591748
	302252	7591703
	302271	7591239
	302294	7592112
	302295	7591881
Aenictophyton aff. *reconditum*	301812	7592243
	302059	7592545
	302092	7592221
	302284	7591926
	301759	7589980
	302392	7592635
	302419	7593169

Introduced Flora locations in the Micro-Siting Survey Area

Species	Easting	Northing
**Aerva javanica*	302683	7592426
	304533	7604167
	304405	7603846
	304277	7605432
	304061	7606086
**Cenchrus ciliaris*	301750	7591750
	302683	7592426
	303301	7593293
	303690	7594721
	302092	7592221
	302059	7592545
	302478	7591875
	302284	7591926
	302073	7592103
	301920	7592013
	301993	7592335
	301812	7592243
	302529	7592111
	301759	7589980
	300523	7590458
	304533	7604167
	304405	7603846
	304277	7605432
	304061	7606086
	302381	7592668
	302582	7592704
	302673	7593068
	303053	7593249
	302537	7593459
	301998	7592997
	302411	7593203
	302203	7593337
	302328	7593069
	302951	7592997
	303480	7593987
	303267	7600986
	303598	7602039
	302814	7598536
**Flaveria trinervia*	303480	7593987
	303598	7602039
	302814	7598536
**Prosopis glandulosa*	303991	7602809
**Tribulus terrestris*	304533	7604167
	304277	7605432
**Vachellia farnesiana*	301843	7592567
	302537	7593459