

EP 413 3D Seismic Acquisition Survey

Section 38 EPA Referral

Prepared for
Norwest Energy NL
by Strategen

October 2013



STRATEGEN
environmental consultants

EP 413 3D Seismic Acquisition Survey

Section 38 EPA Referral

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October 2013

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Client: Norwest Energy NL

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Draft for review	S Finning, C Rea / L Taylor, H Ventriss	Electronic	25/09/2013
Final Draft Report	B	Client review	S Finning / L Taylor	Electronic	14/10/2013
Final Report	0	Submission to EPA	S Finning / L Taylor	Electronic/ Hard copy	15/10/2013

Filename: NEE13184_01_R001 Rev 0 - 15 October 2013

Executive summary

Norwest Energy NL (Norwest) propose to undertake a seismic survey in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia (Proposal).

The purpose of the survey is to expand the capacity of the existing shale gas exploration well at Arrowsmith-2 within Exploration Permit Number 413 (EP 413). EP 413 occupies an area of approximately 10 600 ha (105 km²). The Proposal requires disturbance (by mulching) of up to 250 ha of native vegetation within a defined seismic survey boundary (Proposal area).

This document has been prepared to provide supporting information for the referral of the Project under s 38 of the *Environment Protection Act 1986* (WA) (EP Act).

The key characteristics of the Proposal are summarised in Table ES 1.

Table ES 1 Key Proposal characteristics

Summary of the Proposal		
Proposal Title	EP 413 3D Seismic Survey	
Proponent Name	Norwest Energy NL	
Life of Proposal	Six weeks including demobilisation and rehabilitation (excluding post rehabilitation monitoring)	
Short Description	<p>The Proposal is to undertake a 3D seismic survey within EP 413 in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia.</p> <p>The Proposal comprises the following components:</p> <ul style="list-style-type: none"> • preparation of access lines • laying source and receiver lines and insert geophones • undertaking vibration plate analysis using vibroseis trucks • demobilizing, rehabilitating and closing vehicular access to seismic lines, and monitoring. 	
Physical elements		
Element	Proposed Location	Proposed maximum extent
Total Ground Disturbance Area	Conceptual disturbance footprint is shown in (Figure 2).	No more than 250 hectares (ha) within a total Proposal area of 10 600 ha.

The key environmental factors considered relevant to the Proposal are:

- vegetation and flora
- terrestrial fauna
- rehabilitation and closure.

A summary of the relevant Environmental Protection Authority's objectives, potential impacts and proposed management commitments for these factors is presented in Table ES 2.

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Table ES 2 Preliminary summary of environmental factors, impact, management and proposed studies for the Proposal

Environmental factor	EPA objective(s)	Existing environment	Potential impacts	Proposed management
Flora and vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level	The Survey Area consists of 10 600 ha of remnant native vegetation, road and rail reserve and pasture within the Geraldton Sandplains Bioregion. Proposal Area hosts four vegetation associations, made up of 14 vegetation types. Proposal Area poses potential habitat for 26 conservation-significant flora species (of which only one is designated 'threatened'). Of the 26 species that might occur, eight priority flora species were identified within the Proposal Area during a botanical survey in spring 2012. A further botanical survey is currently underway, expected to be completed in early 2014.	Potential impacts to flora and vegetation include: <ul style="list-style-type: none"> clearing of native vegetation leading to reduction in populations of conservation-significant flora or vegetation species vehicle use leading to degradation of habitat by erosion, introduction or spread of weeds or dieback, alteration of fire regimes or surface contamination. 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> Level 2 botanical survey to identify, demarcate and map populations of conservation-significant flora and vegetation species dieback survey prior to access by contractors to identify, demarcate and map areas affected by <i>Phytophthora cinnamomi</i> or other soil pathogens induction of site personnel identifying excluded areas as identified in L2 botanical survey and dieback survey induction of site personnel in site-specific EMP prepared in associated with EIA use of existing tracks where alignment coincides with mapped path of survey lines deviation of survey lines to avoid populations of conservation-significant flora use of GPS during clearing and mulching of survey lines to adhere to clearing boundaries and avoid vehicle access through excluded areas hand-carrying wires through excluded areas implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA.
Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	The Survey Area consists of potential foraging habitat for Carnaby's Black Cockatoo, and potential habitat for Malleefowl, Rainbow Bee-eater and Western Ground Parrot. Ten key habitat types were identified within the Survey Area.	Potential impacts to fauna include: <ul style="list-style-type: none"> clearing of native vegetation resulting in loss of individual specimens of conservation-significant fauna associated with vehicle strike clearing of native vegetation resulting in reduction in suitable habitat for conservation-significant fauna species 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> induction of site personnel identifying conservation-significant species habitat (for example dense areas of Carnaby's Black Cockatoo foraging species, Malleefowl mounds etc.) as excluded areas induction of site personnel in site-specific EMP prepared in associated with EIA use of existing tracks where alignment coincides with mapped path of survey lines deviation of survey lines to avoid excluded areas including trees of suitable Diameter Breast Height as breeding habitat use of GPS during clearing and mulching of survey lines to avoid vehicle access through excluded areas hand-carrying wires through excluded areas implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA.
Rehabilitation and Closure	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	Part of the Survey Area consists of the Beekeepers Nature Reserve. The remainder of the Survey Area is traversed by public access tracks and rail reserve with associated maintenance tracks on either side of the rail line. The area has been subject to historical exploration activities and while native vegetation has successfully recolonised some lines, others remain open through repeated access. Fire breaks are visible along fencelines throughout the Survey Area.	Potential impacts to rehabilitation and closure include: <ul style="list-style-type: none"> vehicle use resulting in introduction of weeds or soil pathogens poor concealment of survey lines from public access tracks leading to ongoing third party access resulting in poor recovery of vegetation along survey lines. 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> induction of site personnel in concealment of mulched survey lines at access tracks upon completion of survey to prevent third party access induction of site personnel in site-specific EMP prepared in associated with EIA implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA.

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1. Introduction

1.1 Proposal background

Norwest Energy NL (Norwest) propose to undertake a seismic survey in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia (Proposal).

The purpose of this survey is to assess the extent of the resource surrounding the existing Arrowsmith-2 within Exploration Permit Number 413 (EP 413). EP 413 occupies an area of approximately 50 830 ha (508 km²), and a defined survey boundary has been designed to evaluate an area of approximately 10 600 ha (106 km²) (Proposal area). The Proposal requires disturbance (by mulching) of up to 250 ha (approximately 3 km²) of native vegetation within the Proposal area.

1.2 Location

The spatial extent of the 3D seismic survey area is constrained to the north and east by the boundaries of EP 413. The western extent encompasses the Beagle Fault, the target of the 3D seismic survey.

The Proposal area is located within the locality of Arrowsmith, in the Shire of Irwin (Figure 1) and is zoned 'general farming' under Town Planning Scheme No. 5 gazetted in May 2008. The Proposal area comprises portions of several lots and reserves (Table 1).

Table 1 Lot details

Name	Lot	Plan/ Deposited Plan	Reserve	Tenure
-	Lot 12455	221092	Unallocated crown land	
-	Lot 1360	251672	-	Freehold – private owner
-	Lot 12564	221092	-	
-	Lot 3568	134881	-	Freehold – private owner
-	Lot 1457	251675	Crown land	State of Western Australia
-	Lot 2523	110260	-	Freehold – private owner
-	Lot 2441	105058	-	Freehold – private owner
-	Lot 2442	105056	-	Freehold – private owner
-	Lot 11294	214269	-	Freehold – private owner
-	Lot 12176	39607	R24496	
-	Lot 12799	39607	R24496	
-	Lot 12453	221090	-	
-	Lot 10217	206712	Unallocated crown land	
-	Lot 1475	251671	Unallocated crown land	
-	Lot 11863	134868	R12269	
-	Lot 12465	221092	R39745	
	Lot 381	58774	-	
Brand Highway road reserve	Lot 12460	215238	-	
Beekeeper's Nature Reserve	-	-	R24496	
Victoria Location 11864	-	-	R19219	
Rail reserve				

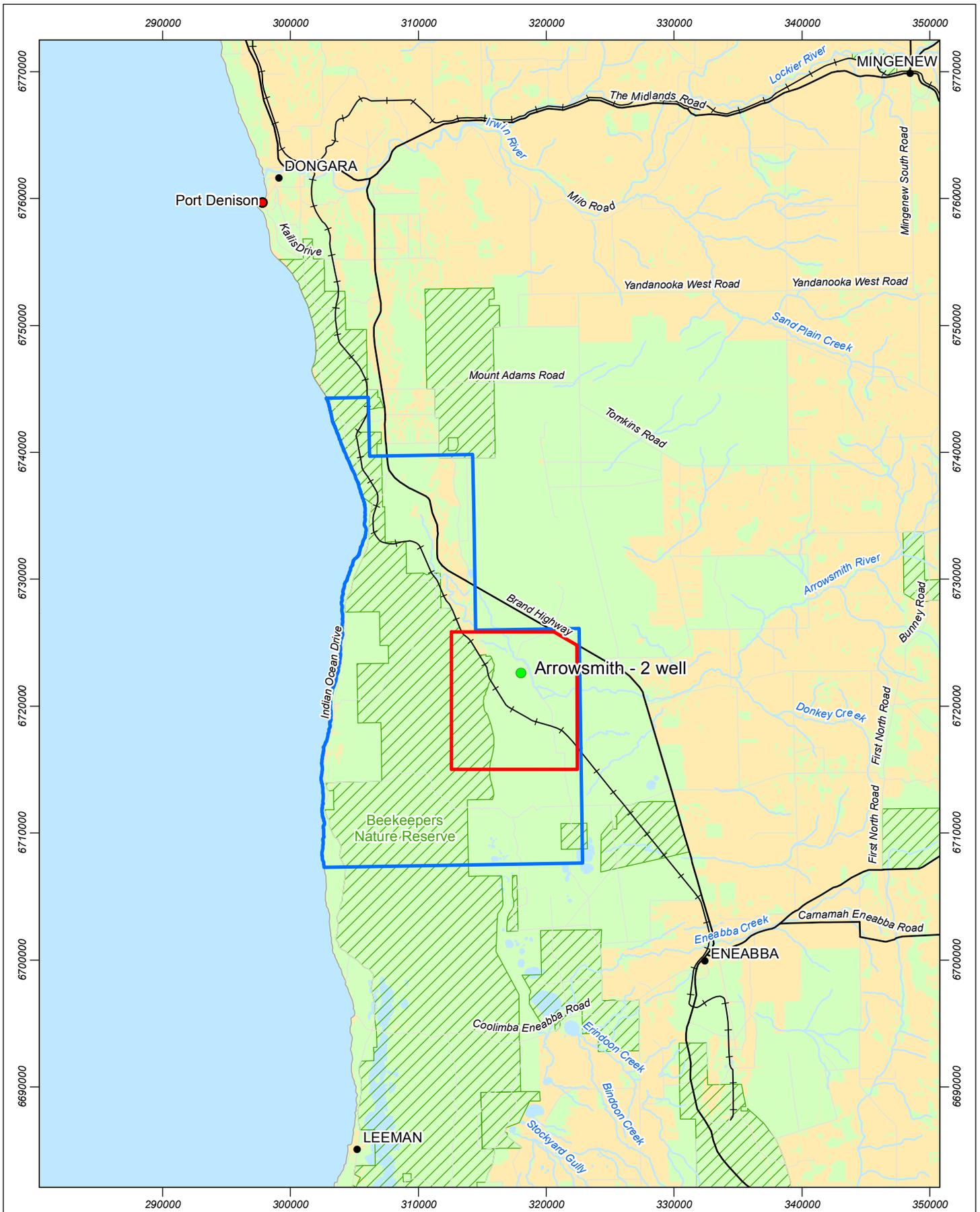


Figure 1 Locality plan – broad scale

<p>Scale 1:400,000 at A4</p>  <p>Coordinate System: GDA 1994 MGA Zone 50 Note that positional errors may occur in some areas Date: 15/10/2013 Author: JCrute Source: Topography: Geoscience Australia 2012. EP 413: DMP 2012.</p>		<p>Legend</p> <ul style="list-style-type: none"> ● Town ● Well Arrowsmith 2 — Major road — Minor road —+ Railway □ Seismic survey boundary □ Exploration Permit EP 413 ▨ Nature Reserve ■ Native vegetation 	 <p>STRATEGEN info@strategen.com.au www.strategen.com.au</p>
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Proposed survey boundaries are provided in Table 2 and displayed in Figure 2.

Table 2 Seismic survey boundaries (supplied by Norwest Energy 22/07/13)

Corner	Northing	Easting	Latitude	Longitude
North-west	6725856.0596	312591.6714	-29.5830	115.0651
North-east (N)	6725851.2975	320594.4325	-29.5842	115.1477
North-east (S)	6724809.0438	322403.8981	-29.5939	115.1662
South-east	6715023.7857	322422.7806	-29.6822	115.1648
South-west	6715040.1982	312575.2588	-29.6806	115.0631

1.3 Purpose of document

This document has been prepared to provide supporting information for the referral of the Proposal under s 38 of the *Environmental Protection Act 1986* (EP Act).

The completed s 38 referral form is presented in Appendix 1.

1.4 Proponent details

The Proponent for the Proposal is Norwest, an Australian-based, ASX listed (ASX:NWE) exploration and production company with assets in Australia and overseas. In Western Australia, the Company's operational focus is on the northern Perth Basin where it has operating and non-operating stakes in a number of northern Perth Basin permits, both onshore and offshore. Norwest has a head office in Perth. Norwest operates EP 413 as a joint venture with AWE Limited (via subsidiaries) and Bharat Petro Resources Limited.

The Proponent contact is:

Norwest Energy NL

Asset Manager

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PO Box 8260

Perth Business Centre, Western Australia, 6849

1.5 Proposal rationale

3D seismic surveys are necessary to assist with planning subsurface petroleum exploration activities, as existing 2D data is of insufficient quality to define the extent of the resource. The primary objective of this survey is to assist with designing future drilling programs and assessing the development potential of the field within EP 413.

Carrying out a 3D seismic survey is a 'Year One' commitment within the application for renewal of access to EP 413 approved by Department of Mines and Petroleum (DMP) on 23 August 2013.

1.6 Proposal description

1.6.1 Summary

The main elements of the Proposal involve laying out a grid of receiver cables and detectors and conducting a vibroseis survey. One of the key objectives of the survey is to define the location and form of the Beagle Fault, which is located near the eastern boundary of Beekeeper's Nature Reserve. There is no intention to conduct any drilling within the nature reserve. The survey will assist Norwest in ensuring future wells are drilled in locations that minimise the risk of intersecting this fault system. Disturbance of native vegetation is required to provide survey line access.

Survey lines are proposed to be placed in a grid of approximately 350 m by 450 m. (Figure 2). The width of disturbance along each line is estimated to be around four metres. Using a 400 m grid of four metre wide tracks the total area of disturbance is 250 ha (approximately 2% of the 10 600 ha footprint).

Source wires are placed along north-south oriented lines, and receiver wires along east-west oriented lines, laid using light vehicles. Geophones are inserted into the ground to approximately 300 mm depth. Vibroseis trucks traverse north-south source lines, creating plate vibrations at regular intervals, which are received by geophones. Data received is interpreted to create subsurface imaging.

Seismic survey lines can be deviated from the nominal mapped alignments by up to approximately 15 m without losing definition in survey results, to account for the presence of rock outcrops, trees, soaks, creek lines, other environmental values such as populations of conservation-significant flora or vegetation or conservation-significant fauna habitat or landforms prohibiting clear passage. Disturbance to native vegetation will also be minimised by using existing tracks where possible.

Where clear passage is prevented or prohibited, access may be sought on foot and wires may be placed by hand.

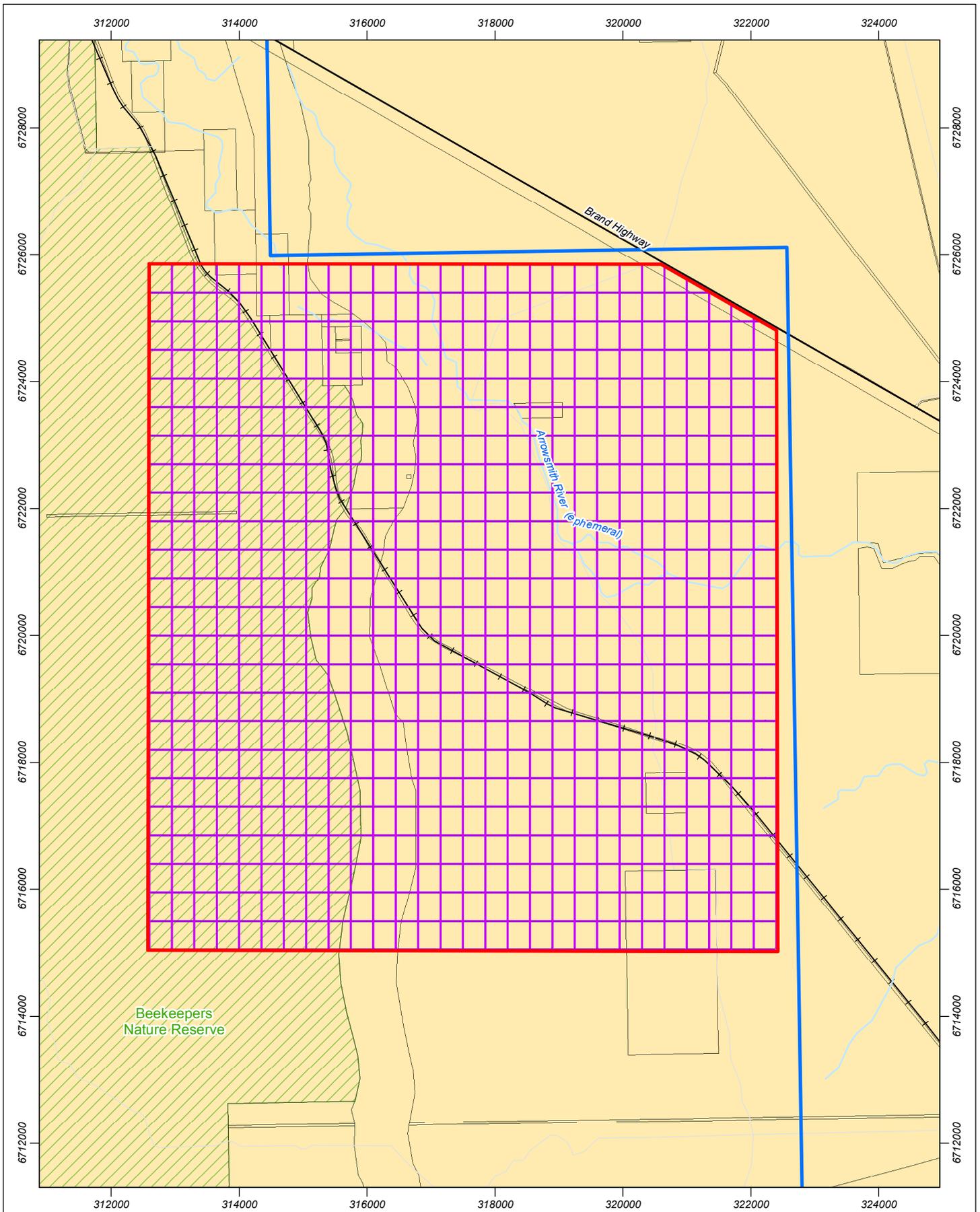
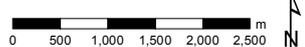


Figure 2 Site plan – Proposal details

Scale 1:80,000 at A4



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 15/10/2013

Author: JCrute
 Source: Roads, Reserve: Geoscience Australia 2011.
 Exploration Permit: DMP 2012. Cadastre: SLIP online, Landgate 2013.

Path: Q:\GIS\Consult\2013\NEE\NEE13184\ArcMap_documents\R001\Rev0\NEE13184_01_R001_Rev0_F002.mxd

Legend

- Major road
- Minor road
- Drainage line
- Rail line
- Exploration Permit EP 413
- Seismic survey boundary
- Survey lines with 2m buffer either side (4m width)
- Cadastral boundaries



1.6.2 Key Proposal characteristics

Key Proposal characteristics are defined in Table 3.

Table 3 Key Proposal characteristics

Summary of the Proposal		
Proposal Title	EP 413 3D Seismic Survey	
Proponent Name	Norwest Energy NL	
Life of Proposal	Six weeks including demobilisation and rehabilitation (excluding ongoing rehabilitation monitoring).	
Short Description	<p>The Proposal is to undertake a 3D seismic survey within EP 413 in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia.</p> <p>The Proposal comprises the following components:</p> <ul style="list-style-type: none"> • preparation of access lines • laying source and receiver lines and insert geophones • undertaking vibration plate analysis using vibroseis trucks • demobilizing, rehabilitating and closing vehicular access to seismic lines, and monitoring. 	
Physical elements		
Element	Proposed Location	Proposed maximum extent
Total Ground Disturbance Area	Conceptual disturbance footprint is shown in (Figure 2).	No more than 250 hectares (ha) within a total Proposal area of 10 600 ha.

1.6.3 Project schedule and life

The seismic survey is expected to take place in winter 2014. The life of the Proposal is expected to be approximately six weeks, including demobilisation and rehabilitation (excluding ongoing rehabilitation monitoring).

1.6.4 Disturbance method

Vegetation will be cleared in tracks to provide survey line access of between 2.5 and 4 m wide. Survey grid spacing is at intervals of between 350 m and 450 m. The conceptual survey grid is displayed in (Figure 2).

Clearing will involve removal of vegetation above ground level only, leaving topsoil and rootstock undisturbed. Vegetation removed will be mulched and respread over the cleared areas immediately following completion of the survey.

Survey lines are prepared by a line preparation crew using swath maps detailing sensitive areas to be avoided. Where sensitive landforms or vegetation communities are identified, seismic lines are hand-prepared.

3D seismic survey lines are set out on the following basis:

- survey lines will follow natural contours
- minimisation of vegetation removal
- minimisation of soil disturbance
- avoidance of windrows to prevent effects on natural drainage patterns
- deviation around sensitive areas or areas of significance
- discouragement of third party use of lines to enhance rehabilitation
- avoidance of blocking channel or impeding water flow at creek crossings by hand-carrying cables and equipment or using naturally clear areas

- avoidance of visual corridor effects, particularly in dense vegetation and at crossings by hand-cutting rather than clearing trees (Terrex Contracting 2010).

This technique has been utilised in surveys of a similar nature, such as the Warro gas field 3D onshore seismic survey (EPA 2010), and prior to that, the Denison 3D seismic survey (EPA 2004a).

The mulching of vegetation has been adopted in preference to broadscale clearing to retain topsoil containing seed stock and rootstock, both of which facilitate rehabilitation and revegetation. This method results in temporary disturbance and vegetation is able to regenerate more quickly than would be the case with clearing (Terrex Seismic 2012).

1.7 Stakeholder consultation

Norwest has undertaken a consultation program with key stakeholders in relation to its exploration activities in the local area. The stakeholder groups identified to date include:

- State government agencies, including DMP (Environmental and Petroleum Divisions), and Department of Parks and Wildlife (DPaW) as the manager of Beekeeper's Nature Reserve.
- community stakeholders
- land owners.

The methods for consultation and communication included:

- face-to-face meetings
- telephone calls
- site visits
- direct mail and email.

Table 4 summarises the key consultation events, topics raised and the response to matters raised.

Norwest will maintain a stakeholder consultation program throughout the life of the Proposal as part of normal business practice, providing updates to relevant stakeholders as required. The list of stakeholders will continue to be developed and revised as required.

Table 4 Stakeholder consultation

Key stakeholder	Issues raised	Response
Government		
DMP – Environmental Division	3D seismic proposal approval pathway	Approvals strategy developed (currently being implemented)
DMP – Petroleum Division	3D seismic proposal approval pathway	Approvals strategy developed (currently being implemented)
DPaW	Meeting to discuss impact on survey area with focus on Beekeeper's Nature Reserve.	DPaW suggested certain strategies for environmental management which have been incorporated into the referral documentation
OEPA	Introduction to Proposal	Preparation of s 38 referral (this document)
Shire of Irwin	Provided with general project updates on a regular basis. No issues raised.	Ongoing consultation will continue.
Department of the Environment (DOTE)	Briefing on the proposal and discussion on relevant matters of National Environmental Significance	Briefing scheduled October 2013
Landowners		
Landowner of pasture in north-west of survey area	Access to land (already cleared) for 3D seismic survey.	Established positive relationship with landowner – access granted
Proposed – landowner of fenced area in south-east of survey area	TBC	

1.8 Regulatory framework and environmental approvals

1.8.1 Applicable legislation

The key environmental legislation applying to the Proposal includes, but is not limited to:

- *Environmental Protection Act 1986* (EP Act) (WA)
- *Conservation and Land Management Act 1984* (CALM Act) (WA)
- *Wildlife Conservation Act 1950* (WC Act) (WA)
- *Petrol and Geothermal Energy Resources Act 1967* (WA)
- *Aboriginal Heritage Act 1972* (AH Act) (WA)
- *Rights in Water and Irrigation Act 1914* (RIWI Act) (WA)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth)
- *Native Title Act 1993* (Commonwealth).

1.8.2 Western Australian environmental impact assessment process

The EP Act is the primary legislation that governs environmental impact assessment and protection in Western Australia. This Proposal is being referred to the EPA under s 38(1) of the EP Act.

1.8.3 Other state environmental approvals

Petroleum tenure

Onshore petroleum exploration and development activity is subject to the *Petroleum and Geothermal Energy Resources Act 1967*, administered by the State Government through the Department of Mines and Petroleum (DMP). Vacant acreage is periodically released by the DMP for applications to implement a work program undertaking a full assessment of the petroleum energy potential of the area. The tenure of EP 413 R2 was extended in 2004 to several parties, one of which is Norwest. This permit was extended by DMP on 23 August 2013 for a further five years. Undertaking a 3D seismic survey is a 'Year One' commitment of this approval. The boundary of EP 413 is shown in Figure 1.

Australian Government environmental impact assessment process

While the states and territories have responsibility for environmental matters at a state and local level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to focus the Australian Government interests on protecting Matters of National Environmental Significance (MNES).

The EPBC Act requires an assessment as to whether a proposed action is likely to have a significant effect on a MNES.

The most relevant matter of MNES is that which aims to protect threatened species and ecological communities. The EPBC Act lists flora and fauna species that are either extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Ecological communities are listed that are critically endangered, endangered or vulnerable. An assessment requires determining the presence (either confirmed or likely) of listed threatened species and communities in the Proposal area and the likelihood of significant impacts that may be posed by the proposed action.

The Proposal will be referred to the Department of the Environment (DotE) under the provisions of the EPBC Act.

1.8.4 Consistency with environmental principles

In 2003, the EP Act was amended to include a core set of principles that are applied by the EPA in assessing proposals. These environmental protection principles listed in s 4A of the EP Act are:

- precautionary principle
- principle of intergenerational equity
- principle of the conservation of biological diversity and ecological integrity
- principle relating to improved valuation, pricing and incentive mechanisms
- principle of waste minimisation.

Norwest has considered these principles in its design and will continue to do so during implementation of the Project (Table 5).

Table 5 Principles of environmental protection

Principle	Consideration	Relevant section
<p>1. Precautionary principle</p> <p>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</p> <p>In the application of the precautionary principle, decisions should be guided by:</p> <ul style="list-style-type: none"> - Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment - An assessment of the risk-weighted consequences of various options. 	<p>Biological and technical studies will be undertaken to ensure that the potential effects of the Proposal have been appropriately identified and assessed. The results of these studies will be used in design and planning to ensure that appropriate management measures have been adopted to avoid, where practicable, and/or minimise potential effects.</p> <p>The current understanding of potential impacts and proposed management has been outlined in this supporting document.</p> <p>Precautionary principles have been applied to environmental impacts related to the Project with the intention of identifying issues early in the process to enable planning to avoid, prevent or manage effects.</p> <p>The Proposal has been designed to minimise potential effects to flora, vegetation, fauna and surface water.</p>	Sections 2.2, 2.3, 2.4 and 2.5.
<p>2. Intergenerational equity</p> <p>The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</p>	<p>The Proposal has been designed to minimise potential effects to flora, vegetation, fauna and surface water and will ensure that the health, diversity and productivity of the environment is maintained and/or enhanced for the benefit of future generations.</p> <p>Survey lines will be rehabilitated on completion of activities.</p>	Sections 2.2, 2.3, 2.4 and 2.5.
<p>3. Conservation of biological diversity and ecological integrity</p> <p>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</p>	<p>Conservation of biological diversity and ecological integrity is the Norwest approach to environmental management and is a major environmental consideration for the Proposal.</p> <p>Biological investigations will be undertaken to identify values of environmental conservation significance required to be protected from disturbance.</p> <p>The Proposal has been designed to minimise potential impacts to the key environmental values of the surrounding environment. Vegetation disturbance will be kept to a minimum through the use of previously cleared areas and the use of existing infrastructure.</p> <p>Norwest is committed to restoring disturbed environments.</p>	Sections 2.2, 2.3, 2.4 and 2.5.

Principle	Consideration	Relevant section
<p>4. Improved valuation, pricing and incentives mechanisms</p> <p>Environmental factors should be included in the valuation of assets and services.</p> <p>The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.</p> <p>The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.</p> <p>Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentives structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.</p>	<p>Norwest acknowledges the need for valuation, pricing and incentive mechanisms and endeavours to pursue these principles when and wherever possible.</p>	<p>Sections 2.2, 2.3, 2.4 and 2.5.</p>
<p>5. Waste minimisation</p> <p>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</p>	<p>Waste management will be consistent with the hierarchy of waste minimisation, that is:</p> <ul style="list-style-type: none"> • avoid and reduce at source • reuse and recycle • treat and/or dispose. 	<p>Sections 2.2, 2.3, 2.4 and 2.5.</p>

1.9 Existing environment

1.9.1 Climate

The climate of this region is dry Mediterranean, characterised by hot, dry summers and mild, wet winters. Climate records for the closest Bureau of Meteorology station to the Proposal area (Green Grove – #8057) indicates a mean annual rainfall of 499.2 mm, 83% of which falls in April through to September (BOM 2012).

The area is subject to high summer day temperatures and low winter night temperatures. Summer days are warm/hot with average maximum temperature reaching above 30°C for between December and February while winter temperatures average a cooler 20°C during June through August.

1.9.2 Geology, landform and soils

Geology

Surface geology is comprised of coastal dune and floodplain deposits, described as Yarragadee formation of fine-grained to coarse-grained sandstone with thin shale interbeds (DMP 2012).

Geology mapping covering the EP 413 area (Dongara – Hill River 1:250,000 sheets) indicates that three broad surface geologies occur across the study area as follows:

1. Qa – channel and flood plain alluvium: gravel, sand, silt, clay. May be locally calcreted.
2. Qd – dunes, sandplain with dunes and swales: may include numerous interdunal claypans. May be locally gypsiferous
3. Qdct – unconsolidated to strongly lithified calcarenite with calcrete/kankar soils; Aeolian. Locally quartzose, feldspathic, or heavy-mineral bearing.

These overlie the Perth Basin, which is a deep trough of sedimentary layers containing substantial groundwater reserves (O2 Ecology 2012).

Landform

Landforms across the Proposal area can be described as flat to gently undulating sand plains, sand ridges, with occasional limestone ridges. Elevation across the Proposal area ranges from approximately 30 m to 75 m above sea level. Arrowsmith Hill (75 m) occurs towards the centre of the Proposal area (O2 Ecology 2012).

The Arrowsmith River is a prominent riparian feature in the Proposal area and provides the only other marked change in the land surface profile (O2 Ecology 2012).

Soils

Soils in the Proposal area reflect the long geological history of the region. The soil landscapes are mostly derived from sedimentary rocks of the Perth Basin and have been subjected to weathering over a long period of time. The result is soils with deeply weathered profiles that are inherently low in nutrients and have an accumulation of salt deep in the profile. Major soil types occurring in the Proposal area are based on North Coastal Plain Land Resources Survey soils mapping are described in Table 6.

Table 6 Soil units across the Proposal area (O2 Ecology 2012).

Soil unit	Description	Soil type	Vegetation association
Correy 1 subsystem	Alluvial plain on Quaternary and recent alluvium and colluvium in the nor-north-west of Eneabba	Pale deep sands dominate with yellow deep sands and shallow and deep sandy duplexes	Banksia low open woodland
Correy 2 system	Active alluvial plain including lower end of main channel on Quaternary and recent alluvium in the west end of Arrowsmith River	Yellow, brown and pale deep sands and sandy earths	Acacia scrub with occasional York gum woodland
Correy 3 subsystem	Rarely inundated flats and depressions on recent alluvium at the end of the surface expression of the Arrowsmith River	Cracking and non-cracking clays and pale sandy earths	York and river gums, some melaleuca
Indoon 2 subsystem	Plain associated with lake, lower lying areas seasonally inundated seasonally inundated, small lakes too small to map	Cracking and non-cracking clays; water; pale deep sands on lunettes	-
Indoon 3 subsystem	Narrow, poorly drained clayey plain adjacent to the coastal limestone	Grey sandy and loamy duplex soils, and grey clays	York gum
Tamala south 4 subsystems	Low hills and rises with relic dunes and some limestone outcrop on lithified Pleistocene calcareous dune deposits in the south of Dongara to Kalbarri	Yellow shallow sand with limestone outcrops and yellow deep sand	Heath

1.9.3 Hydrology

The Proposal area is located within the Arrowsmith River and the Indoon Logue Catchments (O2 Ecology 2012). The Arrowsmith River flows from east to west through the Proposal area. This river is ephemeral and does not reach the ocean, rather terminating in freshwater lakes along the edge of the coastal limestone belt (Shire of Irwin ND).

Groundwater is contained within superficial formations on the coastal plain and the Yarragadee Formation. Groundwater quality in superficial aquifers is increasingly saline towards the coast and near the Irwin and Arrowsmith Rivers due to saltwater intrusion and infiltration of saline runoff (Shire of Irwin ND).

The Yarragadee Formation comprises sand, shale and siltstone and extends 1000 m deep. The water table may lie 130 metres below ground level (mbgl), with only the uppermost 100 m considered fresh. Salinity increases with depth towards the coast and is associated with saltwater intrusion. Groundwater underlying the Yarragadee Formation is saline (Shire of Irwin ND).

1.10 Social environment

Land use in the mid-west of Western Australia has centred around farming (cropping, pastoral and animal husbandry) since the 1860s. Other primary industries in the area include rock lobster fishing, mineral sands mining, aquaculture, olive farming and olive oil production. Onshore exploration for oil and gas production prospects is increasing in prominence in the region.

The Proposal area is located within a sparsely-populated region with minimal settlement, transport and communications infrastructure. The township of Eneabba, approximately 30km to the south, is the largest population centre in the vicinity of the Project area. Land use within the surrounding area is pastoral, primarily wheat, sheep and cattle farming. Various tracts of bushland within the region support honey production (on a seasonal basis) and commercial wildflower harvesting.

The Proposal area for the survey overlays land subject to crown reserve (Victoria Location), unallocated crown land, crown land, road and rail reserve and private freehold tenure. The Proposal encompasses some pasture, some Nature Reserve and some remnant native vegetation. A number of other Nature Reserves are located within the vicinity of the Proposal.

There is some pastoral land located in the north-west corner of the survey area, and some cleared land in the south-east corner hosting a fire water tank under the management of the regional branch of DPaW. There is a freecamp along Brand Highway located approximately 500 m north of the northern boundary of the Proposal, and the nearest residential building is located approximately 3.8 km north of the northern boundary of the Proposal.

Cultural heritage

A search of the Aboriginal Heritage Inquiry System was conducted in September 2013. No heritage sites were identified within the boundaries of EP 413 (Appendix 3).

An Aboriginal heritage and ethnographic survey was conducted in April 2010 to assist in the planning of the Arrowsmith-2 well-site (within the Proposal area) in order to avoid all possible Aboriginal artefacts/relics and heritage areas. No items of heritage significance were identified during this survey.

Norwest is committed to ensuring that any sites of heritage significance will not be impacted by the Proposal.

2. Potential environmental impacts and management

2.1 Relevant factors

This chapter provides a summary of the preliminary environmental factors potentially relevant to the assessment of impacts of this Proposal. The preliminary environmental factors have been separated into two groups:

1. Key factors: Those environmental factors of elevated significance, which require the most attention in the Environmental Impact Assessment (EIA) process. The key factors include the following, and are discussed in Sections 2.2 to 2.4:
 - vegetation and flora
 - terrestrial fauna
 - rehabilitation and closure.
2. Other factors: Those environmental factors and issues of lesser importance that are recognised as potentially requiring consideration and management. Other factors or issues include the following, and are discussed in Section 2.4:
 - air quality (dust)
 - terrestrial environmental quality/inland waters environmental quality (hazardous waste).

This list and division of factors and issues has been based on pre-referral consultation and guidance from regulatory agencies such as Office of the EPA, DPaW, DMP and DotE, the results of relevant regional studies, as well as the experience and advice of Norwest personnel and the range of environmental consultants engaged to undertake environmental assessments and investigations of the Proposal.

The following sections describe and discuss these factors.

2.2 Vegetation and flora

2.2.1 EPA objectives

Management strategies will be developed and implemented to meet the following EPA objectives for vegetation and flora:

To maintain representation, diversity, viability and ecological function at the species, population and community level.

2.2.2 Surveys and investigations

Completed surveys

A Level 1 flora survey was undertaken within EP 413 (survey area) by O2 Ecology in October 2012 to capture spring flowering species. The survey was conducted in accordance with EPA Guidance Statement No. 51: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b) and EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000). The survey report is provided as Appendix 2.

Planned surveys

A Level 2 vegetation survey and targeted threatened flora survey has been commissioned. The Level 2 survey will be undertaken in accordance with EPA Guidance Statement 51; specifically:

- the survey will be multi-seasonal and include field assessment during the optimal spring flowering period (September and January)
- the survey will comprise sufficient quadrats to be considered representative of the survey area – i.e. be reasonably spread across the survey area, cover all landforms, and sample all vegetation communities present
- quadrats will follow standard methodology to enable statistical comparison with the database of threatened and priority communities
- the targeted threatened flora survey will aim to target 'high risk' areas (where threatened flora are most likely to be found), based on preliminary outcomes of the Level 2 survey.

DPaW has been consulted in relation to the scope and nature of the proposed survey.

2.2.3 Description of factor

Flora species

137 taxa (24 families and 73 genera) were recorded in the Level 1 spring survey (O2 Ecology 2012).

Vegetation associations

Four vegetation associations based on vegetation mapping of pre-European extent (Shepherd et al 2002 & Beard 1976) were mapped and described (O2 Ecology 2012) within the survey area as follows:

- **433** – Mosaic: Shrublands: *Acacia rostellifera* & *Melaleuca cardiophylla* thicket/ Sparse low woodland; illyarrie
- **377** – Mosaic: Shrublands: scrub-heath on limestone in northern Swan region/ Sparse low woodland; illyarrie
- **352** – Medium woodland: York gum
- **378** – Shrublands; scrub-heath with scattered *Banksia* spp., *Eucalyptus todtiana* & *Xylomelum angustifolium* on deep sandy flats in the Geraldton Sandplains region
 - * *Acacia* mixed open shrubland
 - * *Banksia* mixed open shrubland
 - * *Calytrix* mixed heath.

The distribution of these vegetation associations is shown in Figure 3.

Vegetation types

Fourteen vegetation units have been surveyed and mapped by across the survey area (O2 Ecology 2012) and are shown in Figure 4 and described in Table 7.

Table 7 O2 Ecology (2012) vegetation units

Unit name	Description	Presence of priority flora recorded	% cover of entire survey area
<i>Acacia blakelyi</i> open shrubland	<i>Acacia blakelyi</i> open shrubland typically over <i>Hibbertia hypericoides</i> . <i>Banksia</i> spp., <i>Calothamnus quadrifidus</i> open heath with occasional <i>Conospermum candicans</i> over <i>Scaevola sericea</i> and <i>Dampiera spicigera</i> low sparse shrubland/heathland. A very sparse layer of sedges may be present. Isolated <i>Eucalyptus tottiana</i> mallee trees, <i>Banksia prionotes</i> and/or <i>Xylomelum angustifolium</i> may be present.	P4	0.9
<i>Acacia spathulifolia</i> shrubland	<i>Acacia spathulifolia</i> shrubland/heathland to closed shrubland to 2 m tall occasionally with <i>Banksia sessilis</i> , <i>Jacksonia hakeoides</i> over a low shrubland of <i>Banksia leptophylla</i> , <i>Eremaea beaufortoides</i> , <i>Hibbertia hypericoides</i> . <i>Xanthorrhoea drummondii</i> and <i>Macrozamia fraseri</i> are occasionally conspicuous components. Ground layer is very open to sparse rushland of <i>Ecdeiocolea monostachya</i> . Isolated <i>Eucalyptus erythrocorys</i> mallee trees may be present at various sites. Forms a mosaic with the <i>Banksia</i> spp. low open shrubland unit.	P3 P4	39.3
<i>Acacia</i> tall closed shrubland	<i>Acacia rostelifera</i> forms a tall (5 m) closed shrubland to dense thickets in places over <i>Jacksonia hakeoides</i> , <i>Hakea trifurcata</i> , <i>Melaleuca</i> spp. open shrub layer to 1.5 m over a sparse forbland of <i>Conostylis</i> among other species. Occurs within Beekeeper's NR towards to western boundary of the study area.	-	-
<i>Banksia</i> spp. low open shrubland	<i>Banksia</i> spp. and/or <i>Melaleuca</i> spp. low (to 1 m) open to closed shrubland/heathland with <i>Hakea trifurcata</i> , <i>H. circumalata</i> , <i>Regelia ciliata</i> , <i>Hibbertia hypericoides</i> , <i>Macrozamia fraseri</i> , <i>Eremaea beaufortoides</i> , <i>Calothamnus quadrifidus</i> common. Ground layer typically open sedgeland, to forbland to clumps of grass (<i>Neurachne alopecuroidea</i>).	P3 P4	9
<i>Banksia</i> spp. low open shrubland with emergents	<i>Banksia</i> spp. and/or <i>Melaleuca</i> spp. form a low (to 1.2 m) open to closed shrubland/heathland (as above). Scattered individuals or clumps of <i>Eucalyptus tottiana</i> mallee trees, <i>Banksia prionotes</i> and/or <i>Xylomelum angustifolium</i> are present above the shrubland canopy	P3 P4	16.9
<i>Eucalyptus camaldulensis</i> woodland	<i>Eucalyptus camaldulensis</i> and/or <i>E. loxophleba</i> woodland to 16 m tall along the active channels and associated floodplains of the Arrowsmith River over open to closed shrubland of <i>Melaleuca raphiophylla</i> , <i>Grevillea</i> spp., <i>Jacksonia hakeoides</i> over a sparse forbland/sedgeland characterised by sedges, grasses and forbs.	P3	1.5
<i>Eucalyptus erythrocorys</i> mallee woodland	<i>Eucalyptus erythrocorys</i> forms a mallee woodland 3 – 8 m tall typically over an open to closed shrubland of <i>Acacia spathulifolia</i> with <i>Banksia sessilis</i> and/or <i>Jacksonia hakeoides</i> over <i>Ecdeiocolea monostachya</i> sparse rushland. Often found on sands overlying limestone.	P2 P4	16.7
<i>Eucalyptus erythrocorys</i> open mallee woodland	<i>Eucalyptus erythrocorys</i> open mallee woodland over closed shrubland of <i>Acacia spathulifolia</i> with <i>Gyrostemon ramulosus</i> and/or <i>Banksia sessilis</i> . <i>Melaleuca</i> spp. comes more prominent depending on position in landscape and depth of soil over a <i>Hibbertia hypericoides</i> , <i>Thryptomene</i> sp. low shrubland over <i>Ecdeiocolea monostachya</i> sparse rushland. Typically on limestone ridges with shallow sandy soils.	P3	9.6
<i>Eucalyptus erythrocorys</i> open woodland	<i>Eucalyptus erythrocorys</i> and/or <i>E. loxophleba</i> open woodland over sparse tall shrub layer of <i>Anthocercis littorea</i> over <i>Acacia spathulifolia</i> shrubland. Occurs on alluvial floodplains associated with Arrowsmith River.	-	-
<i>Melaleuca</i> tall closed to tall shrubland	<i>Melaleuca raphiophylla</i> tall (to 2 m) closed shrubland to thicket with <i>Leptospermum oligandrum</i> over low open shrubland of <i>Hibbertia</i> sp. Predominantly confined to recent alluvial plains associated with the Arrowsmith River.	P2 P3	2.5
Open shrubland	<i>Acacia</i> sp., <i>Banksia sessilis</i> open shrubland over <i>Stirlingia latifolia</i> , <i>Daviesia pedunculata</i> , <i>Hibbertia hypericoides</i> heathland.	-	-

Unit name	Description	Presence of priority flora recorded	% cover of entire survey area
Tall shrubland	Tall shrubland of <i>Anthocercis littorea</i> , <i>Banksia prionotes</i> and <i>Macrozamia fraseri</i> over shrubland of <i>Acacia</i> sp., <i>Chamelaucium uncinatum</i> , <i>Hakea trifurcata</i> over sparse grassland of <i>Neurachne alopecuroidea</i> .	-	-
Ephemeral lake	A drainage depression is evident on the aerial photography towards the southern boundary of the project area but was not assessed during this survey. It is assumed that it would act as an ephemeral lake during the wetter part of the year and may support a range of ephemeral species.	P2	0.1
Pasture	Areas towards the north of the study area have been converted to wheat/sheep production. Includes clumps and isolated trees of <i>Eucalyptus</i> spp. with no native understorey strata remaining.	-	-

Vegetation condition

The vegetation condition within the survey area ranged from completely degraded to excellent as adapted from the Keighery (1994) and Kaesehagen (1994) scales (Table 8).

Table 8 Vegetation condition within 2012 botanical survey area

Vegetation condition scale (Keighery [1994] and Kaesehagen [1994])		Area (ha)	Proportion of total area (%)	Description
Condition	Condition description			
1	Excellent	10 300	92.6	>80% native flora composition; vegetation structure intact or nearly so; minor signs of disturbance; weed are non-aggressive species (cover <5%)
2	Good	616	5.5	60-80% native flora composition; vegetation structure altered in places; obvious signs of disturbance; weed cover/abundance 5-20%
3	Fair	63	0.6	40-60% native flora composition; vegetation structure significantly altered yet retains basic structure or ability to regenerate to it; very obvious signs of multiple disturbance; weed cover/abundance 20-50%
4	Completely degraded	143	1.3	<20% native flora composition; vegetation structure no longer intact; extensive disturbance/modification present; weeds are highly invasive (cover/abundance >80%)
Total area (ha)		11 122	100	

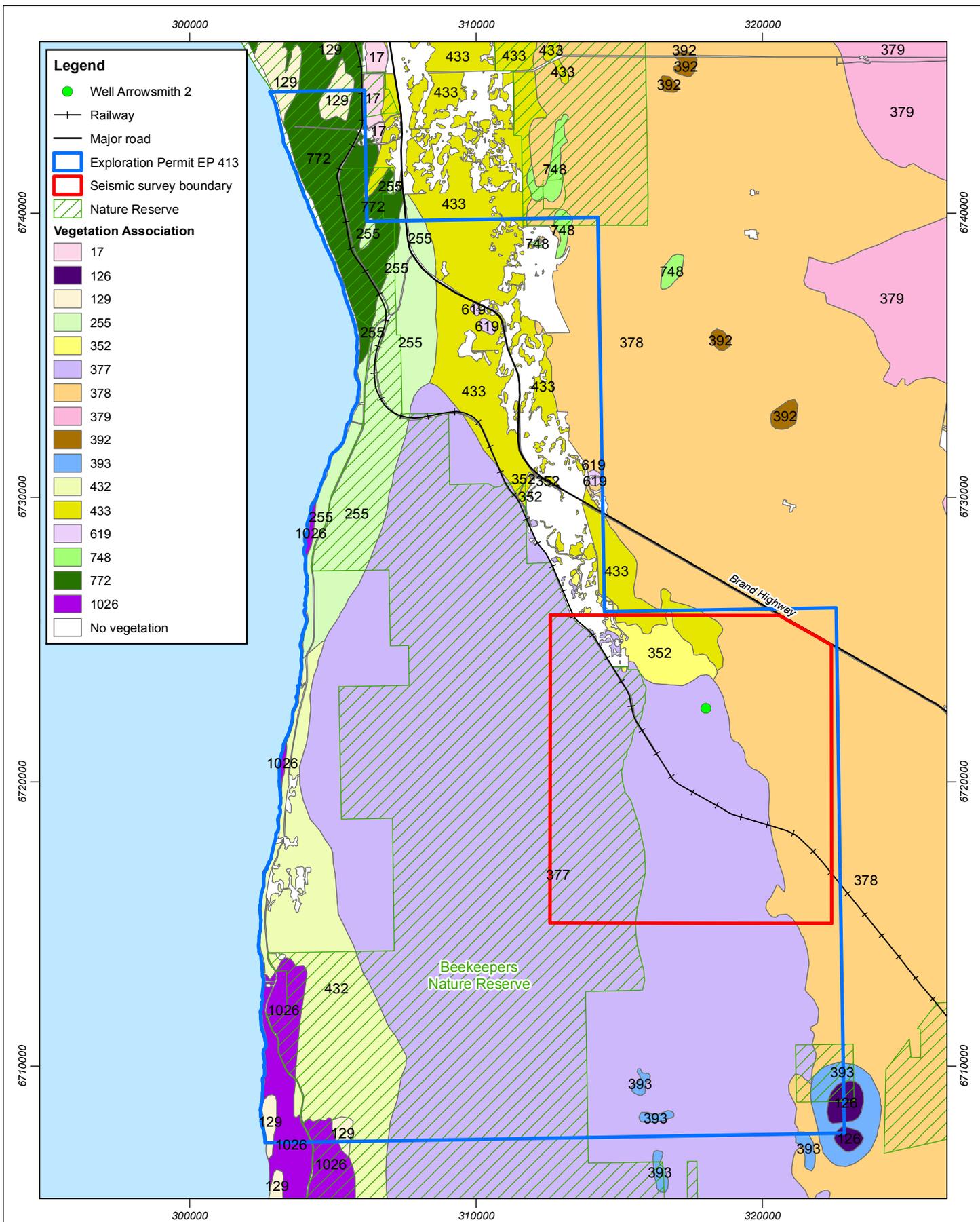


Figure 3 Vegetation associations within the Proposal area (Shepherd et al 2002 & Beard 1976)

Scale 1:180,000 at A4



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 15/10/2013

Author: JCrute

Source: Topography: Geoscience Australia 2012.

EP 413: DMP 2012. Vegetation: DAFWA 2011.

Path: Q:\GIS\Consult\2013\NEE\NEE13184\ArcMap_documents\R001\Rev0\NEE13184_01_R001_Rev0_F003.mxd



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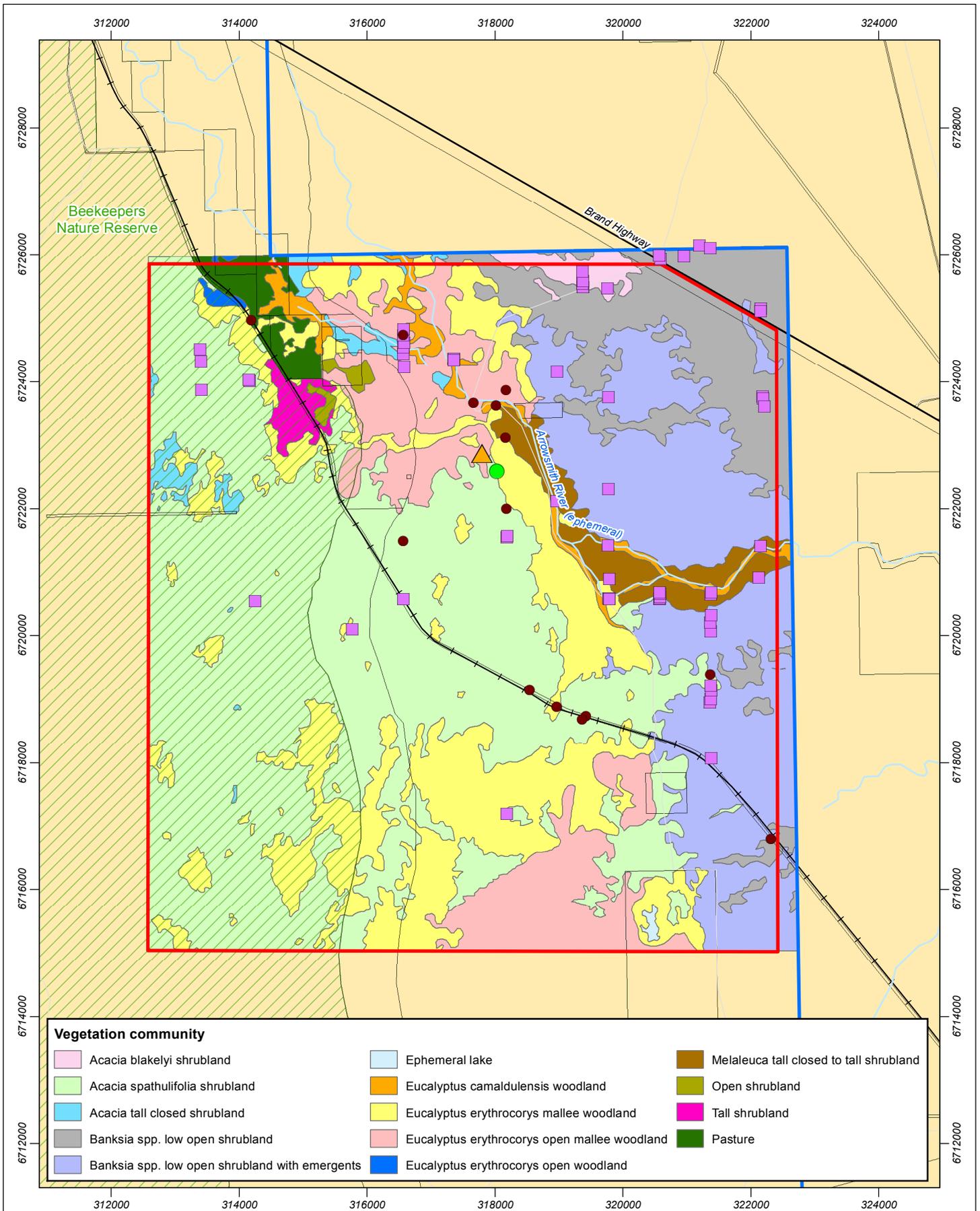
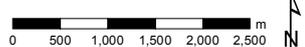


Figure 4
Vegetation units within the Proposal area and conservation significant species recordings (O2 Ecology 2012)

Scale 1:80,000 at A4



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 15/10/2013

Author: JCrute
 Source: Roads, Reserve: Geoscience Australia 2011. Vegetation/fauna: O2 Ecology 2012.
 Exploration Permit: DMP 2012. Cadastre: SLIP online, Landgate 2013.

Path: Q:\GIS\Consult\2013\NEE\NEE13184\ArcMap_documents\R001\Rev0\NEE13184_01_R001_Rev0_F004.mxd

Conservation areas

The western edge of the Proposal area partially overlays Beekeeper's Nature Reserve (Figure 2). Beekeeper's Nature Reserve is a major regional nature reserve that was vested with the Conservation Commission of Western Australia as a "C" Class Nature Reserve for the Protection of Flora in 1992. It is listed as a nature reserve under the *Conservation and Land Management Act 1984*.

Threatened and Priority Ecological Communities

No threatened ecological communities (TEC) or priority ecological communities (PEC) were identified during the Level 1 spring survey (O2 Ecology 2012).

Conservation significant flora

A total of 26 conservation significant flora species have the potential to be present in the Proposal area, including one threatened species (*Leucopogon obtectus*). Of these, eight priority listed species were recorded during the Level 1 survey (O2 Ecology 2012) and included the following (Figure 4):

- *Banksia elegans* (P4)
- *Grevillea erinacea* (P4)
- *Guichenotia quasicalva* (P3)
- *Hopkinsia anoectocolea* (P2)
- *Persoonia rudis* (P3)
- *Schoenus griffinianus* (P3)
- *Stawellia dimorphantha* (Arrowsmith stilt-lily) (P4)
- *Verticordia fragrans* (P3).

Riparian vegetation

The Arrowsmith River is located within the Proposal area (O2 Ecology 2012). Disturbance will be minimised by:

- leaving riparian vegetation intact so as to retain bank stability and habitat for riparian fauna
- leaving riparian vegetation intact to obscure line-of-sight along seismic survey lines as a method of deterring third party use.

Mechanisms with which to achieve the objectives above include:

- the use of updated map and global positioning systems (GPS) to orient line preparation processes and highlight excluded areas
- using existing constructed crossings wherever possible
- stopping survey lines before reaching the creek, leaving vegetation and soil on the creek banks untouched
- hand-carrying cables and equipment to avoid damage to riparian vegetation
- deviate lines to cross creeks in naturally-cleared areas, or where the least amount of vegetation removal is necessary to facilitate safe vehicle crossing (Terrex Contracting 2010).

Introduced flora and weed species

Ten introduced species were recorded in the Proposal area (O2 Ecology 2012), including the following:

- P1 – *Echium plantagineum*
- Moderate – *Arctotheca calendula*, *Avena barbata*, *Briza maxima*, *Centaurea melitensis*, *Lysimachia arvensis*, *Sonchus oleraceus*, *Vulpia bromoides*
- Low – *Bromus hordeaceus*
- Mild – *Pennisetum setaceum*.

2.2.4 Key potential impacts

The following aspects of the Proposal may affect flora and vegetation values:

- **disturbance to vegetation** for the seismic survey lines will temporarily reduce the extent of vegetation communities, and may disturb conservation significant flora species
- **introduction and spread of weeds and dieback** from vehicle movements
- **increased incidence/frequency of fire** from on-site ignition sources may favour the establishment of weeds and prevent the regeneration of native vegetation.

2.2.5 Mitigation and management measures

Management and monitoring actions for vegetation and flora will be detailed in an Environmental Management Plan (EMP) to be developed as part of the EIA for this Proposal. Management of potential impacts on flora and vegetation will be based on.

- adherence to clearing boundaries
- minimising clearing of riparian vegetation
- erosion protection
- dust control
- surface water management
- weed/hygiene management
- dieback management
- hydrocarbon management
- fire management.

2.3 Terrestrial fauna

2.3.1 EPA objectives

The EPA applies the following objective in its assessment of proposals that may affect terrestrial fauna:

To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.

2.3.2 Surveys and investigations

Completed surveys

A threatened fauna assessment was undertaken within EP 413 (survey area) by O2 Ecology in October 2012. The survey was conducted in October 2012 in accordance with EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (2002). The survey report is provided as Appendix 2.

Planned surveys

Any required further studies will be in accordance with EPA guidance (Position Statement No. 3, Guidance Statement No. 20 and Guidance Statement No. 56) and in consultation with Office of the EPA and DPaW.

2.3.3 Description of factor

Fauna habitat

O2 Ecology (2012) identified ten key fauna habitats within the survey area that are described in Table 9.

Table 9 Fauna habitat within the Proposal area (O2 Ecology 2012)

Habitat type	Description	Fauna habitat value
<i>Banksia</i> low open shrubland with emergents	<i>Banksia</i> over open to closed shrubland or heathland. Some fallen woody debris and leaf litter. Abundant flowers and fruits. Abundant microhabitats in the form of hollows and depressions in ground.	Good foraging and cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles.
<i>Casuarina</i> woodland	Medium to tall trees over bare sand. Abundant leaf litter. Abundant fruits. Some groundcover by large sedges	Potential food source for the endangered Carnaby's Black-Cockatoo.
Closed heathland	Low vegetation. Abundant flowers. No hollow-bearing logs or hollows in trees. Thick groundcover of sedges and grasses. Abundant microhabitats in the form of hollows and depressions in ground.	Good foraging and cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles.
<i>Eucalyptus</i> woodland	Tall <i>Eucalyptus</i> over open to closed shrubland. Large fallen woody debris and leaf litter. Tree hollows and log hollows.	Good foraging and cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles.
<i>Melaleuca</i> closed tall shrubland	Dense vegetation cover adjacent to Arrowsmith River. Some flowers.	Good cover for small fauna. Plentiful nesting materials and locations. Potentially supports a range of birds and small mammals.
Mallee woodland	Open woodland typically over open to closed shrubland. Cover provided by shrubs. Fallen woody debris and leaf litter. Tree hollows and log hollows.	Good cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles. Likely to support the vulnerable Malleefowl.
Open heathland	Low vegetation. Abundant flowers. No hollow-bearing logs or hollows in trees. Sparse groundcover of sedges and low shrubs. Abundant microhabitats in the form of hollows and depressions in ground.	Good foraging. Provides some cover for small mammals, reptiles and birds. Potentially supports a range of birds, small mammals and reptiles.
Open woodland on limestone ridge	Open woodland with scrub. Abundant flowers. Some hollow-bearing logs or hollows in trees. Abundant loose rocks and crevices. Sparse groundcover of sedges and low shrubs.	Good cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles.
Pasture	Low vegetation with few emergent trees. Negligible flowers, hollow bearing logs or hollows in trees. Light groundcover of grasses	Likely to support insectivorous species. Little cover for small terrestrial species.
Permanent creek with riparian vegetation	Tall riparian vegetation with thick undergrowth. Numerous small, medium and large hollows. Permanent shallow flowing water	Tall riparian vegetation may provide roosting sites for raptors. Thick riparian vegetation hosts abundant birdlife. Important water source for fauna. Numerous hollows in riparian vegetation provide good nesting habitat for birds and small mammals.

Conservation significant fauna

A search of the threatened fauna database and EPBC Act Protected Matters database indicated that two Priority 4 species, six specially protected and two threatened species may be present in the Proposal area (O2 Ecology 2012) (Table 10).

Table 10 Conservation significant fauna potentially occurring within Proposal area

Species	Status		Assessment
	WC Act / DEC	EPBC Act	
Carnaby's Cockatoo	T	E	Observed in woodland within study area
Rainbow Bee-eater	IA	M	Several sightings within survey area
Malleefowl	T	V	Nesting site (disused mound) observed within survey area
Peregrine Falcon	S		May occur. There are records in the region
Australian Bustard	P4		May occur. There are records in the region.
Western Brush Wallaby	P4		Likely to occur. There are records in the region.

T = Threatened under *Wildlife Conservation Act 1950* (WC Act); E = Endangered under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); M= migratory under EPBC Act; IA = International Agreement (JAMBA (Japan-Australia Migratory Bird Agreement)).

Three conservation significant fauna species were observed on site, including Carnaby's Cockatoo, Rainbow Bee-eater and Malleefowl (O2 Ecology 2012). Observations have been aligned with vegetation types and habitat types to identify distribution within the Proposal area. The recorded locations of each listed species are provided in (Figure 4). While a Protected Matters search did not identify Western Ground Parrot and no records exist for the region, anecdotal evidence indicates that this species may also be found in the area.

Carnaby's Cockatoo

Habitat for Carnaby's Cockatoo is described as follows (DSEWPaC 2012c):

“Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain Salmon Gum and Wandoo, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. The species is a seasonal visitor to pine plantations in areas that receive high rainfall, and is a less frequent visitor to forests containing Marri, Jarrah or Karri. It is occasionally recorded in casuarina woodlands, or in 'mallee country', and is sometimes seen in towns or on roadside verges.”

Black cockatoos breed in large hollow-bearing trees, generally within woodlands or forests. Breeding habitat is defined in the EPBC Act referral guidelines (DSEWPaC 2012j) as “trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height to develop a nest hollow.”

Potential Carnaby's Cockatoo habitat within the Proposal area was identified by comparing flora observed (O2 Ecology 2012) against flora species used by Carnaby's Cockatoo provided in the Plants for Carnaby's Search Tool (DEC 2012a).

A significant portion of the Proposal area (96.3%) contains suitable species to comprise feeding habitat for Carnaby's Cockatoo. Nineteen flora species were observed that are considered to be utilised by Carnaby's Cockatoos. O2 Ecology (2012) noted several habitat types as providing plentiful nesting materials and locations, including the following:

- *Banksia* low open shrubland with emergents
- closed heathland
- *Eucalyptus* woodland

- *Melaleuca* closed tall shrubland
- mallee woodland
- open woodland on limestone ridge
- permanent creek with riparian vegetation.

Casuarina woodland was also noted to comprise a potential food source for the endangered Carnaby's Cockatoo.

Malleefowl

Habitat for Malleefowl is described as follows (DSEWPaC 2012d):

The Malleefowl occurs in semi-arid and arid zones of temperate Australia, where it inhabits shrublands and low woodlands that are dominated by mallee vegetation with a dense understorey of shrubs (including species of Acacia, Cassia, Bossiaea and Beyeria) or grass (especially species of Triodia) and herbs with an abundance of leaf litter.

O2 Ecology (2012) noted the habitat type 'mallee woodland' was likely to support the vulnerable Malleefowl, as it provided good cover for fauna and supported a range of birds, mammals and reptiles. An abandoned Malleefowl mound was observed within the vegetation type *Eucalyptus erythrocorys* mallee woodland (O2 Ecology 2012). Mallee woodland vegetation types cover an area of 2922 ha, or 26.3% of the total Proposal area.

Other habitat types that may comprise appropriate habitat for malleefowl include the following:

- *Banksia* low open shrubland with emergents
- closed heathland
- *Eucalyptus* woodland
- *Melaleuca* closed tall shrubland
- open woodland on limestone ridge.

Approximately one quarter of the Proposal area appears to provide suitable habitat conditions for Malleefowl.

Rainbow Bee-eater

The Rainbow Bee-eater is a summer migrant that occurs in a large range of habitats. The species will often nest on sparsely vegetated slopes even in disturbed areas and have been known to nest on slopes around construction sites. The species occurs in open woodlands, semi-arid scrub, grasslands, clearing in heavier forests, farmlands and coastal areas. It avoids heavy forests due to hindrance to feeding (catching insects) (Morcombe 2003).

Habitat types that may comprise appropriate habitat for Rainbow Bee-eater comprise areas with good nesting materials and locations, including the following:

- *Banksia* low open shrubland with emergents
- closed heathland
- *Eucalyptus* woodland
- *Melaleuca* closed tall shrubland
- mallee woodland
- open heathland
- open woodland on limestone ridge
- pasture
- permanent creek with riparian vegetation.

Potential Rainbow Bee-eater habitat comprises a large proportion of the Proposal area; however, critical nesting habitat is unlikely to be present.

Western ground parrot

While a Protected Matters search did not identify Western Ground Parrot and no records exist for the region, anecdotal evidence indicates that this species may also be found in the area.

The survey undertaken in the Proposal area did not record any individuals of the Western Ground Parrot; either visually or aurally. The Western Ground Parrot is a cryptic species with a current distribution range restricted to the south coast near Albany and Esperance. One sighting was recorded from the nearby Mt Adams Road in 1992, but there have been no confirmed sightings since.

2.3.4 Key activities and their potential impacts

Potential direct and indirect effects of the Proposal on fauna include:

- **temporary loss of habitat** from vegetation disturbance resulting in a direct loss of species, and reduced breeding and foraging habitat
- **increased injuries and mortalities** from vehicle movements, infrastructure, machinery and the workforce
- **degradation of habitat** from altered hydrological regimes, increased human access, noise, dust and weed invasion
- **increased fire potential** from the presence of human activity in the area, resulting in the modification or loss of fauna habitat and conservation significant fauna
- **introduction of feral species** due to introduction of workforce and vehicles, inappropriate waste collection and disposal practices, and inadequate rehabilitation of disturbed land, resulting in fauna mortality and/or competition for resources.

2.3.5 Mitigation and management measures

Mitigation of potential impacts on fauna include:

- avoiding disturbance to habitat
- identifying and avoiding Malleefowl mounds and Western Ground parrot nests through realignment of survey lines
- avoiding removal of potential nesting / breeding trees.

Management of potential impacts on fauna will be centred on:

- reducing vehicle speeds and implementing other fauna management measures in accordance with a site-specific EMP
- adhering to clearing boundaries
- responsible storage and management of waste
- the implementation of survey during daylight hours only, preventing the need for artificial lighting
- appropriate use and storage of hydrocarbons and other hazardous material.

Management and monitoring actions for fauna will be further detailed in an EMP to be developed as part of the EIA for this Proposal.

2.4 Rehabilitation and closure

2.4.1 EPA objective

The EPA applies the following objective in its assessment of proposals relating to rehabilitation and closure:

To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.

2.4.2 Description of factor

Land rehabilitation and monitoring is aimed at minimising the potential environmental impacts of the proposed seismic survey, in particular the loss of threatened and Priority species and the loss of topsoil and erosion from wind and water.

Norwest will conduct rehabilitation work at the completion of the seismic survey, including closing the line entrances from access tracks.

2.4.3 Key impacts

The key aspects relevant to rehabilitation following completion of seismic activities include:

- controlling third party access to lines following the survey
- avoiding survey access lines becoming permanent or longer term access tracks within previously isolated areas of Nature Reserves and Unallocated Crown Land leading to second order impacts
- effectiveness of, and long term commitment to, adequate rehabilitation of seismic access lines, weed and disease control and mitigation actions.

2.4.4 Mitigation and management measures

The following management measures will be implemented to maximise rehabilitation success:

- using a mulching technique to retain vegetation rootstock
- storing vegetation matter in windrows
- replacing vegetative matter upon completion
- establishing rehabilitation completion criteria
- controlling weeds
- managing unauthorised access.

2.5 Other environmental factors and issues

Table 11 briefly outlines potential impacts and activities, and their management, associated with other environmental factors or issues relevant to the Proposal that were not identified as key factors. These other factors and issues can be regulated by other government agencies under other statutes or effectively managed through an EMP.

Primary accommodation for site personnel if permanent facilities in Dongara. The Proposal will be self-sufficient with respect to provision of utilities and services.

Table 11 Other environmental factors and issues

Factor	EPA Objective	Description	Statute	Responsible agency	Proposed management
Air quality (Dust)	To maintain air quality for the protection of the environment and human health and amenity.	Dust may be generated as a result of the Proposal primarily through vegetation disturbance activities and light traffic movements on unsealed roads.	EP Act	DER	<p>Management measures to minimise dust will include:</p> <ul style="list-style-type: none"> the application of water (or appropriate suppressants) to access roads, working surfaces and stockpiles (as required) implementing and enforcing appropriate vehicle speed limits on site access roads. <p>Management and monitoring actions for air quality will be detailed in an Environmental Management Plan to be developed as part of the EIA for this Proposal.</p>
Terrestrial environmental quality/inland waters environmental quality (hazardous waste)	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	The Proposal may involve the use of hazardous materials such as fuels and lubricants in small quantities for refuelling and maintenance of vehicles. Inappropriate handling, transport and/or storage of hazardous materials has the potential to result in discharges to the environment (i.e. contamination) and create health or safety hazards.	<i>Dangerous Goods Safety Act 2004</i>	DMP, Resources Safety Branch	<p>All hazardous material or dangerous goods storage facilities will comply with the <i>Dangerous Goods Safety Act 2004</i> and associated Dangerous Goods Safety Regulations 2007, at a minimum.</p> <p>Handling and transport of dangerous goods listed in Australian Dangerous Goods Code (currently ADG7) will be carried out as described in the MSDS for each identified material.</p> <p>Management and monitoring actions for hazardous materials will be further detailed in an Environmental Management Plan to be developed as part of the EIA for this Proposal.</p>

2.6 Offsets strategy

Norwest is aware of the need to provide environmental offsets for possible significant residual environmental impacts to high value environmental assets remaining after on-site efforts to avoid, minimise and rectify impacts have been applied.

2.6.1 Relevant policy and guidance

State offsets policy and guidance

EPA guidance is that offsets should aim 'to counterbalance any significant residual environmental impacts and risks of a proposal' (EPA 2012). Environmental offsets represent the 'last line of defence' for the environment, ensuring that adverse impacts are counterbalanced by an environmental gain somewhere else (EPA 2006). Environmental offsets should be a component of the environmental impact assessment procedure, and the EPA expects proponents to put forward commitments for offsets as part of their Proposal.

The EPA has prepared two reference papers in relation to offsets: *EPA Guidance Statement No. 19 Guidance for the Assessment of Environmental Factors - Environmental Offsets – Biodiversity* (EPA 2008) and *Position Statement No. 9 Environmental Offsets* (EPA 2006). Both documents define a series of guiding principles for proponents to follow when developing an offsets package. Environmental offsets should also consider the *Draft Environmental Assessment Guideline for Environmental Offsets* (EPA 2012) and *WA Environmental Offsets Policy* (Government of Western Australia 2011).

Australian Government offsets policy

DSEWPaC has released an EPBC Act Environmental Offsets Policy (EPBC Act Policy) (DSEWPaC 2012b) that defines two types of offsets

- **direct offsets:** measures that have on-ground, tangible benefits that improve the viability of the protected matter
- **other compensatory measures:** any other measure that contributes to the overall conservation outcome of the protected matter.

Principles guiding the EPBC Act Policy are that offsets:

1. Deliver an overall conservation outcome.
2. Be efficient, effective, transparent, proportionate, scientifically robust and reasonable.
3. Be built around direct offsets but may include indirect (i.e. compensatory) offsets.
4. Be of a size and scale proportionate to the impacts being offset.
5. Be in proportion to the level of statutory protection that applies to the affected species or community.
6. Effectively manage the risks of the offset not succeeding.
7. Be able to be readily measured, monitored, audited and enforced.

2.6.2 Net conservation benefit

As part of the EIA process, offsets will be developed in accordance with State and Australian Government guidance to address any significant residual impacts to biodiversity values associated with the Proposal. Potential residual impacts associated with the Proposal have been identified at this stage to include localised impacts on Beekeeper's Nature Reserve and habitat for Carnaby's Cockatoo; however, other potential residual impacts may be identified during future stages of the environmental impact assessment process.

As part of the EIA process, an offsets strategy will be developed and refined, and will include related mitigation strategies developed with input from the State and Australian agencies. The mitigation package will include accurate details regarding potential impact and the proposed offset measures to achieve a net conservation benefit for the area.

2.7 Conclusion

This section summarises the content discussed above regarding the key and other environmental factors and issues potentially relevant to the assessment of impacts of this Proposal (Table 12). It provides a summary of the potential impacts, proposed management measures to be addressed in detail during the anticipated EIA process as well as the further studies proposed to support the EIA.

Table 12 Preliminary summary of environmental factors, impact, management and proposed studies for the Proposal

Environmental factor	EPA objective(s)	Existing environment	Potential impacts	Proposed management	Proposed studies
Flora and vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level	The Survey Area consists of 10 600 ha of remnant native vegetation, road and rail reserve and pasture within the Geraldton Sandplains Bioregion. Proposal Area hosts four vegetation associations, made up of 14 vegetation types. Proposal Area poses potential habitat for 26 conservation-significant flora species (of which only one is designated 'threatened'). Of the 26 species that might occur, eight priority flora species were identified within the Proposal Area during a botanical survey in spring 2012. A further botanical survey is currently underway, expected to be completed in early 2014.	Potential impacts to flora and vegetation include: <ul style="list-style-type: none"> clearing of native vegetation leading to reduction in populations of conservation-significant flora or vegetation species vehicle use leading to degradation of habitat by erosion, introduction or spread of weeds or dieback, alteration of fire regimes or surface contamination. 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> Level 2 botanical survey to identify, demarcate and map populations of conservation-significant flora and vegetation species dieback survey prior to access by contractors to identify, demarcate and map areas affected by <i>Phytophthora cinnamomi</i> or other soil pathogens induction of site personnel identifying excluded areas as identified in L2 botanical survey and dieback survey induction of site personnel in site-specific EMP prepared in associated with EIA use of existing tracks where alignment coincides with mapped path of survey lines deviation of survey lines to avoid populations of conservation-significant flora use of GPS during clearing and mulching of survey lines to adhere to clearing boundaries and avoid vehicle access through excluded areas hand-carrying wires through excluded areas implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA. 	<ul style="list-style-type: none"> Level 2 botanical survey commenced in September 2013, currently ongoing Dieback survey
Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	The Survey Area consists of potential foraging habitat for Carnaby's Black Cockatoo, and potential habitat for Malleefowl, Rainbow Bee-eater and Western Ground Parrot. Ten key habitat types were identified within the Survey Area.	Potential impacts to fauna include: <ul style="list-style-type: none"> clearing of native vegetation resulting in loss of individual specimens of conservation-significant fauna associated with vehicle strike clearing of native vegetation resulting in reduction in suitable habitat for conservation-significant fauna species 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> induction of site personnel identifying conservation-significant species habitat (for example dense areas of Carnaby's Black Cockatoo foraging species, Malleefowl mounds etc.) as excluded areas induction of site personnel in site-specific EMP prepared in associated with EIA use of existing tracks where alignment coincides with mapped path of survey lines deviation of survey lines to avoid excluded areas including trees of suitable Diameter Breast Height as breeding habitat use of GPS during clearing and mulching of survey lines to avoid vehicle access through excluded areas hand-carrying wires through excluded areas implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA. 	None proposed
Rehabilitation and Closure	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	Part of the Survey Area consists of the Beekeepers Nature Reserve. The remainder of the Survey Area is traversed by public access tracks and rail reserve with associated maintenance tracks on either side of the rail line. The area has been subject to historical exploration activities and while native vegetation has successfully recolonised some lines, others remain open through repeated access. Fire breaks are visible along fencelines throughout the Survey Area.	Potential impacts to rehabilitation and closure include: <ul style="list-style-type: none"> vehicle use resulting in introduction of weeds or soil pathogens poor concealment of survey lines from public access tracks leading to ongoing third party access resulting in poor recovery of vegetation along survey lines. 	Potential impacts will be managed as follows: <ul style="list-style-type: none"> induction of site personnel in concealment of mulched survey lines at access tracks upon completion of survey to prevent third party access induction of site personnel in site-specific EMP prepared in associated with EIA implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with site-specific EMP developed as part of EIA. 	None proposed

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Appendix 1
s 38 referral form



Referral of a Proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* (EP Act) provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the EP Act. This form sets out the information requirements for the referral of a proposal by a proponent.

Proponents are encouraged to familiarise themselves with the EPA’s *General Guide on Referral of Proposals* [see Environmental Impact Assessment/Referral of Proposals and Schemes] before completing this form.

A referral under section 38(1) of the EP Act by a proponent to the EPA must be made on this form. A request to the EPA for a declaration under section 39B (derived proposal) must be made on this form. This form will be treated as a referral provided all information required by Part A has been included and all information requested by Part B has been provided to the extent that it is pertinent to the proposal being referred. Referral documents are to be submitted in two formats – hard copy and electronic copy. The electronic copy of the referral will be provided for public comment for a period of 7 days, prior to the EPA making its decision on whether or not to assess the proposal.

CHECKLIST

Before you submit this form, please check that you have:

	Yes	No
Completed all the questions in Part A (essential).	<input checked="" type="checkbox"/>	
Completed all applicable questions in Part B.	<input checked="" type="checkbox"/>	
Included Attachment 1 – location maps.	<input checked="" type="checkbox"/>	
Included Attachment 2 – additional document(s) the proponent wishes to provide (if applicable).	<input checked="" type="checkbox"/>	
Included Attachment 3 – confidential information (if applicable).		<input checked="" type="checkbox"/>
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but excluding confidential information.	<input checked="" type="checkbox"/>	

Following a review of the information presented in this form, please consider the following question (a response is optional).

Do you consider the proposal requires formal environmental impact assessment?		
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not sure
If yes, what level of assessment?		
<input checked="" type="checkbox"/> Assessment on Proponent Information	<input type="checkbox"/> Public Environmental Review	

PROPONENT DECLARATION (to be completed by the proponent)

I,, (*full name*) declare that I am authorised on behalf of..... (being the person responsible for the proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature 	Name (print) Shelley Robertson
Position Asset Manager	Company Norwest Energy NL
Date 15.10.2013	

PART A - PROPONENT AND PROPOSAL INFORMATION

(All fields of Part A must be completed for this document to be treated as a referral)

1 PROPONENT AND PROPOSAL INFORMATION

1.1 Proponent

Name	Norwest Energy NL
Joint Venture parties (if applicable)	AWE Limited (via subsidiaries) and Bharat PetroResources Limited
Australian Company Number (if applicable)	078 301 505
Postal Address (where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)	288 Stirling Street PERTH WA 6000
Key proponent contact for the proposal: <ul style="list-style-type: none"> • name • address • phone • email 	Norwest Energy NL Shelley Robertson, Asset Manager 288 Stirling Street Perth, Western Australia, 6000 Phone: (08) 9227 3240
Consultant for the proposal (if applicable): <ul style="list-style-type: none"> • name • address • phone • email 	Strategen Environmental Consultants Level 2, 322 Hay Street SUBIACO WA 6008 (08) 9380 - 3100

1.2 Proposal

Title	EP 413 3D Seismic Acquisition Survey (the Proposal)
Description	<p>The Proposal is to undertake a seismic survey in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia.</p> <p>The Proposal is planned to assess the extent of the resource surrounding the existing Arrowsmith-2 exploration well within the delineated area of Exploration Permit Number (EP413).</p> <p>The Proposal will involve mulching vegetation to create four metre-wide tracks navigable by vibroseis trucks at approximately 500 m intervals across the Proposal area.</p> <p>Disturbance will be undertaken to:</p> <ul style="list-style-type: none"> • provide vehicle access to the extent of the survey area • lay source and receiver lines and insert geophones • undertake vibration plate analysis using vibroseis trucks.
Extent (area) of proposed ground disturbance.	The Proposal is being undertaken over an area of 10 600 hectares (110 km ²). Of this area, approximately 2% (250 ha) is proposed to be disturbed to create four metre-

	<p>wide tracks navigable by vibroseis trucks at approximately 500 m intervals across the Proposal area.</p> <p>Seismic survey lines can deviate up to approximately 15 m either side of mapped lines. This allows activities to avoid protected or threatened vegetation or flora, slow-growing species, rock outcrops, habitat or foraging trees, soaks, creeklines or other landforms prohibiting clear passage. Survey lines will join up with existing tracks where present to minimise disturbance of native vegetation.</p>
Timeframe in which the activity or development is proposed to occur (including start and finish dates where applicable).	<p>Seismic exploration is anticipated to commence in winter 2014, between July and September.</p> <p>The Proposal activity is expected to extend over a period of six weeks, including demobilisation and rehabilitation activities (excluding post rehabilitation monitoring).</p>
Details of any staging of the proposal.	The on-ground component of the Proposal will be undertaken as a single stage involving exploration, rehabilitation and rehabilitation monitoring.
Is the proposal a strategic proposal?	No
<p>Is the proponent requesting a declaration that the proposal is a derived proposal?</p> <p>If so, provide the following information on the strategic assessment within which the referred proposal was identified:</p> <ul style="list-style-type: none"> • title of the strategic assessment; and • Ministerial Statement number. 	No
Please indicate whether, and in what way, the proposal is related to other proposals in the region.	<p>The Proposal is an extension of the nearby Denison 3D seismic survey (2004). The Proposal will use the same exploration methodology.</p> <p>The Proposal is not being undertaken in conjunction with any current seismic surveys or other exploration projects in the region.</p>
Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?	<p>The Proponent does not own any of the land on which the proposal is to be established.</p> <p>Lot details are outlined in the supporting documentation.</p>
What is the current land use on the property, and the extent (area in hectares) of the property?	<p>The Proposal area is zoned 'general farming'.</p> <p>Further information on lot details covered by the Proposal are provided in the supporting documentation (Section 1.2).</p>

1.3 Location

Name of the Shire in which the proposal is located.	Shire of Irwin
For urban areas: <ul style="list-style-type: none"> • street address; • lot number; • suburb; and • nearest road intersection. 	N/A
For remote localities: <ul style="list-style-type: none"> • nearest town; and • distance and direction from that town to the proposal site. 	The Proposal is to undertake a 3D seismic survey in the locality of Arrowsmith, located approximately 250 km north of Perth along the Brand Highway between Eneabba and Dongara in the mid-west region of Western Australia.
Electronic copy of spatial data - GIS or CAD, geo-referenced and conforming to the following parameters: <ul style="list-style-type: none"> • GIS: polygons representing all activities and named; • CAD: simple closed polygons representing all activities and named; • datum: GDA94; • projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA); • format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD. 	Enclosed.

1.4 Confidential Information

Does the proponent wish to request the EPA to allow any part of the referral information to be treated as confidential?	No
If yes, is confidential information attached as a separate document in hard copy?	N/A

1.5 Government Approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	No	
Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal? If yes, please complete the table below.	Yes	
Agency/Authority	Approval required	Application lodged Yes / No
Department of Parks and Wildlife (DPaW)	Authority to undertake works within the nature reserve under the <i>Conservation and Land Management Act 1984</i>	No

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)	Approval under the EPBC Act	No
Department of Mines and Petroleum (DMP)	Approval under the <i>Petroleum and Geothermal Energy Resources Act 1967</i>	No
Economic Regulation Authority (ERA)	Approval to access rail corridor	No

PART B - ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, by answering the questions contained in Sections 2.1-2.11:

- 2.1 flora and vegetation;
- 2.2 fauna;
- 2.3 rivers, creeks, wetlands and estuaries;
- 2.4 significant areas and/ or land features;
- 2.5 coastal zone areas;
- 2.6 marine areas and biota;
- 2.7 water supply and drainage catchments;
- 2.8 pollution;
- 2.9 greenhouse gas emissions;
- 2.10 contamination; and
- 2.11 social surroundings.

These features should be shown on the site plan, where appropriate.

For all information, please indicate:

- (a) the source of the information; and
- (b) the currency of the information.

2.1 Flora and Vegetation

2.1.1 Do you propose to clear any native flora and vegetation as a part of this proposal?

[A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)]. Please contact the Department of Environment and Conservation (DEC) for more information.

(please tick) Yes **If yes**, complete the rest of this section.

No **If no**, go to the next section

2.1.2 How much vegetation are you proposing to clear (in hectares)?

[Up to 250 ha of vegetation will be mulched in the creation of tracks within the Proposal area.](#)

2.1.3 Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

Yes No **If yes**, on what date and to which office was the application submitted of the DEC?

2.1.4 Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

Yes

No

If yes, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

A Level 1 botanical survey was carried out by O2 Ecology in October 2012 (O2 Ecology 2012). A Level 2 vegetation survey and targeted threatened flora survey has been commissioned, with results expected to be reported early 2014.

Section 2.2 of the supporting document describes the results of 2012 biological survey (O2 Ecology 2012) and outlines the planned Level 2 survey. The biological survey report is appended to the supporting document (Appendix 2).

2.1.5 Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site?

Yes

No

If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

2.1.6 Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?

Yes

No

If yes, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

No threatened taxa were recorded in the Proposal area during the 2012 survey and no threatened ecological communities (TEC) were identified (O2 Ecology 2012). A total of 26 conservation significant flora species have the potential to be present in the Proposal area, including one threatened species (*Leucopogon obtectus*). Of these, eight priority listed species were recorded during the Level 1 survey. The biological survey report is appended to the supporting document (Appendix 2).

2.1.7 If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

Yes

No

If yes, please indicate which Bush Forever Site is affected (site number and name of site where appropriate).

2.1.8 What is the condition of the vegetation at the site?

The majority of existing vegetation is considered to be in excellent condition. Some areas within the survey boundaries have been used as pasture for primary industries (wheat and sheep) and are in a degraded condition (O2 Ecology 2012).

2.2 Fauna

2.2.1 Do you expect that any fauna or fauna habitat will be impacted by the proposal?

- (please tick) Yes **If yes**, complete the rest of this section.
 No **If no**, go to the next section.

2.2.2 Describe the nature and extent of the expected impact.

The Proposal has the potential to affect fauna through the formation of tracks to facilitate vehicle access. Tracks will be deviated up to 15 m either side of the intended route around important fauna habitat features such as mature *Banksia sp.*, potential breeding / nesting trees and Malleefowl mounds.

Potential direct and indirect effects of the Proposal on fauna include:

- temporary loss of up to 250 ha of fauna habitat from vegetation disturbance resulting in a direct loss of species, and reduced breeding and foraging habitat
- increased injuries and mortalities from vehicle movements, infrastructure, machinery and the workforce
- degradation of habitat from altered hydrological regimes, increased human access, noise, dust and weed invasion
- increased fire potential from the presence of human activity in the area, resulting in the modification or loss of fauna habitat and conservation significant fauna
- introduction of feral species due to introduction of workforce and vehicles, inappropriate waste collection and disposal practices, and inadequate rehabilitation of disturbed land, resulting in fauna mortality and/or competition for resources.

2.2.3 Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

- Yes No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).
If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

The Level 1 botanical survey carried out in October 2012 by O2 Ecology incorporated an assessment of fauna habitat. The area is expected to constitute foraging habitat for Carnaby's Cockatoo and evidence of historical nesting by Malleefowl was observed.

Section 2.3 of the supporting document describes the fauna values of the Proposal area. The O2 Ecology (2012) biological survey report is also appended to the supporting document (Appendix 2).

2.2.4 Has a search of DEC records for known occurrences of Specially Protected (threatened) fauna been conducted for the site?

Yes No (please tick)

2.2.5 Are there any known occurrences of Specially Protected (threatened) fauna on the site?

Yes No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

A search of the threatened fauna database and EPBC Act Protected Matters database indicated that two Priority 4 species, six specially protected and two threatened species may be present in the Proposal area. Three conservation significant fauna species listed under the WC Act and EPBC Act were observed on site, including Carnaby's Cockatoo, Rainbow Bee-eater and Malleefowl.

While a Protected Matters search did not identify Western Ground Parrot and no records exist for the region, anecdotal evidence indicates that Western Ground Parrot may also be found in the area.

The O2 Ecology (2012) biological survey report is also appended to the supporting document (Appendix 2).

2.3 Rivers, Creeks, Wetlands and Estuaries

2.3.1 Will the development occur within 200 metres of a river, creek, wetland or estuary?

(please tick) Yes **If yes**, complete the rest of this section.
 No **If no**, go to the next section.

2.3.2 Will the development result in the clearing of vegetation within the 200 metre zone?

Yes No **If yes**, please describe the extent of the expected impact.

An ephemeral river (Arrowsmith River) occurs within the Proposal area. Given the nature of activities associated with the Proposal, surface or groundwater hydrology or quality will not be affected. Vegetation growing in association with the ephemeral river will be avoided, with management measures outlined within an Environmental Management Plan.

2.3.3 Will the development result in the filling or excavation of a river, creek, wetland or estuary?

Yes No **If yes**, please describe the extent of the expected impact.

2.3.4 Will the development result in the impoundment of a river, creek, wetland or estuary?

Yes No **If yes**, please describe the extent of the expected impact.

2.3.5 Will the development result in draining to a river, creek, wetland or estuary?

Yes No **If yes**, please describe the extent of the expected impact.

2.3.6 Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure
Perth's Bush Forever site	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure
The management area as defined in s4(1) of the <i>Swan River Trust Act 1988</i>	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unsure

2.4 Significant Areas and/ or Land Features

2.4.1 Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?

Yes No **If yes**, please provide details.

The western edge of the Proposal area is located within Beekeeper's Nature Reserve vested with the Conservation Commission of Western Australia in 1992 as a 'C' class Nature Reserve for the Protection of Flora. This reserve is a component of the Beekeeper's-Lesueur-Coomallo Area and Nambung National Park.

Section 2.2 of the supporting document describes the location of the Proposal in the context of significant areas.

2.4.2 Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?

Yes No **If yes**, please provide details.

A portion of the Proposal area is located within Beekeeper's Nature Reserve. Approximately 3014 ha of the Proposal area is located within the Reserve and approximately 63 ha of vegetation will be disturbed within the Reserve.

2.4.3 Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

Yes No **If yes**, please provide details.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

2.5.1 Will the development occur within 300metres of a coastal area?

(please tick) Yes **If yes**, complete the rest of this section.

No **If no**, go to the next section.

2.5.2 What is the expected setback of the development from the high tide level and from the primary dune?

2.5.3 Will the development impact on coastal areas with significant landforms including beach ridge plain, cusped headland, coastal dunes or karst?

Yes No **If yes**, please describe the extent of the expected impact.

N/A

2.5.4 Is the development likely to impact on mangroves?

Yes No **If yes**, please describe the extent of the expected impact.

N/A

2.6 Marine Areas and Biota

2.6.1 Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

Yes No **If yes**, please describe the extent of the expected impact.

2.6.2 Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

Yes No **If yes**, please describe the extent of the expected impact.

2.6.3 Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?

- Yes No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

2.7 Water Supply and Drainage Catchments

2.7.1 Are you in a proclaimed or proposed groundwater or surface water protection area?
(You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

- Yes No **If yes**, please describe what category of area.

The Proposal area is located within the Arrowsmith Groundwater Area and is subject to the requirements of the RIWI Act regarding groundwater abstractions.

2.7.2 Are you in an existing or proposed Underground Water Supply and Pollution Control area?

(You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

- Yes No **If yes**, please describe what category of area.

2.7.3 Are you in a Public Drinking Water Supply Area (PDWSA)?

(You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

- Yes No **If yes**, please describe what category of area.

2.7.4 Is there sufficient water available for the proposal?

(Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

- Yes No (please tick)

There is no additional water requirement for the Proposal.

2.7.5 Will the proposal require drainage of the land?

- Yes No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

2.7.6 Is there a water requirement for the construction and/ or operation of this proposal?

(please tick) Yes **If yes**, complete the rest of this section.

No **If no**, go to the next section.

2.7.7 What is the water requirement for the construction and operation of this proposal, in kilolitres per year?

2.7.8 What is the proposed source of water for the proposal? (e.g. dam, bore, surface water etc.)

2.8 Pollution

2.8.1 Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

(please tick) Yes **If yes**, complete the rest of this section.

No **If no**, go to the next section.

[Survey personnel will be accommodated in Dongara at existing facilities.](#)

2.8.2 Is the proposal a prescribed premise, under the Environmental Protection Regulations 1987?

(Refer to the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

Yes No **If yes**, please describe what category of prescribed premise.

2.8.3 Will the proposal result in gaseous emissions to air?

Yes No **If yes**, please briefly describe.

[The Proposal will result in vehicle emissions only.](#)

2.8.4 Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

Yes No **If yes**, please briefly describe.

2.8.5 Will the proposal result in liquid effluent discharge?

Yes No **If yes**, please briefly describe the nature, concentrations and receiving environment.

2.8.6 If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

Yes No **If yes**, please describe.

2.8.7 Will the proposal produce or result in solid wastes?

Yes No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

The main wastes produced during routine survey operations include:

- domestic waste
- hazardous wastes (diesel fuel, lubricants).

Where practicable, Norwest will employ the principles of reduce, reuse and recycle for the management of waste generated as a result of the Proposal.

Wastes will be disposed off-site at appropriate approved facilities.

2.8.8 Will the proposal result in significant off-site noise emissions?

Yes No **If yes**, please briefly describe.

2.8.9 Will the development be subject to the Environmental Protection (Noise) Regulations 1997?

Yes No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

2.8.10 Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other “sensitive premises” such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

Yes No **If yes**, please describe and provide the distance to residences and other “sensitive premises”.

2.8.11 If the proposal has a residential component or involves “sensitive premises”, is it located near a land use that may discharge a pollutant?

Yes No Not Applicable

If yes, please describe and provide the distance to the potential pollution source

2.9 Greenhouse Gas Emissions

2.9.1 Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?

Yes

No

If yes, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

2.9.2 Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

2.10 Contamination

2.10.1 Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

Yes

No

Unsure

If yes, please describe.

2.10.2 Has any assessment been done for soil or groundwater contamination on the site?

Yes

No

If yes, please describe.

2.10.3 Has the site been registered as a contaminated site under the *Contaminated Sites Act 2003*? (on finalisation of the CS Regulations and proclamation of the CS Act)

Yes

No

If yes, please describe.

2.11 Social Surroundings

2.11.1 Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

Yes

No

Unsure

If yes, please describe.

2.11.2 Is the proposal on a property which contains or is near a site of high public interest (e.g. a major recreation area or natural scenic feature)?

Yes

No

If yes, please describe.

2.11.3 Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

Yes

No

If yes, please describe.

3. PROPOSED MANAGEMENT

3.1 Principles of Environmental Protection

3.1.1 Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA website)

- | | | |
|--|---|-----------------------------|
| 1. The precautionary principle. | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. The principle of intergenerational equity. | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. The principle of the conservation of biological diversity and ecological integrity. | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Principles relating to improved valuation, pricing and incentive mechanisms. | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. The principle of waste minimisation. | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |

Norwest has considered these principles and will continue to do so during subsequent implementation of the Project. The principles are addressed in Section 1.8 of the supporting document.

3.1.2 Is the proposal consistent with the EPA's Environmental Protection Bulletins/Position Statements and Environmental Assessment Guidelines/Guidance Statements (available on the EPA website)?

Yes No

The following key EPA policies and guidance documents are relevant to the Proposal:

- Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012
- Environmental Assessment Guideline No. 1 – Defining the Key Characteristics of a Proposal
- EPA Position Statement No. 2, Environmental Protection of Native Vegetation in Western Australia (EPA 2000)
- 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 2004)
- EPA Guidance Statement No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b)
- EPA Guidance Statement No. 20, Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia (EPA 2009)
- EPA Guidance Statement No. 19 – Environmental Offsets (GS 19)
- Environmental Protection Bulletin No. 1 – Environmental Offsets – Biodiversity (EPB 1)
- EPA Draft Guidance Statement No. 8 Environmental Noise
- Guidance Statement No. 55 Implementing best practice in proposals submitted to the environmental impact assessment process
- EPA Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems. (GS 6).

3.2 Consultation

3.2.1 Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?

Yes No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

Norwest has undertaken a consultation program with key stakeholders. Stakeholders were identified through previous experience with exploration work in the local area. Section 1.7 of the supporting document provides details of the stakeholders identified and liaison that has occurred.

Norwest will maintain stakeholder consultation throughout the life of the Proposal as part of normal business practice, providing updates to relevant stakeholders as required.

Appendix 2

Botanical survey and threatened fauna assessment

Arrowsmith Level 1 Botanical Survey and Threatened Fauna Assessment Report



CLIENT:

**Strategen Environmental
Consultants**

STATUS:

Final

REPORT NUMBER:

R001913

ISSUE DATE:

November 2012

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Version Register

Version	Status	Author	Reviewer	Change from Previous Version	Authorised for Release	
					Signature	Date
	Draft	A.Franks/M.Ng	S. Potts			
a	Final	A.Franks/M.Ng	A. Franks	Updated draft by addressing comments received 20/11/2012		22/11/12

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1. Introduction

1.1. Project Overview

O2 Ecology was engaged by Strategen Environmental Consultants to conduct a Level 1 botanical and terrestrial vegetation assessment and a threatened fauna assessment of a proposed seismic survey site near Arrowsmith, Western Australia.

The botanical assessment of the proposed seismic lines was carried out to identify threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Declared Rare Flora (DRF) under the Western Australian *Wildlife Conservation Act 1950* (WC Act), Priority Flora, other significant taxa, and Threatened or Priority Ecological Communities or otherwise restricted vegetation communities.

The likelihood of occurrence of threatened fauna and migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was also assessed.

1.2. Study Objectives

The objectives of this study were as follows:

- conduct a desktop review to collect ecological information relevant to the study area;
- investigate, prepare and compile a description of the terrestrial flora and vegetation communities of the study area, including the compilation of records of DRF species listed under Schedules 1 and 2 of the Wildlife Conservation (Rare Flora) Notice under the WC Act and the Commonwealth's EPBC Act or Priority flora listed by the Western Australian Department of Conservation (DEC);
- identify fauna habitat, particularly for threatened fauna taxa;
- identify the presence or likely presence of any DRF or Priority flora species or species' habitats within the study area, their regional status and abundance and broad distribution patterns; and
- identify populations of significant weed/pest species

A desktop assessment and literature review of available information relating to the flora, vegetation and fauna of the region established potential target species for the region.

The field survey was then carried out to confirm and provide additional data to the information gathered during the desktop assessment.

This report presents the findings of the desktop and field assessment for the Level 1 flora survey over the site and is structured as follows:

- Section 2 - methods used to assess the existing environmental values.
- Section 3 - existing environmental values of the study area.
- Section 4 - results of field surveys.

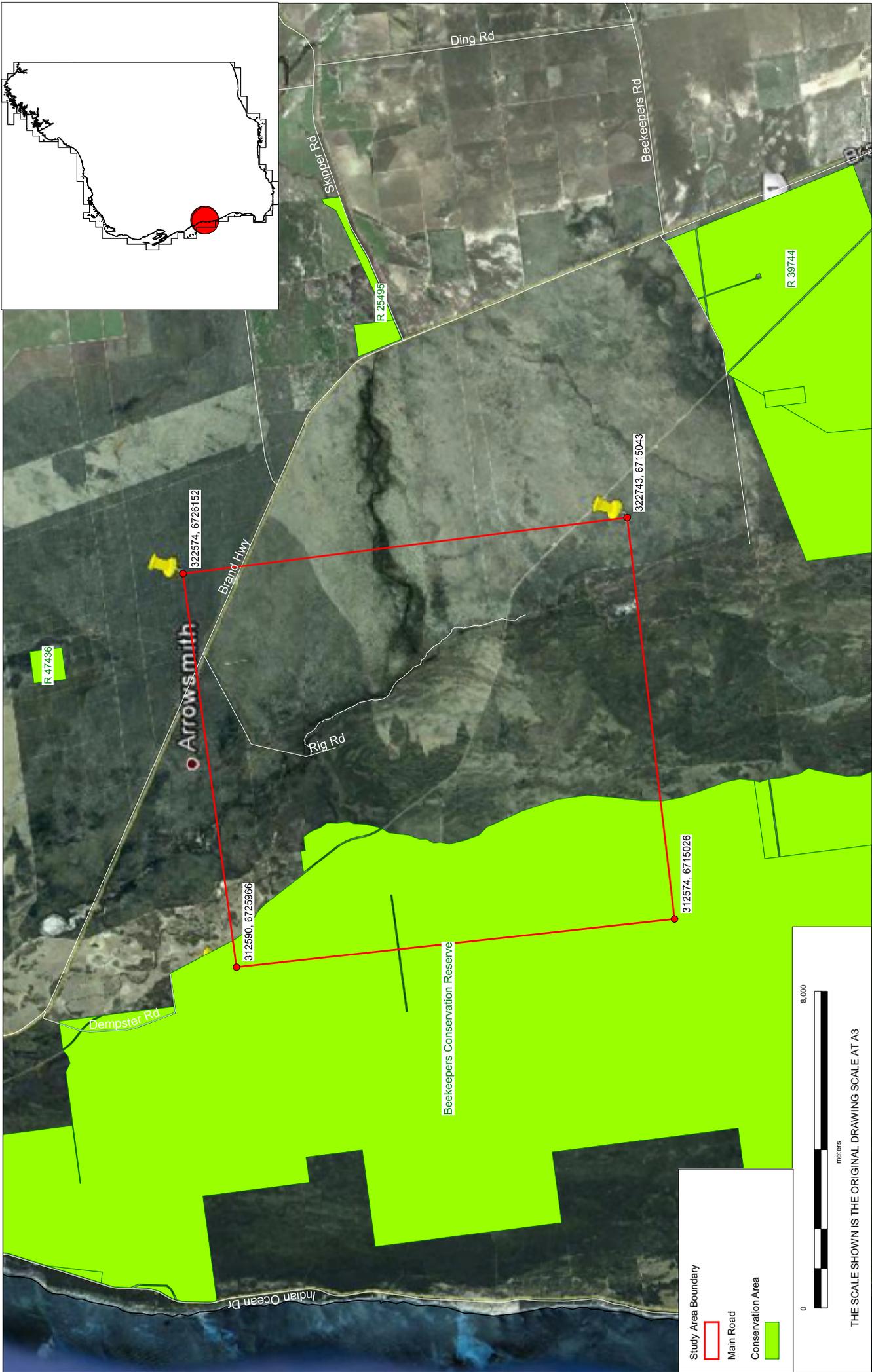
1.3. Location of Study Area

The Arrowsmith project area falls between the population centres of Eneabba and Dongara and is near the locality of Arrowsmith, approximately 110 km south-east of Geraldton.

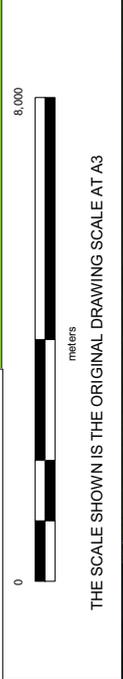
The survey area is a rectangle approximately 11.1 km long and 10 km wide. The seismic survey lines are proposed to run in a north – south direction spaced approximately 400 m apart.

The site is within the Lesueur Sandplain subregion of the Geraldton Sandplains bioregion. The Brand Highway is located towards the north-east corner of the study area and the Eneabba to Geraldton railway line bisects the study area from the south-east to the north-west. Some unsealed roads and tracks exist within the study area, the most prominent being Rig and Healy's Roads and the tracks that run adjacent to the railway line. Past seismic survey lines are evident on aerial photographs but these have mostly regenerated to the pre-rolled structure of the near-by remnant vegetation.

The location of the study area is mapped in **Figure 1**.



Study Area Boundary
 Main Road
 Conservation Area



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rev.	amendments	date



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Arrowsmith Botanical Survey and Fauna Habitat Assessment
 Figure 1 Location
 Strategen Environmental Consultants

November 2012	ECOSC12-0037	ECOSC12-0037-01
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2. Methods

This section outlines the methods undertaken to describe the existing environmental values of the study area. A combination of desktop assessments and spring field surveys were conducted as part of this study. The desktop assessments included a review of relevant literature and mapping, database searches and previously prepared technical reports. Flora field surveys were conducted to obtain specific ecological information relevant to the study area and to ground-truth results from desktop assessments. This section also outlines the terminology and nomenclature used in this technical report and describes the procedures and guidelines used for assessing the vegetation and flora values of the study area.

2.1. Desktop Review

Desktop assessments of State and Commonwealth databases were undertaken prior to the commencement of the field survey to identify records or potential occurrences of conservation significant flora species, threatened ecological communities and threatened fauna species within the study area. The desktop assessment utilised the below databases.

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities Protected Matters search tool was used to identify Threatened Ecological Communities (TEC) and species listed under the EPBC Act that may occur within the search area. The Protected Matters search tool is a predictive database that identifies EPBC Act listed flora and fauna species that may occur in a given search area based on bioclimatic modelling. The search area was defined by the latitude/longitude coordinates in **Table 1** and a 5 km buffer.

The DEC Threatened (Declared Rare) Flora database, the Western Australian Herbarium specimen database (WAHERB) and the Declared Rare and Priority Flora List (TPFL) were queried to identify DRF and Priority flora known, or likely, to occur within the study area. The search area was defined by the easting/northings coordinates in **Table 1** and a 5 km buffer.

The DEC Threatened Ecological Community (TEC) database was queried for listings of ecological communities known, or likely, to occur within the study area. The search area was defined by the easting/northings coordinates in **Table 1** and a 5 km buffer.

A Threatened and Priority Fauna search was conducted through the DEC for listings of ecological communities known, or likely, to occur within the study area. The search area was defined by the easting/northings coordinates in **Table 1** and a 5 km buffer.

Table 1 – Locations of the corners of the study area

Study Area Location	Easting/Northing MGA94 Zone 50	Decimal Latitude/Longitude
North West Corner	312590, 6725966	-29.58202N, 115.06512E
North East Corner	322574, 6726152	-29.5818N, 115.16818E
South East Corner	322743, 6715043	-29.68204N, 115.16812E
South West Corner	312574, 6715026	-29.6807N, 115.06307E

Australia’s Virtual Herbarium (AVH) and DEC’s FloraBase and NatureMap databases were also queried for species recorded within the Shire of Irwin.

2.2. Field Survey

Spring surveys were conducted to identify species and vegetation within the study area and to verify the results of the desktop review. Field surveys also aimed to determine the likelihood of occurrence of DRF or Priority flora species, TEC or listed fauna species considered to have the potential to occur in the study area, as identified by desktop searches (federal listings under EPBC Act, or State listings under WC Act).

2.2.1. Timing of Field Surveys

Field surveys were undertaken between, and inclusive of, the 16th and 24th of October 2012. The spring survey coincided with the optimal period for vegetative vigour and inflorescence set, particularly for shrub species.

2.2.2. Site Selection

Surveys were conducted using north-south oriented lines spaced at 400 m intervals beginning at the eastern border of the site to coincide with our best knowledge of the proposed seismic lines. Given the time and access constraints, approximately every second line was surveyed, where possible, to give the best coverage over the site. See **Figure 2** for surveyed traverses.

2.2.3. Field Survey Methods – Flora

The survey was carried out in a manner designed to be compliant with the Western Australian Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting for flora and vegetation in Western Australia, as set out in the following documents:

- Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area. Position Statement No. 2 (EPA 2000);
- Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002); and
- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004).

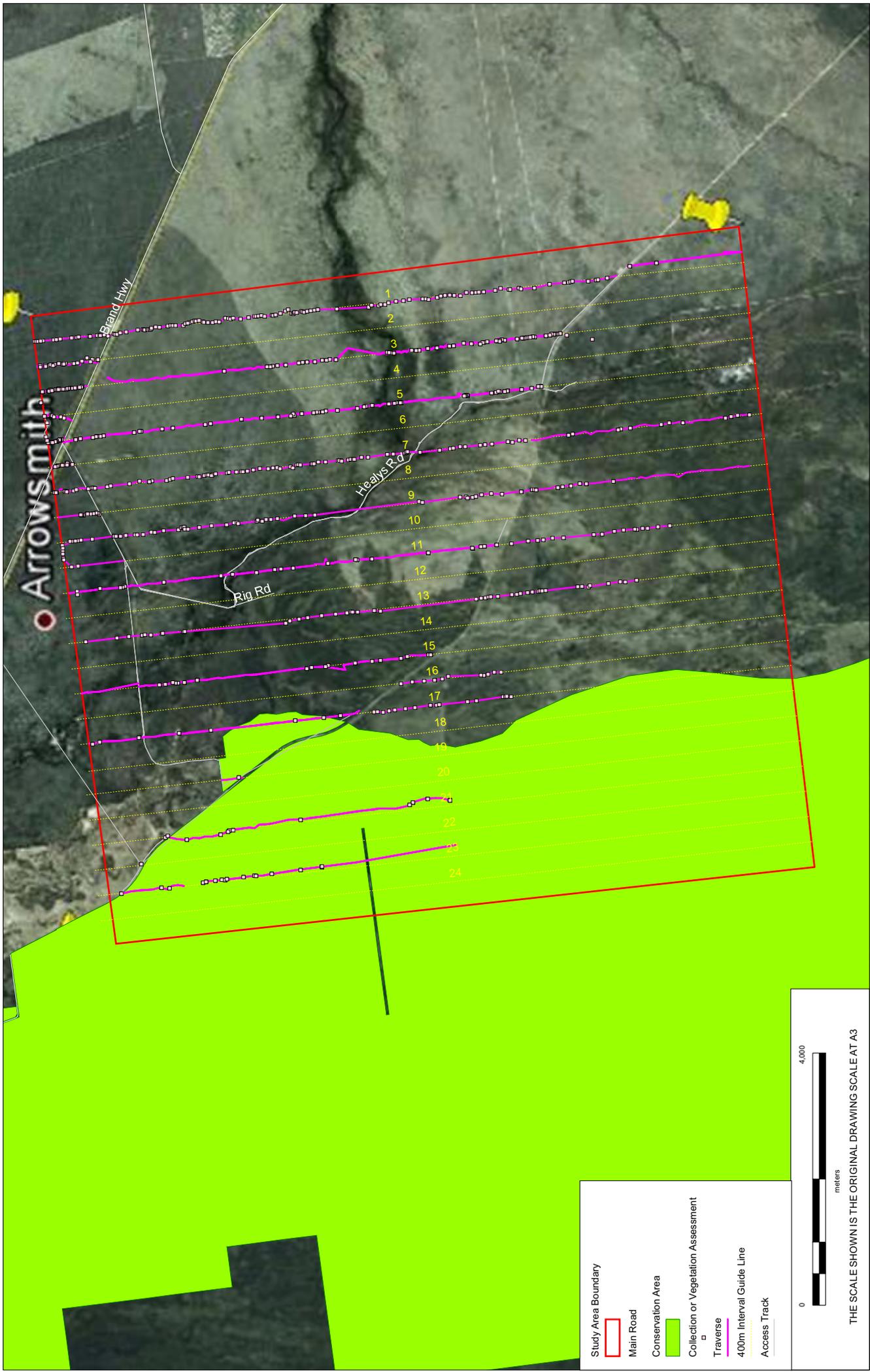
EPA Guidance Statement No. 51 (EPA 2004) outlines the expectations of the EPA and details the extent, design and intensity of field surveys for environmental assessments. Two formal levels of flora survey are defined by the EPA Guidance Statement No. 51:

- Level 1: a 'desktop' study to collate historical knowledge conducted in conjunction with a reconnaissance survey (site inspection); and
- Level 2: an intensive survey that incorporates a detailed and comprehensive survey to characterise the flora present, combined with a Level One survey.

A Level 1 survey approach was used for this project. The reconnaissance survey included:

- Vegetation description and mapping; and
- Traverses.

All plant collections were undertaken under permit SL010190 issued to Andrew Franks (O2 Ecology).



Study Area Boundary

Main Road

Conservation Area

Collection or Vegetation Assessment

Traverse

400m Interval Guide Line

Access Track

0 4,000
meters

THE SCALE SHOWN IS THE ORIGINAL DRAWING SCALE AT A3

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Arrowsmith Botanical Survey and Fauna Habitat Assessment

Figure 2 Survey Lines

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November 2012

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ECOSC12-0037-02

Vegetation Description and Mapping

The vegetation of the survey area was mapped by digital aerial photography interpretation at a scale of 1:10,000. Vegetation descriptions were based on the height and estimated percentage cover of dominant species using the National Vegetation Information System (NVIS) structural terminology (adapted from Specht 1970 and Walker and Hopkins 1990). Descriptions were made during the DRF and Priority flora and weed searches along the traverses whenever there was an obvious change in vegetation structure or composition. Detailed site recordings were taken within each plant community and included an assessment of the condition of the vegetation at that site. A standard proforma was used to ensure the consistent collection of flora and site data by all field staff. At each site the following information was collected within a 10 m radius:

- site location (general description and GPS coordinates);
- soil type and colour;
- rock type (if present);
- general landform;
- vegetation structure and description (NVIS Level 5);
- dominant plant species in each stratum; and
- vegetation condition (adapted from Keighery 1994 and Kaesehagen 1995 (Kaesehagen 1994)).

Traverses

The study area was traversed by a series of transects approximately 800 m apart, searching for DRF and Priority flora species. These transects were traversed on foot and the random meander technique (Cropper 1993) applied. The random meander technique is a widely accepted method to survey for DRF species that may not occur in surveyed plots. It involves traversing sections of the study area and recording vegetation type and dominant vascular flora species along each traverse. A comprehensive flora survey of the study area was not undertaken as part of this survey.

Any locations of DRF or Priority flora or weeds were recorded using a hand-held Global Positioning System (GPS) unit (see **Figure 2**), together with an indication of the number of individuals present, the habitat and associated plant species.

2.2.4. Field Survey Methods – Fauna

The fauna habitat assessments and opportunistic observations were carried out in conjunction with the flora surveys and used the same traverses and random meander technique as described above.

Habitat Assessment

Habitat assessments were conducted to describe the extent and types of terrestrial fauna habitats in the study area. This involved walking through the study area documenting the structural characteristics of vegetation and other features, and potential opportunities for fauna. Areas with similar vegetation structure were classified into distinct habitat types. The ecological value of each habitat type was then evaluated on the basis of the ecological characteristics noted.

For each habitat, the following parameters were considered:

- structural complexity of vegetation (i.e. tree density, canopy cover, vertical structural complexity, ground cover);
- complexity of ground-level microhabitats (i.e. substrate type, vegetation cover, leaf litter, woody debris, presence of rocks);
- habitat/forage resources (i.e. hollows, fallen logs, nests, water bodies);
- sources of disturbance (i.e. adjacent land-use, feral animal evidence, predation, weed infestation); and
- wider landscape features and habitat context (i.e. connectivity, movement corridors, fragment size, barriers).

Photographs were taken across the study area.

Habitat Assessment – Threatened Species

While conducting the general habitat assessment for fauna within the study area, specific attention was given to the potential for habitats to support the threatened species that were likely to occur within the study area based on information provided by the desktop assessment.

Opportunistic Fauna Observations

Opportunistic observations were made throughout the study area during the course of the survey. Fauna species were recorded from direct observation and through hearing distinctive calls. Observations of terrestrial vertebrates or signs of their presence (i.e. scats, tracks, diggings, nests or dreys, feathers, bones, pellets) were also recorded.

Opportunistic observations increase the likelihood of detecting threatened species, which have unique habitat requirements and may not be captured/detected using systematic techniques. Thus, while searches were non-systematic, there was a focus on detecting species of conservation significance (e.g. Malleefowl, Carnaby's Black-Cockatoo).

2.3. Specimen Identification and Nomenclature

Suspected DRF or Priority taxa were collected and later identified or confirmed at the Western Australian Herbarium and/or by a taxonomist. Scientific names for terrestrial flora are consistent with the botanical binomials presently accepted by the Western Australian Herbarium, DEC. An asterisk (*) preceding a species name indicates a non-native exotic species.

A likelihood of occurrence ranking was attributed to each DRF and Priority species recorded in the desktop study. This likelihood of occurrence ranking is based on the following framework:

- **Unlikely to occur:** species has not been recorded in the region (no records from desktop searches) AND/OR current known distribution does not encompass study area AND/OR suitable habitat is generally lacking from the study area.
- **May occur:** species has been recorded in the region (desktop searches) however suitable habitat is generally lacking from the study area OR species has not been recorded in the region (no records from desktop searches) however potentially suitable habitat occurs within the study area.
- **Likely to occur:** species has been recorded in the region (desktop searches) AND suitable habitat is present in the study area.
- **Confirmed present:** species positively identified during field surveys within the study area.

2.4. Coordinate System and Map Datum

Positional data was collected with a handheld Garmin GPS unit, with accuracy between 4 and 8 m. Locations were recorded using the UTM coordinate system with a GDA94 datum. All locations presented in this report are within UTM Zone 50J.

2.5. Limitations of the Study

A number of limitations of the field surveys and subsequent conservation assessments are discussed in the following section. These are factors that must be considered when reviewing and applying the results of this study. Despite these limitations, the field study and the subsequent analyses are believed to give a good representation of the flora and vegetation values of the Arrowsmith study area.

Availability of Information

The actual location of proposed seismic lines were not known at the time of the survey and traverses were placed based on the indication that the lines would be running in a north-south orientation at 400 m intervals.

Access

There are few defined access tracks within the study area and the study was limited by the distances traversable by foot within a reasonable work day.

The south-western corner of the study area was not reachable within the study period due to logistical and time (see below) constraints.

Two fenced areas were encountered and not entered during the study. The first was a farming property north of the railway line in the north eastern part of the study area. The second appeared to be a water reserve in the south-western part of the study area.

Disturbances

Evidence of fire was observed throughout most of the study area, with some regions affected more recently than others. Opportunistic species that grow and bloom soon after a fire are likely to have been missed in most parts of the study area where fire had occurred more than six months ago.

Timing and Resources

Although the study was carried out during the optimal period for vegetative vigour and inflorescence set, the timing was outside the flowering period for some of the DRF or Priority flora, impeding the detection of such species. For example, orchids flower earlier in the season. Ephemeral species may also have been missed.

The study team covered as much ground as practically possible within the highly biodiverse area during the study period. However, time and access constraints did not allow for all of the proposed seismic lines to be traversed in their entirety.

As many flora species were identified as practically possible during the field survey. However, as time was of the essence, searching for DRF, Priority flora and TEC was given priority over creating a detailed flora species list.

Completeness

Traverses at 800 m intervals give a reasonable coverage of the study area within the given time and resources within this highly biodiverse region. However, the south western corner of the study area was not surveyed and it is recommended that this area and the actual seismic lines (once known) are surveyed before any clearing work or similar disturbance is carried out on site.

3. Existing Environment

The study area falls between the population centres of Eneabba and Dongara and is near the locality of Arrowsmith, approximately 110 km south-east of Geraldton. The study area falls entirely within the Shire of Irwin and lies in the Northern Agricultural Natural Resource Management region. The survey area is approximately 11.1 km long and 10 km wide and occurs within Exploration Permit area 413 (EP413).

3.1. Physical Environment

3.1.1. Climate

The climate of this region is dry Mediterranean, characterised by hot, dry summers and mild, wet winters. Climate records for the closest Bureau of Meteorology station to the study area (Green Grove – 8057) indicate a mean annual rainfall of 499.2 mm, 83% of which falls in the winter half-year of April through to September (BOM, 2012).

3.1.2. Geology and Geomorphology

Geology mapping covering the EP413 area (Dongara – Hill River 1:250,000 sheets) indicates that three broad surface geologies occur across the study area (see **Table 2**). These overlie the Perth Basin, which is a deep trough of sedimentary layers containing substantial groundwater reserves.

Table 2 – Major surface geologies occurring in the study area.

Map Code	Age	Description	Area (ha)
Qa	Quaternary	Channel and flood plain alluvium; gravel, sand, silt, clay; may be locally calcreted	1054
Qd	Quaternary	Dunes, sandplain with dunes and swales; may include numerous interdune claypans; may be locally gypsiferous	3562
Qdct	Quaternary	Unconsolidated to strongly lithified calcarenite with calcrete/kankar soils; Aeolian. Locally quartzose, feldspathic, or heavy-mineral bearing.	6496

The landform across the study area can be described as flat to gently undulating sand plains, sand ridges, with occasional limestone ridges. Elevation across the study area ranges from approximately 30 m to 75 m above sea level. Arrowsmith Hill (75 m) occurs towards the centre of the study area.

The Arrowsmith River is a prominent riparian feature in the landscape of the study area and provides the only other marked change in the land surface profile other than the areas identified above.

3.1.3. Soils

Soils in the study area reflect the long geological history of this region. The soil landscapes of the region are mostly derived from sedimentary rocks of the Perth Basin and have been subjected to prolonged weathering over a long period of time. The result is soils with deeply weathered profiles that are inherently low in nutrients and have an accumulation of salt deep in the profile. Major soil types occurring in the study area based on North Coastal Plain Land Resources Survey soils mapping prepared at 1:100,000 scale are listed in **Table 3**.

Table 3 – Major soils occurring in the study area.

Soil Map Unit	Name	Description and General Characteristics
221Cy_1	Correy 1 Subsystem	Alluvial plain on Quaternary and Recent alluvium and colluvium in the nor-north-west of Eneabba. Pale deep sands dominate with yellow deep sands and shallow and deep sandy duplexes. Banksia low open woodland
221Cy_2	Correy 2 Subsystem	Active alluvial plain including lower end of main channel on Quaternary and Recent alluvium in the west end of Arrowsmith River. Yellow, brown and pale deep sands and sandy earths. Acacia scrub with occasional York gum woodland.
221Cy_3	Correy 3 Subsystem	Rarely inundated flats and depressions on Recent alluvium at the end of the surface expression of the Arrowsmith River. Cracking and non-cracking clays and pale sandy earths. York and river gums, some melaleuca.
221In_2	Indoon 2 Subsystem	Plain associated with lake, lower lying areas seasonally inundated seasonally inundated, small lakes too small to map. Cracking and non-cracking clays; water; pale deep sands on lunettes.
221In_3	Indoon 3 Subsystem	Narrow, poorly drained clayey plain adjacent to the coastal limestone. Grey sandy and loamy duplex soils, and grey clays. York Gum.
221Ta_4	Tamala South 4 Subsystems	Low hills and rises with relict dunes and some limestone outcrop on Lithified Pleistocene calcareous dune deposits in the South of Dongara to Kalbarri. Yellow shallow sand with limestone outcrops and yellow deep sand. Heath.

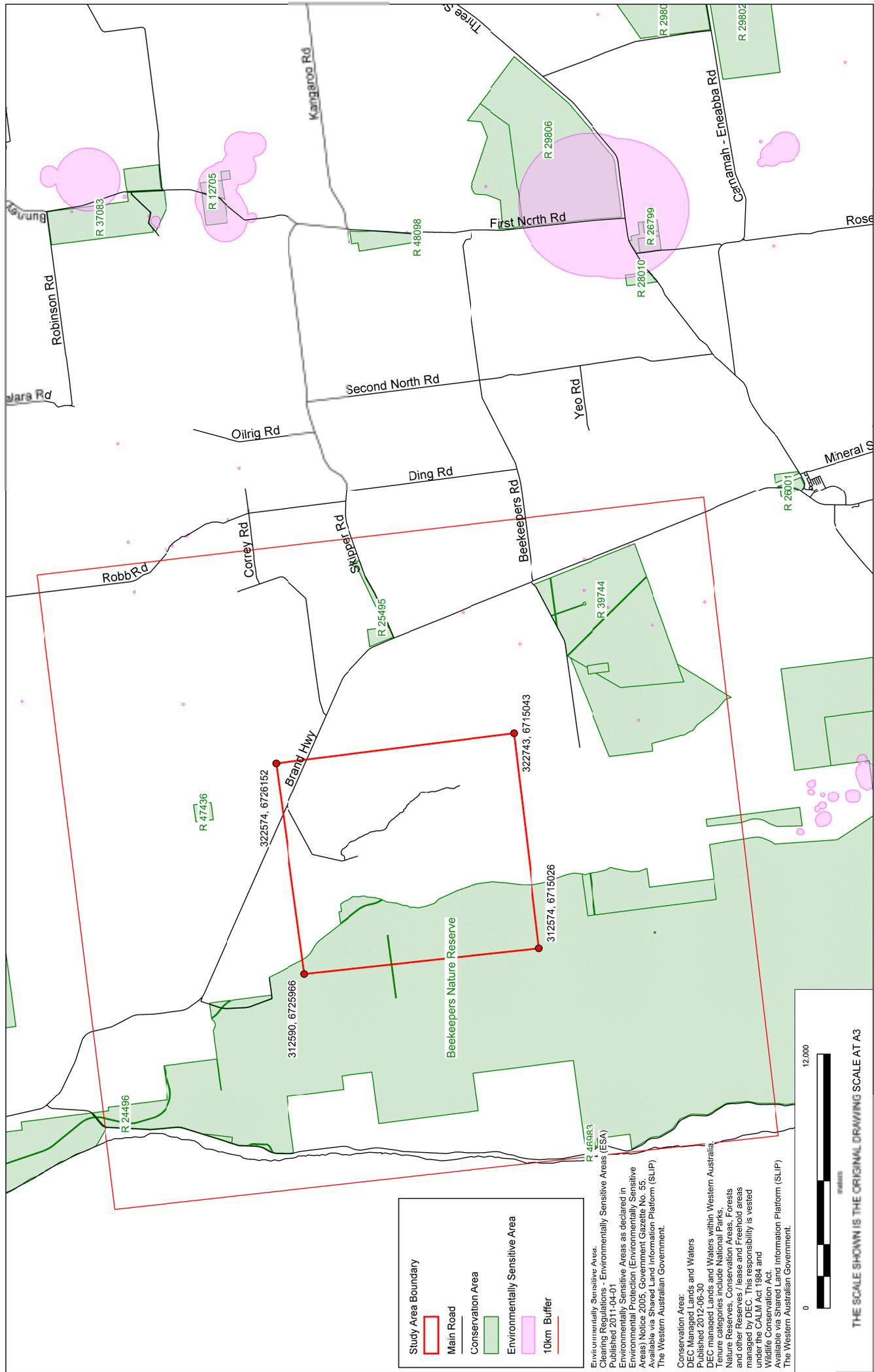
3.1.4. Drainage

The study area falls within the Arrowsmith River and the Indoon Logue Catchments.

3.2. Biological Environment

The study area lies within the region known as the kwongan sand plains. The complex kwongan sand plain or heath shrub vegetation has plant species richness unequalled by most other vegetation types in the world (Burbidge, Hopper, & van Leeuwen, 1990). This area is exceptional in Australia due to its diversity of plant and animal species. It holds as much as 10% of all the flora species found in Western Australia and is considered one of the most significant areas for flora conservation in south-western Australia (Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2012).

Figure 3 presents the biologically significant areas described in Sections 3.2.1 to 3.2.5.



Study Area Boundary

Main Road

Conservation Area

Environmentally Sensitive Area

10km Buffer

Environmentally Sensitive Areas (ESAs)
 Environmental Protection (Environmentally Sensitive Areas) Notice 2005, Government Gazette No. 55, Available via Shared Land Information Platform (SLIP) The Western Australian Government.

Conservation Areas
 DEC Managed Lands and Waters
 Published 2012, 05-30
 DEC managed Lands and Waters within Western Australia. Tenure categories include National Parks, Nature Reserves, Conservation Areas, Forests and other Reserves / lease and Freehold areas managed by DEC. This responsibility is vested under the CALM Act 1984 and Wildlife Conservation Act.
 Available via Shared Land Information Platform (SLIP) The Western Australian Government.

0 12,000 METRES

THE SCALE SHOWN IS THE ORIGINAL DRAWING SCALE AT A3

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Arrowsmith Botanical Survey and Fauna Habitat Assessment
 Figure 3 Biologically Significant Areas
 Strategen Environmental Consultants

November 2012
ECOSC12-0037
ECOSC12-0037-03

3.2.1. IBRA Bioregion and Subregion

The study area falls entirely within the Lesueur Sandplain subregion (GS3) of the Geraldton Sandplains bioregion. The Geraldton Sandplains bioregion is characterised by proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata. Extensive York Gum and Jam woodlands occur on outwash plains and associated drainage lines. The Lesueur Sandplain (GS3) comprises coastal Aeolian and limestones, Jurassic siltstones and sandstones (often heavily lateritised) of the central Perth Basin. Alluvial soils are associated with drainage systems. There are extensive yellow sandplains in south-eastern parts, especially where the subregions overlaps the western edge of the Pilbara Craton. Shrub-heaths rich in endemics occur on a mosaic of lateritic mesas, sandplains, coastal sands and limestones (Desmond & Chant, 2001). See **Plate 1** for representative land forms and vegetation communities in the study area.



Plate 1 – Indicative site photos

3.2.2. Vegetation

Beard's Vegetation Mapping

The Arrowsmith study area occurs entirely within the Northern Sandplain Region of the Irwin Botanical District of the South West Botanical Province as defined by Beard (1990). This Botanical District is characterised by scrub heath on sandplains near the coast; Acacia-Casuarina thickets further inland, and Acacia scrub with scattered trees of York gum (*Eucalyptus loxophleba*) on the hard-setting loams. Specifically the study area is located within the Dandaragan Tablelands physiographic unit of the Irwin Botanical District described as dissected ferruginous plateaus and hills on sedimentary rocks with areas of sandplains and extensive coastal dune system in the west of the district.

The study area was mapped as part of the Vegetation Survey of Western Australia (Beard 1976). This mapping subdivided the Irwin Botanical District into vegetation systems, with the study area located within Ilyarrie and Eridoon Systems. The Ilyarrie System is identified as a coastal limestone belt with undulating hilly country of lithified calcarenite overlain by yellow siliceous sands. It is characterised by proteaceous scrub heath with patches of low, open woodland (Beard 1976). The Eridoon System occurs on the flat coastal plain between the coastal limestone deposits and the Pleistocene shoreline. There are numerous small lakes and swamps in depressions and a few alluvial flats.

Shepherd *et al.* (2002) vegetation mapping of Pre-European extent, compiled primarily from Beard's (1976) mapping indicates that the study area contains a number of vegetation associations. These are listed and described in **Table 4**.

Table 4 – Vegetation associations mapped from the study area.

Vegetation Association	Description	Environmental Descriptor	NVIS Lv2 – Structural Formation	NVIS Lv3 – Broad floristic group
433	Mosaic: Shrublands; <i>Acacia rostellifera</i> & <i>Melaleuca cardiophylla</i> thicket/Sparse low woodland; illyarrie	Ilyarrie	Open shrubland	Acacia mixed open shrubland
377	Mosaic: Shrublands; scrub-heath on limestone in northern Swan Region/Sparse low woodland; illyarrie	Ilyarrie	Open shrubland	Acacia mixed open shrubland
352	Medium woodland; York gum		Woodland	Eucalyptus woodland
378	Shrublands; scrub-heath with scattered <i>Banksia</i> spp., <i>Eucalyptus todtiana</i> & <i>Xylomelum angustifolium</i> on deep sandy flats in the Geraldton Sandplains region	Eridoon – sandplain	Open shrubland	Acacia mixed open shrubland
378	Shrublands; scrub-heath with scattered <i>Banksia</i> spp., <i>Eucalyptus todtiana</i> & <i>Xylomelum angustifolium</i> on deep sandy flats in the Geraldton Sandplains region	Eridoon – sand ridges	Open shrubland	Banksia mixed open shrubland
378	Shrublands; scrub-heath with scattered <i>Banksia</i> spp., <i>Eucalyptus todtiana</i> & <i>Xylomelum angustifolium</i> on deep sandy flats in the Geraldton Sandplains region	Eridoon – winter wet areas	Heath	Calytrix mixed heath

3.2.3. Conservation Significant Ecosystems

Six occurrences of two types of known distinct, species rich and geographically restricted communities occur within 10 km to the south of the study area. These communities are preliminary listings in the DEC TEC/PEC database without an assigned category and are Freshwater Basin Wetlands of the Central Wheatbelt and Freshwater Basin Wetlands of the Southern Wheatbelt.

3.2.4. Conservation Significant Flora

A large number of rare flora has been recorded within the Lesueur Sandplain subregion. The area exhibits extremely high floristic endemism, with over 250 species of sandplain flora endemic to the subregion. The area is known Australia-wide and internationally as having particularly high floristic diversity and levels of endemism (Desmond & Chant, 2001).

Hart, Simpson and Associates (2003) undertook an assessment of the flora and vegetation within the entire EP413 exploration permit area. This study recorded 161 vascular plant species, including three Priority flora taxa as listed by the DEC. These were *Anthocercis intricata* (P3), *Haloragis foliosa* (P3) and *Eucalyptus zopherophloia* (P4). This study did not map the vegetation but described 20 plant assemblages as present within the EP413 area. The vegetation and flora within Beekeepers Nature Reserve, part of which occurs within the study area, has also been surveyed by Woodman Environmental Consulting (2003, 2004, 2006). Woodman Environmental Consulting (2006) recorded a total of 182 plant species, five of which are listed Priority flora, these being *Hemigenia saligna* (P3), *Dampiera tephrea* (P2), *Anthocercis intricata* (P3), *Eucalyptus zopherophloia* (P4) and *Eucalyptus diminuta* (P4).

Within the present study area, Ecologia Environmental (2011) undertook a Level 1 survey of 4.51 ha covering the Arrowsmith-2 project area and found two Priority flora species: *Lepidobolus quadratus* (P3) and *Mesomelaena stygia* subsp. *deflexa* (P3).

3.2.5. Other Significant Areas

The reserves in **Table 5** are located within 10 km of the study area.

Table 5 – Reserves located within 10km of the study area

Reserve Name	Purpose
Arrowsmith Lake Area	Waterfowl, birds and wild flowers
Beekeepers Reserve	Protection of Flora
R 39744	Conservation of Flora and Fauna
R 47436	Conservation of Flora and Fauna
R 25495	Conservation of Flora and Fauna
R 46983	Conservation and Marl Extraction

Beekeepers Nature Reserve is a major regional nature reserve that was vested with the Conservation Commission of Western Australia as a “C” Class Nature Reserve for the Protection of Flora in 1992. It is now deemed a nature reserve under the *Conservation and Land Management Act 1984*.

The western side of the study area that lies within Beekeepers Nature Reserve represents approximately 27% of the total study area (refer to **Figure 1**).

4. Results

4.1. Desktop Assessment

4.1.1. Threatened and Priority Ecological Communities

Ecological communities are naturally occurring biological assemblages that occur in a particular type of habitat. TEC are ecological communities that have been assessed and assigned to a particular category related to the status of the threat to the community at a State scale, i.e. presumed totally destroyed, critically endangered, endangered, or vulnerable.

Potentially threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. 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 TEC. 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.

The DEC TEC database was queried for listings of TEC or PEC known, or likely, to occur within the study area. The results of this query returned six occurrences of two types of community within 10 km south of the study area. These communities are preliminary listings without an assigned category and are Freshwater Basin Wetlands of the Central Wheatbelt and Freshwater Basin Wetlands of the Southern Wheatbelt.

4.1.2. Threatened Flora Species

DRF species are defined as those species listed under the provisions of the EPBC Act (Cwlth) and/or listed under Schedules 1 and 2 of the Wildlife Conservation (Rare Flora) Notice under the WC Act. Priority Flora species are listed by the DEC. **Table 15** (in **Appendix B**) lists all DRF and Priority flora species recorded in the desktop database searches and their respective threat status. **Figure 4** shows the results of the DRF and Priority flora searches.

EPBC Protected Matters

The EPBC Protected Matters search tool identified the general region that includes the study area as having potential habitat for nine threatened flora species listed under the EPBC Act (**Appendix A**), these being:

- *Centrolepis caespitosa* (Endangered);
- *Conostylis dielsii* subsp. *teres* (Endangered);
- *Conostylis micrantha* (Endangered);
- *Eucalyptus impensa* (Endangered);
- *Hemiandra gardneri* (Endangered);
- *Leucopogon obtectus* (Endangered);
- *Paracaleana dixonii* (Endangered);
- *Stawellia dimorphantha* (Vulnerable); and
- *Wurmbea tubulosa* (Endangered).

It should be noted that the EPBC Act online search gives details of species that are predicted to be present with the defined area based on bioclimatic modelling. As such, these species have not necessarily been observed within the study area.

DEC Threatened and Priority Flora database

A query of the DEC TPFL database (**Table 11, Appendix A**) returned six DRF or Priority flora taxa that have been recorded within 10 km of the study area, these being:

- *Calytrix chrysantha* (P4);
- *Calytrix eneabensis* (P4);
- *Guichenotia quasicalva* (P2);
- *Leucopogon obtectus* (Threatened (Endangered));
- *Stawellia dimorphantha* (P4); and
- *Verticordia fragrans* (P3).

DEC Threatened and Priority Flora List

A query of the DEC Threatened and Priority Flora List (TP List) (

Table 12, **Appendix A**) returned 18 DRF or Priority flora taxa that have been recorded within the general region of the study area, these being:

- *Acacia vittata* (P2);
- *Banksia elegans* (P4);
- *Calytrix eneabbensis* (P4);
- *Diuris eburnea* (P1);
- *Eryngium pinnatifidum* subsp. *palustre* (P3);
- *Guichenotia quasicalva* (P2);
- *Haloragis foliosa* (P3);
- *Homalocalyx chapmanii* (P2);
- *Hopkinsia anoectocolea* (P3);
- *Paracaleana dixonii* (Threatened (Endangered));
- *Stawellia dimorphantha* (P4);
- *Stylidium torticarum* (P3);
- *Synaphea oulopha* (P1);
- *Triglochin protuberans* (P3);
- *Verticordia dasystylis* subsp. *oestopoia* (P1);
- *Verticordia luteola* var. *luteola* (P3);
- *Verticordia luteola* var. *rosea* (P1); and
- *Verticordia penicillaris* (P4).

WAHERB Retrieval

The WAHERB database search (**Table 13, Appendix A**) returned 26 records of DRF and Priority species listed under the WC Act or by the DEC:

- *Acacia latipes* subsp. *licina* (P3);
- *Banksia elegans* (P4);
- *Beyeria gardneri* (P3);
- *Calytrix chrysantha* (P4);
- *Calytrix ecalycata* subsp. *ecalycata* (P3);
- *Calytrix eneabbensis* (P4);
- *Calytrix superba* (P4);
- *Dampiera tephrea* (P2);
- *Grevillea erinacea* (P3);
- *Guichenotia quasicalva* (P2);
- *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3);
- *Hopkinsia anoectocolea* (P3);
- *Hypocalymma tetrapterum* (P3);
- *Leucopogon obtectus* (Threatened (Endangered));
- *Persoonia rudis* (P3);
- *Schoenus griffinianus* (P3);
- *Stawellia dimorphantha* (P4);
- *Stylidium longitubum* (P3);
- *Stylidium pseudocaespitosum* (P2);
- *Synaphea oulopha* (P1);
- *Triglochin protuberans* (P3);
- *Verticordia argentea* (P2);
- *Verticordia dasystylis* subsp. *oestopoia* (P1);
- *Verticordia fragrans* (P3);

- *Verticordia luteola* var. *luteola* (P3); and
- *Verticordia luteola* var. *rosea* (P1).

NatureMap

DEC's NatureMap was queried for the study area including a 10 km buffer. The results of this query included four DRF and 51 Priority flora. It should be noted that NatureMap relies on data provided from a wide range of sources, both internal and external to DEC, and with varying degrees of data accuracy, quality, currency and comprehensiveness.

FloraBase

DEC's FloraBase was queried for the Shire of Irwin in which the study area occurs. The results of this query included 71 DRF and Priority flora. It should be noted that while information contained within FloraBase is taken from the WAHERB, the results are based on a search of the whole Irwin Shire and not just the study area.

Not all of the threatened species indicated through desktop sources are expected to occur within the study area. **Table 6** shows the species that are most likely to occur within the study site based on previous records within the area (TPFL and WAHERB databases for a search area containing a 10 km buffer around the study area). The survey was focussed on, but not limited to, searching for the species listed here with other species included in search efforts listed in **Appendix B**.

Table 6 – DRF and Priority flora likely to exist within the study area.

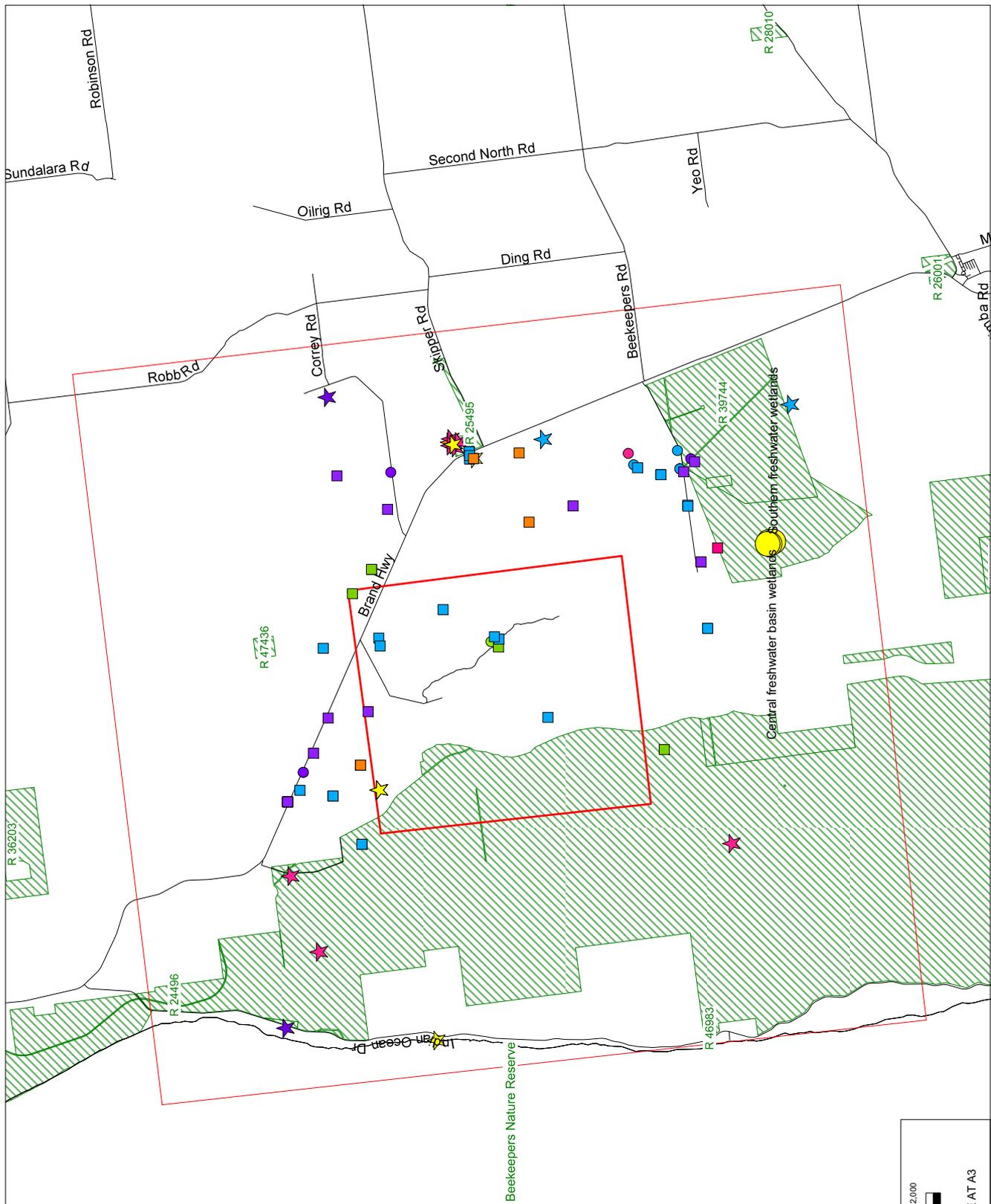
Species	Conservation Status	Previously Found within Study Area
<i>Acacia latipes</i> subsp. <i>licina</i>	P3	
<i>Banksia elegans</i>	P4	Yes
<i>Beyeria gardneri</i>	P3	Yes
<i>Calytrix chrysantha</i>	P4	
<i>Calytrix ecalycata</i> subsp. <i>ecalycata</i>	P3	
<i>Calytrix eneabensis</i>	P4	
<i>Calytrix superba</i>	P4	
<i>Dampiera tephrea</i>	P2	
<i>Grevillea erinacea</i>	P3	
<i>Guichenotia quasicalva</i>	P2	Yes
<i>Hemiandra</i> sp. <i>Eneabba</i> (H. Demarz 3687)	P3	Yes
<i>Hopkinsia anoectocolea</i>	P3	
<i>Hypocalymma tetrapterum</i>	P3	
<i>Leucopogon obtectus</i>	T	
<i>Persoonia rudis</i>	P3	Yes
<i>Schoenus griffinianus</i>	P3	Yes
<i>Stawellia dimorphantha</i>	P4	
<i>Stylidium longitubum</i>	P3	Yes
<i>Stylidium pseudocaespitosum</i>	P2	Yes
<i>Synaphea oulopha</i>	P1	
<i>Triglochin protuberans</i>	P3	Yes
<i>Verticordia argentea</i>	P2	
<i>Verticordia dasystylis</i> subsp. <i>oestopoia</i>	P1	
<i>Verticordia fragrans</i>	P3	
<i>Verticordia luteola</i> var. <i>luteola</i>	P3	
<i>Verticordia luteola</i> var. <i>rosea</i>	P1	

4.1.3. Threatened Fauna Species

A search of the DEC threatened fauna database and the EPBC Act Protected Matters database indicated that threatened and Priority fauna known or likely to occur in the area include two Priority 4, six Specially Protected and two Threatened species.

Figure 4 shows the results of the fauna searches (refer to **Appendix A** for the original database search results).

The threatened and Priority fauna species that could potentially be found within the study area are shown in **Table 16** in **Appendix B**.



Study Area Boundary

Main Road

Conservation Area

10km Buffer

WA Herbarium

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened

Threatened (Declared Rare) and Priority Flora Database

- Priority 2
- Priority 3
- Priority 4
- Threatened

Fauna Search

- Priority 3
- Priority 4

International Agreement

- Specially Protected
- Threatened

Threatened and Priority Ecological Communities Database

0 12,000
meters

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Arrowsmith Botanical Survey and Fauna Habitat Assessment

Figure 4 DRF - Priority Flora and Fauna and TEC Search Results

Strategen Environmental Consultants

November 2012

ECOSC12-0037

ECOSC12-0037-04

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4.2. Field Survey

4.2.1. Threatened and Priority Ecological Communities

No TEC or PEC were found during the field surveys.

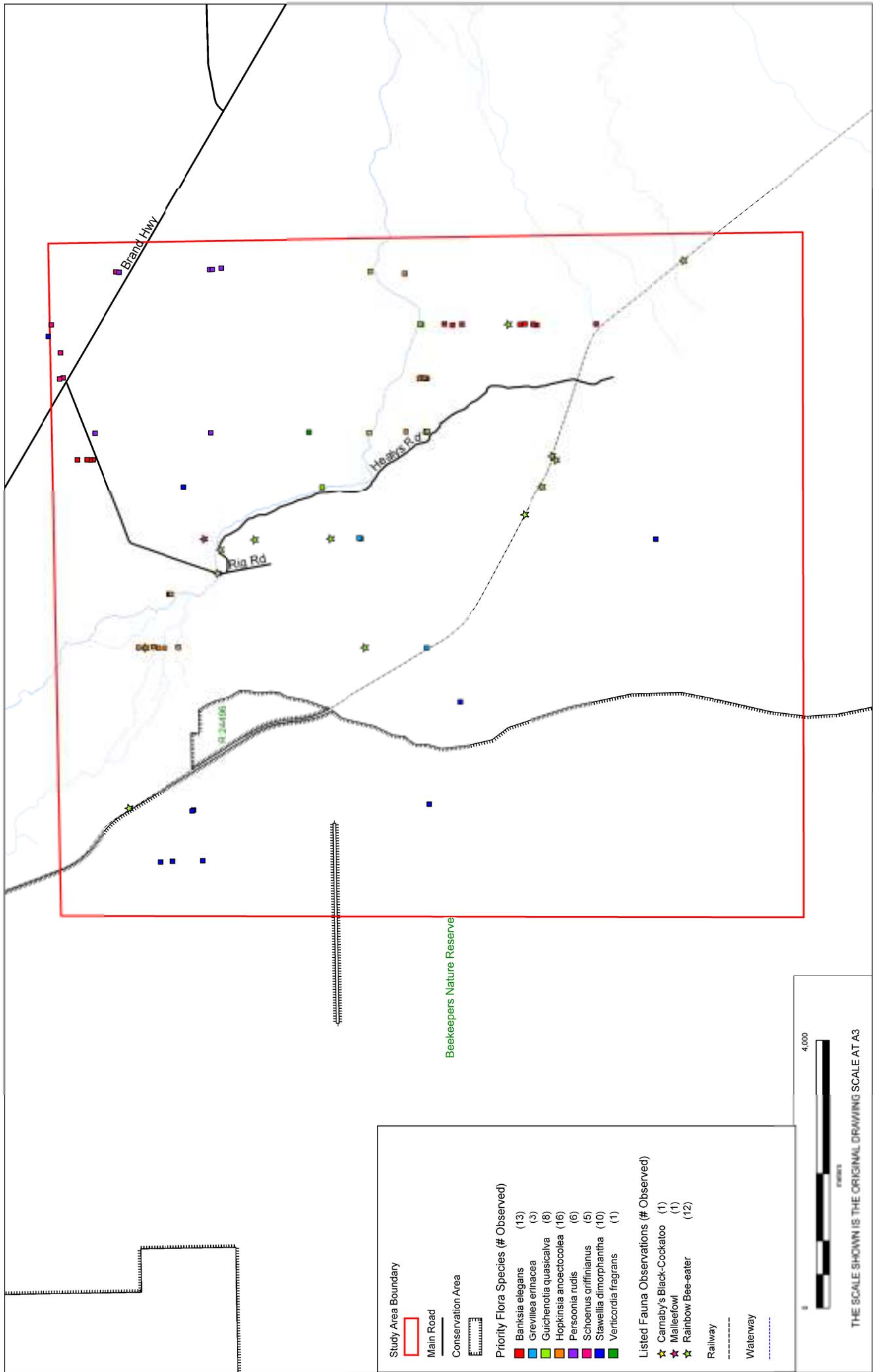
4.2.2. DRF and Priority Flora

All flora species identified during the field survey are shown in **Table 18** in **Appendix C**.

No DRF taxa were recorded during the reconnaissance survey. However, eight Priority flora taxa as listed by the DEC (2012) were recorded within the study area, these being;

- *Banksia elegans* (P4);
- *Grevillea erinacea* (P3);
- *Guichenotia quasicalva* (P2);
- *Hopkinsia anoectocolea* (P3);
- *Persoonia rudis* (P3);
- *Schoenus griffinianus* (P3);
- *Stawellia dimorphantha* (P4); and
- *Verticordia fragrans* (P3)

The location of these taxa is shown in **Figure 5** and listed in **Table 17** (in **Appendix C**). All of these taxa have previously been recorded within 10 km of the study area. One species, *Stawellia dimorphantha*, is also listed as Vulnerable under the EPBC Act.



Study Area Boundary

Main Road

Conservation Area

Priority Flora Species (# Observed)

- Banksia elegans (13)
- Grevillea erinacea (3)
- Guichenotia quasicalva (8)
- Hopkinsia aneotocolea (16)
- Persoonia rudis (6)
- Schoenus griffithianus (5)
- Stawellia dimorphantha (10)
- Verticordia fragrans (1)

Listed Fauna Observations (# Observed)

- ★ Carnaby's Black-Cockatoo (1)
- ★ Malleefowl (1)
- ★ Rainbow Bee-eater (12)

Railway

Waterway

4,000
METERS

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Arrowsmith Botanical Survey and Fauna Habitat Assessment
 Figure 5 Priority Flora and Listed Fauna Observations
 Strategen Environmental Consultants

4.2.3. Weeds

A weed is defined as any plant that requires some form of action to reduce its harmful effects on the economy, the environment, human health and amenity (Natural Resource Management Ministerial Council, 2006). There are two types of invasion: introduction of exotic plants and movement by native species into new areas well outside their native range. Weeds have an adverse effect on an area's environmental values and ecological functioning for the following reasons:

- competition with native species;
- change in the structure of a plant community through addition or removal of strata;
- repress recruitment of native species;
- change the natural fire fuel characteristics, which can change the natural fire regime to the detriment of native species, often resulting in the loss of native species;
- change the food sources and habitat values available to native fauna, reducing some and increasing others;
- may change geomorphological processes such as erosion; and
- may lead to changes in the hydrological cycle.

Weed species considered to be of greatest threat to natural and economic values on a national basis have been categorised as Weeds of National Significance (WONS) (Thorp & Lynch, 2000). Weed significance at a national level was assessed using four major criteria:

- invasiveness;
- impacts;
- potential for spread; and
- socio-economic and environmental impacts.

One introduced species listed as a Declared Weed under the *Agricultural and Related Resources Protection Act 1976* was recorded during the site survey, this being **Echium plantagineum* (Paterson's curse). This species was occasionally encountered as individuals along the edge of the track that runs adjacent to the railway line. **Echium plantagineum* is a P1 Category weed within the State and the movement of the plants or their seed, including contaminated machinery and produce, is prohibited.

Other weed species encountered during site traverses include **Arctotheca calendula*, **Avena barbata*, **Briza maxima*, **Centaurea melitensis*, **Lysimachia arvensis*, **Sonchus oleraceus*, **Vulpia bromoides*; all of which are listed as Environmental Weeds with 'Moderate' rating under the *Environmental Weed Strategy for Western Australia* (CALM, 1999) with **Bromus hordeaceus* listed as 'Low' and **Pennisetum setaceum* as 'Mild'. Weed species were commonly encountered along the margins of tracks, near the railway line and along the banks of the Arrowsmith River. **Pennisetum setaceum* is locally problematic particularly along the railway easement towards the northern part of the study area.

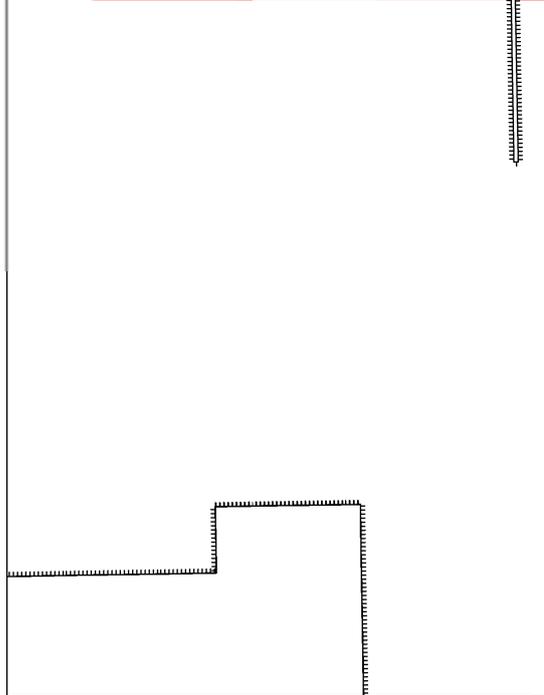
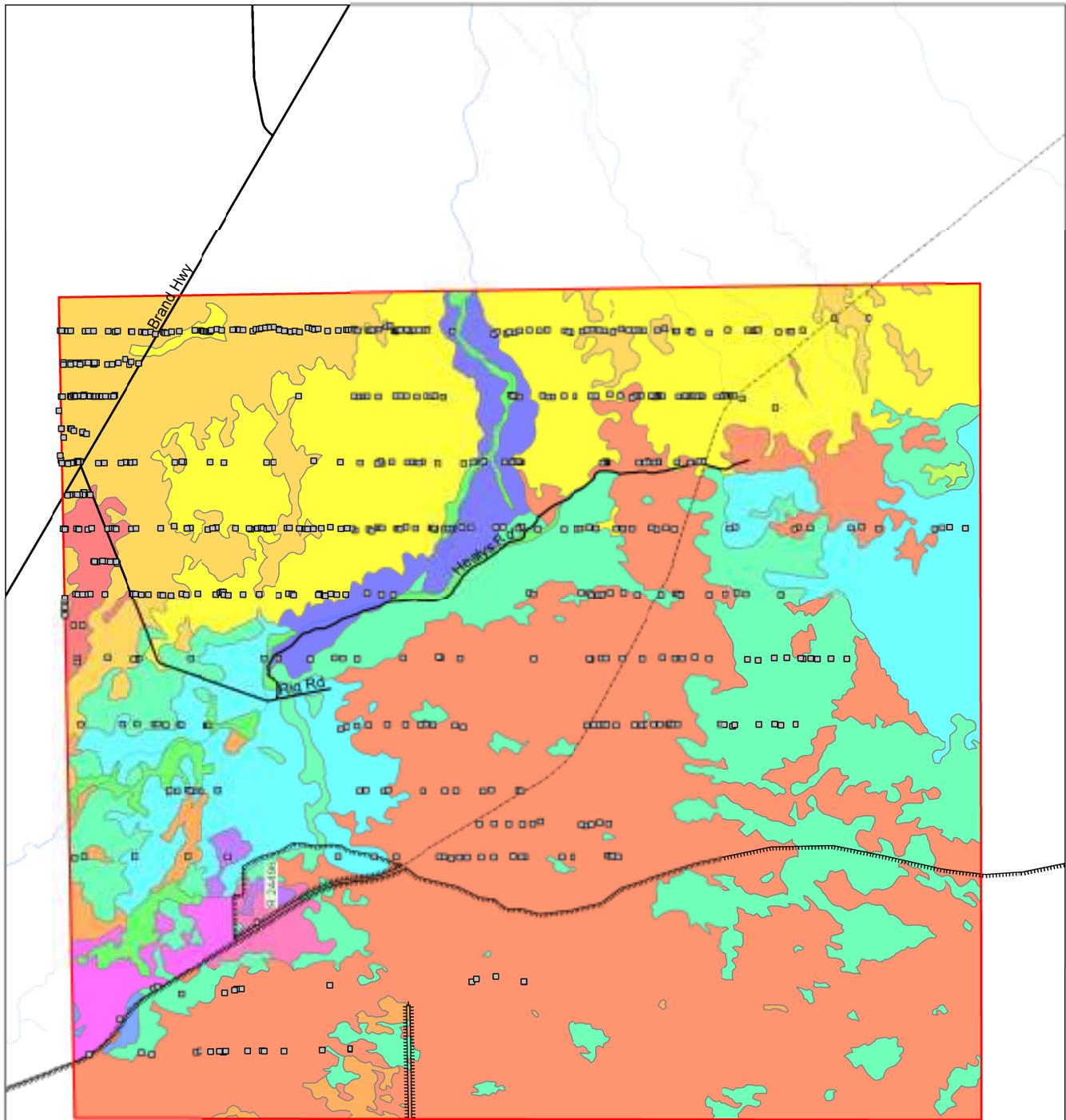
4.2.4. Vegetation Mapping Units

Vegetation communities were surveyed and mapped at 1:10,000 or greater across the study area and varied from low open to closed heathland to mallee and open woodland to cleared sites associated with pastoral land use. Detailed description of the vegetation communities present within the study area are provided below (**Table 7**) with their distribution mapped in **Figure 6**.

Table 7 – Vegetation unit descriptions

Vegetation unit	Description	Area (m ²)	Proportion of total area (%)
<i>Acacia blakelyi</i> open shrubland	<i>Acacia blakelyi</i> open shrubland typically over <i>Hibbertia hypericoides</i> . <i>Banksia</i> spp., <i>Calothamnus quadrifidus</i> open heath with occasional <i>Conospermum candicans</i> over <i>Scaevola sericea</i> and <i>Dampiera spicigera</i> low sparse shrubland/heathland. A very sparse layer of sedges may be present. Isolated <i>Eucalyptus todtiana</i> mallee trees, <i>Banksia prionotes</i> and/or <i>Xylomelum angustifolium</i> may be present.	97	0.9
<i>Acacia spathulifolia</i> shrubland	<i>Acacia spathulifolia</i> shrubland/heathland to closed shrubland to 2 m tall occasionally with <i>Banksia sessilis</i> , <i>Jacksonia hakeoides</i> over a low shrubland of <i>Banksia leptophylla</i> , <i>Eremaea beaufortioides</i> , <i>Hibbertia hypericoides</i> . <i>Xanthorrhoea drummondii</i> and <i>Macrozamia fraseri</i> are occasionally conspicuous components. Ground layer is very open to sparse rushland of <i>Ecdiocollea monostachya</i> . Isolated <i>Eucalyptus erythrocorys</i> mallee trees may be present at various sites. Forms a mosaic with the <i>Banksia</i> spp. low open shrubland unit.	4368	39.3
<i>Acacia</i> tall closed shrubland	<i>Acacia rostellifera</i> forms a tall (5 m) closed shrubland to dense thickets in places over <i>Jacksonia hakeoides</i> , <i>Hakea trifurcata</i> , <i>Melaleuca</i> spp. open shrub layer to 1.5 m over a sparse forbland of <i>Conostylis</i> among other species. Occurs within Beekeepers NR towards to western boundary of the study area.	131	1.2
<i>Banksia</i> spp. low open shrubland	<i>Banksia</i> spp. and/or <i>Melaleuca</i> spp. low (to 1 m) open to closed shrubland/heathland with <i>Hakea trifurcata</i> , <i>H. circumalata</i> , <i>Regelia ciliata</i> , <i>Hibbertia hypericoides</i> , <i>Macrozamia fraseri</i> , <i>Eremaea beaufortioides</i> , <i>Calothamnus quadrifidus</i> common. Groundlayer typically open sedgeland, to forbland to clumps of grass (<i>Neurachne alopecuroidea</i>).	995	9.0
<i>Banksia</i> spp. low open shrubland with emergents	<i>Banksia</i> spp. and/or <i>Melaleuca</i> spp. form a low (to 1.2 m) open to closed shrubland/heathland (as above). Scattered individuals or clumps of <i>Eucalyptus todtiana</i> mallee trees, <i>Banksia prionotes</i> and/or <i>Xylomelum angustifolium</i> are present above the shrubland canopy.	1884	16.9
<i>Eucalyptus camaldulensis</i> woodland	<i>Eucalyptus camaldulensis</i> and/or <i>E. loxophleba</i> woodland to 16 m tall along the active channels and associated floodplains of the Arrowsmith River over open to closed shrubland of <i>Melaleuca raphiophylla</i> , <i>Grevillea</i> spp., <i>Jacksonia hakeoides</i> over a sparse forbland/sedgeland characterised by sedges, grasses and forbs.	171	1.5
<i>Eucalyptus erythrocorys</i> mallee woodland	<i>Eucalyptus erythrocorys</i> forms a mallee woodland 3 – 8 m tall typically over an open to closed shrubland of <i>Acacia spathulifolia</i> with <i>Banksia sessilis</i> and/or <i>Jacksonia hakeoides</i> over <i>Ecdiocollea monostachya</i> sparse rushland. Often found on sands overlying limestone.	1857	16.7
<i>Eucalyptus erythrocorys</i> open mallee woodland	<i>Eucalyptus erythrocorys</i> open mallee woodland over closed shrubland of <i>Acacia spathulifolia</i> with <i>Gyrostemon ramulosus</i> and/or <i>Banksia sessilis</i> . <i>Melaleuca</i> spp. comes more prominent depending on position in landscape and depth of soil over a <i>Hibbertia hypericoides</i> , <i>Thryptomene</i> sp. low shrubland over <i>Ecdiocollea monostachya</i> sparse	1065	9.6

Vegetation unit	Description	Area (m ²)	Proportion of total area (%)
	<p>rushland. Typically on limestone ridges with shallow sandy soils.</p>		
<i>Eucalyptus enythrocorys</i> open woodland	<i>Eucalyptus enythrocorys</i> and/or <i>E. loxophleba</i> open woodland over sparse tall shrub layer of <i>Anthocercis littorea</i> over <i>Acacia spathulifolia</i> shrubland. Occurs on alluvial floodplains associated with Arrowsmith River.	17	0.2
<i>Melaleuca</i> tall closed to tall shrubland	<i>Melaleuca raphiophylla</i> tall (to 2 m) closed shrubland to thicket with <i>Leptospermum oligandrum</i> over low open shrubland of <i>Hibbertia</i> sp. Predominantly confined to recent alluvial plains associated with the Arrowsmith River.	274	2.5
Open shrubland	<i>Acacia</i> sp., <i>Banksia sessilis</i> open shrubland over <i>Stirlingia latifolia</i> , <i>Daviesia pedunculata</i> , <i>Hibbertia hypericoides</i> heathland.	32	0.3
Tall shrubland	Tall shrubland of <i>Anthocercis littorea</i> , <i>Banksia prionotes</i> and <i>Macrozamia fraseri</i> over shrubland of <i>Acacia</i> sp., <i>Chamelaucium uncinatum</i> , <i>Hakea trifurcata</i> over sparse grassland of <i>Neurachne alopecuroidea</i> .	79	0.7
Ephemeral lake	A drainage depression is evident on the aerial photography towards the southern boundary of the project area but was not assessed during this survey. It is assumed that it would act as an ephemeral lake during the wetter part of the year and may support a range of ephemeral species.	9	0.1
Pasture	Areas towards the north of the study area have been converted to wheat/sheep production. Includes clumps and isolated trees of <i>Eucalyptus</i> spp. with no native understorey strata remaining.	143	1.3



Study Area Boundary

Main Road

Conservation Area

Environmental Boundary

Vegetation Community

- Acacia blakelyi shrubland
- Acacia spathulifolia shrubland
- Acacia tall closed shrubland
- Banksia spp. low open shrubland
- Banksia spp. low open shrubland with emergents
- Ephemeral lake
- Eucalyptus camaldulensis woodland
- Eucalyptus erythrocorys open mallee woodland
- Eucalyptus erythrocorys open mallee woodland
- Eucalyptus erythrocorys open woodland
- Meialeuca tall closed to tall shrubland
- Open shrubland
- Pasture
- Tall shrubland

Flora Collections and Vegetation Assessments

Railway

Waterway

0 4,000 METRES

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Arrowsmith Botanical Survey and Fauna Habitat Assessment

Figure 6 Vegetation Communities

Stratagen Environmental Consultants

November 2012

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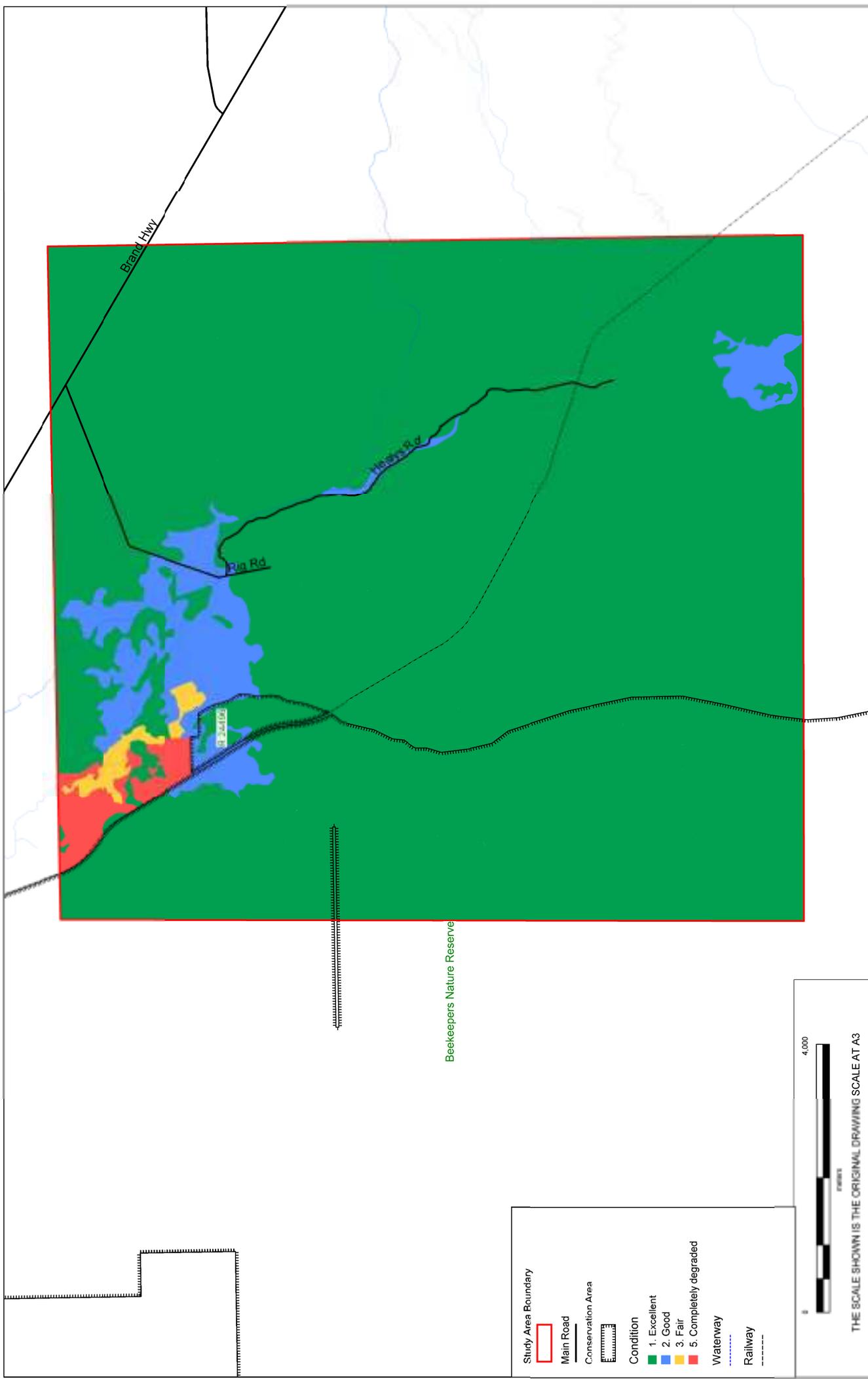
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4.2.5. Vegetation Condition

The vegetation condition across the site varied from Completely Degraded where the native vegetation has been removed and converted to wheat/pastures, to Excellent where vegetation structure was intact with minimal disturbance (Table 8, Figure 7). Evidence of past fire events was present across most of the study area with the majority of the area burnt within the last 10 years.

Table 8 – Vegetation condition within the study area (Kaesehagen 1994)

Condition Rating	Area (m ²)	Proportion of total area (%)	Description
1. Excellent	10300	92.6	>80% native flora composition; vegetation structure intact or nearly so; minor signs of disturbance; weed are non-aggressive species (cover <5%)
2. Good	616	5.5	60-80% native flora composition; vegetation structure altered in places; obvious signs of disturbance; weed cover/abundance 5-20%
3. Fair	63	0.6	40-60% native flora composition; vegetation structure significantly altered yet retains basic structure or ability to regenerate to it; very obvious signs of multiple disturbance; weed cover/abundance 20-50%
4. Completely Degraded	143	1.3	<20% native flora composition; vegetation structure no longer intact; extensive disturbance/modification present; weeds are highly invasive (cover/abundance >80%)



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 ECOSC12-0037-07

Arrowsmith Botanical Survey and Fauna Habitat Assessment
 Figure 7 Vegetation Condition
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Study Area Boundary
 Study Area Boundary

Main Road
 Main Road

Conservation Area
 Conservation Area

Condition

- 1. Excellent
- 2. Good
- 3. Fair
- 5. Completely degraded

Waterway
 Waterway

Railway
 Railway

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4.2.6. Fauna Habitat Assessment

Ten distinct fauna habitat types were identified:

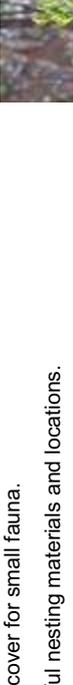
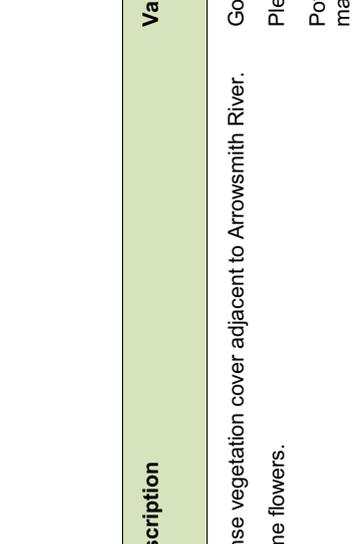
- Banksia low open shrubland with emergents;
- Casuarina woodland;
- Closed heathland;
- Eucalyptus woodland;
- Melaleuca closed tall shrubland;
- Mallee woodland;
- Open heathland;
- Open woodland on limestone ridge;
- Pasture; and
- Permanent creek with riparian vegetation

These habitats as they were observed on-site are described in **Table 9**.

Table 9 – Fauna habitat descriptions.

Site #	Habitat Type	Description	Value for Wildlife	Photo
Lines 1, 3, 5, 9, 11, 13, 15, 17	Banksia low open shrubland with emergents	Banksia over open to closed shrubland or heathland. Some fallen woody debris and leaf litter. Abundant flowers and fruits. Abundant microhabitats in the form of hollows and depressions in ground.	Good foraging and cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles.	
Lines 1, 5, 7, 11	Casuarina woodland	Medium to tall trees over bare sand. Abundant leaf litter. Abundant fruits. Some groundcover by large sedges.	Potential food source for the endangered Carnaby's Black-Cockatoo.	

Site #	Habitat Type	Description	Value for Wildlife	Photo
Lines 1, 3, 13, 15	Closed heathland	<p>Low vegetation. Abundant flowers.</p> <p>No hollow-bearing logs or hollows in trees.</p> <p>Thick groundcover of sedges and grasses.</p> <p>Abundant microhabitats in the form of hollows and depressions in ground.</p>	<p>Good foraging and cover for fauna.</p> <p>Plentiful nesting materials and locations.</p> <p>Supports a range of birds, mammals and reptiles.</p>	
Lines 1, 3, 7, 9, 11, 13, 15, 17, 19, 21, 23	Eucalyptus woodland	<p>Tall Eucalyptus over open to closed shrubland.</p> <p>Large fallen woody debris and leaf litter.</p> <p>Tree hollows and log hollows.</p>	<p>Good foraging and cover for fauna.</p> <p>Plentiful nesting materials and locations.</p> <p>Supports a range of birds, mammals and reptiles.</p>	

Site #	Habitat Type	Description	Value for Wildlife	Photo
Lines 3, 5, 7, 9	Melaleuca closed tall shrubland	Dense vegetation cover adjacent to Arrowsmith River. Some flowers.	Good cover for small fauna. Plentiful nesting materials and locations. Potentially supports a range of birds and small mammals.	
Lines 1, 7, 9, 13, 15, 17, 19, 23	Mallee woodland	Open woodland typically over open to closed shrubland. Cover provided by shrubs. Fallen woody debris and leaf litter. Tree hollows and log hollows.	Good cover for fauna. Plentiful nesting materials and locations. Supports a range of birds, mammals and reptiles. Likely to support the vulnerable Malleefowl.	

Site #	Habitat Type	Description	Value for Wildlife	Photo
Lines 1, 2, 3, 5, 9, 11, 13, 15, 17	Open heathland	<p>Low vegetation.</p> <p>Abundant flowers.</p> <p>No hollow-bearing logs or hollows in trees.</p> <p>Sparse groundcover of sedges and low shrubs.</p> <p>Abundant microhabitats in the form of hollows and depressions in ground.</p>	<p>Good foraging.</p> <p>Provides some cover for small mammals, reptiles and birds.</p> <p>Potentially supports a range of birds, small mammals and reptiles.</p>	
Lines 9, 11, 13, 15, 17, 19, 21, 23	Open woodland on limestone ridge	<p>Open woodland with scrub.</p> <p>Abundant flowers.</p> <p>Some hollow-bearing logs or hollows in trees.</p> <p>Abundant loose rocks and crevices.</p> <p>Sparse groundcover of sedges and low shrubs.</p>	<p>Good cover for fauna.</p> <p>Plentiful nesting materials and locations.</p> <p>Supports a range of birds, mammals and reptiles.</p>	

Site #	Habitat Type	Description	Value for Wildlife	Photo
Line 19	Pasture	<p>Low vegetation with few emergent trees.</p> <p>Negligible flowers, hollow bearing logs or hollows in trees.</p> <p>Light groundcover of grasses.</p>	<p>Likely to support insectivorous species.</p> <p>Little cover for small terrestrial species.</p>	
Lines 1, 3, 5, 7, 9	Permanent creek with riparian vegetation	<p>Tall riparian vegetation with thick undergrowth.</p> <p>Numerous small, medium and large hollows.</p> <p>Permanent shallow flowing water.</p>	<p>Tall riparian vegetation may provide roosting sites for raptors.</p> <p>Thick riparian vegetation hosts abundant birdlife.</p> <p>Important water source for fauna.</p> <p>Numerous hollows in riparian vegetation provide good nesting habitat for birds and small mammals.</p>	

4.2.7. Opportunistic Observations of Fauna

A variety of fauna was observed throughout the study area. Forty-nine bird, seven mammal (six introduced species) and four reptile species were observed either by direct visual observation or by calls, scats, tracks or lodgings.

The opportunistic observations are listed in **Table 19** (in **Appendix C**) and it should be noted that observations were limited to those species easily detectable during daylight hours.

Carnaby's Black-Cockatoo

There was one visual and aural observation of an adult Carnaby's Black-Cockatoo which flew over open woodland and landed on an *Eucalyptus camaldulensis* in the distance. A pair of Black Cockatoos was seen in the area on a different day but no positive identification was made.

The location of the observation was 317666mE, 6723670mN.

Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by *Hakea*, *Banksia* and *Grevillea* species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. It is occasionally recorded in casuarina woodlands, or in 'mallee country', and is sometimes seen in towns or on roadside verges (Department of Sustainability, Environment, Water, Population and Communities, 2012).

Patches of suitable habitat occur within the study area and there are records of Carnaby's Black-Cockatoo in the region containing the study area and 10km buffer.

Malleefowl

A malleefowl mound was observed along the Line 11 traverse, north of 318175.39mE, 6723681.39mN in *Eucalyptus erythrocorys* mallee woodland with *Acacia* spp., *Hibbertia* and *Banksia* shrubland.

The Malleefowl occurs in semi-arid and arid zones of temperate Australia, where it inhabits shrublands and low woodlands that are dominated by mallee vegetation with a dense understorey of shrubs (including species of *Acacia*, *Cassia*, *Bossiaea* and *Beyeria*) or grass (especially species of *Triodia*) and herbs with an abundance of leaf litter (Department of Sustainability, Environment, Water, Population and Communities, 2012).

Patches of suitable habitat occur within the study area and there are records of Malleefowl in the region containing the study area and 10km buffer.

Rainbow Bee-Eater

Multiple groups of Rainbow Bee-Eaters were observed throughout the study area. Observations and notes are shown in **Table 10**. The Rainbow Bee-eater occurs in open woodlands, semi-arid scrub, grasslands, clearing in heavier forests, farmlands and coastal areas (Morcombe, 2003).

Patches of suitable habitat occur within the study area and there are records of Rainbow Bee-eaters in the region containing the study area and 10km buffer.

Table 10 – Rainbow bee-eater observations (GDA94 zone 50)

Easting	Northing	Comments
321370	6719389	Sand plain dominated by low shrub to 0.5m tall. Sparse Eucalyptus to <3 m tall. Call.
319424	6718735	Scrubland with emergent banksia to 2 m tall. 3 individuals.
318542	6719145	Scrubland with emergent banksia to 2 m tall. 3 individuals.
318179	6722003	Woodland to 10 m tall <i>Eucalyptus erythrocoys</i> (mallee). Acacia to 1.5 m. Low shrubs. Yellow sand
318164	6723120	Open Xanthorrhoea, Acacia, everlastings and sedges.
322313	6716802	Along railway
316570	6721494	Dominant canopy at 1-1.5 m tall. <i>Banksia leptophylla</i> , gently undulating ground. Emergent sparse Xanthorrhoea and Eucalyptus to 3 m tall.
316569	6724734	<i>Eucalyptus camaldulensis</i> open woodland 10-30% cover 16 m tall. Dogwood, Xanthorrhoea sparse shrubland 2.5 m tall. Acacia shrubland 30-70% cover.
314189	6724971	Eucalyptus woodland. 3 individuals next to track.
318018	6723630	1 individual in Eucalyptus woodland
319366	6718679	Acacia to 2 m tall hunting above shrub and perched in dead tree
318967	6718882	Eucalyptus woodland to 20 m tall, acacia shrub to 1.5 m tall, sedges to 0.5 m tall

5. Summary & Conclusion

5.1. Flora and Vegetation

5.1.1. Vegetation of Conservation Significance

Thirteen vegetation communities were identified and mapped within the Arrowsmith study area. All of the vegetation communities identified are typical of the habitats in the study area. The most widespread vegetation communities of the study area were *Acacia spathulifolia* shrubland/heathlands (39.27%), mallee and woodland communities characterised by *Eucalyptus erythrocorys* (26.44%) and *Banksia* spp. shrubland/heathland communities (25.89%). A small proportion of the study area (1.29%) comprises an area cleared for wheat/sheep production.

Overall, the majority of the vegetation of within the study area was in Very Good to Excellent condition with only scattered occurrences of weeds or other disturbances. Evidence of past fires was apparent at the majority of sites. No vegetation communities listed as TECs or PECs occur in the study area or have been previously recorded from the Arrowsmith locality.

5.1.2. Flora of Conservation Significance

No DRF species were recorded from the Arrowsmith study area.

One Priority 2 species, *Guichenotia quasicalva*, was recorded from within the *Melaleuca* tall closed to tall shrubland unit associated with alluvial soils of the Arrowsmith River. Five Priority 3 species (*Grevillea erinacea*, *Hopkinsia anoetocolea*, *Persoonia rudis*, *Schoenus griffinianus* and *Verticordia fragrans*) and two Priority 4 species (*Banksia elegans* and *Stawellia dimorphantha*) were recorded during this survey. *Stawellia dimorphantha* is also listed as Vulnerable under the EPBC Act. All of the Priority flora recorded during this survey have been previously recorded within the general vicinity of the study area and none are outside their known geographical range.

5.2. Fauna

One species listed as Vulnerable under the EPBC Act is likely to occur within the study area. A Malleefowl (*Leipoa ocellata*) nesting site was observed but the mound did not appear to be in use at the time of the survey.

One species listed as Endangered under the EPBC Act, Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), was observed in woodland within the study area.

One migratory species listed under the EPBC Act, Rainbow Bee-eater (*Merops ornatus*), was observed multiple times within the study area.

All three of these species have been previously recorded within the general vicinity of the study area and none are outside their known geographical range.

Habitat for the Priority 4 listed Western Brush Wallaby (*Macropus irma*) was confirmed present and there have been previous records of the species within the region containing the study area and 10km buffer. This species is likely to occur within the study area.

There are records of Fork-tailed Swift (*Apus pacificus*) in the region containing the study area and 10km buffer. This species is also likely to occur within the study area.

5.3. Potential impacts

The primary impact of the proposed seismic survey within the study area is from rolling and hand cutting of remnant vegetation and disturbance to the soil surface. Movement of vehicles and machinery associated with seismic surveys may exacerbate the introduction and spread of weeds and dieback due to *Phytophthora* infection.

Impacts on terrestrial fauna are likely to be minimal and comprise removal of habitat that is widespread in the locality and the region, and loss of individuals from local populations.

5.4. Recommendations

The proponent should commit to rehabilitating the area as well as monitoring and reporting to the DEC on the progress of rehabilitation. Rehabilitation on the privately owned farm land to the northern of the study area would be to the landholder's satisfaction. In areas of native vegetation it is expected that rolled vegetation would regain pre-rolled structure within three growing seasons. This would be monitored by the proponent annually and if there is not sufficient vegetation growth returning, remedial rehabilitation work would be implemented. Any vegetation that has been set aside from brush cutting or pruning would be placed on top of the seismic lines to provide organic matter, habitat, seed source and assist in rehabilitation. Monitoring of the line rehabilitation will be via comparing the rolled vegetation to near-by intact vegetation.

Level 2 surveys may be required to improve the resolution of this assessment particularly in regards to terrestrial fauna and DRF or Priority taxa that are predicted to occur in the study area.

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7. Glossary

Term	Definition
DEC	Western Australian Department of Environment and Conservation
DRF	Declared Rare Flora under the Western Australian <i>Wildlife Conservation Act 1950</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	Global Positioning System
NVIS	National Vegetation Information System
PEC	Priority Ecological Community
TEC	Threatened Ecological Communities
TP List	DEC's Threatened and Priority Flora List
TPFL	DEC's Threatened (Declared Rare) and Priority Flora database
WAHERB	Western Australian Herbarium Specimen database
WC Act	Western Australian <i>Wildlife Conservation Act 1950</i>
WONS	Weeds of National Significance

Appendix A Search Results

Add when PDF: EPBC PMST results, NatureMap species list report

Table 11 – TPFL search results

POPID	NAMEID	TAXON	CONSSTATUS	WARANK	POPNUMBER	SUBPOPCODE	GDA94LAT	GDA94LONG	VESTING	PURPOSE1	COUNTDATE
87631	5447	<i>Calytrix chrysantha</i>	4		11		-29.707097090	115.201448300	RAI	RRE	3/02/1992
87671	5455	<i>Calytrix eneabensis</i>	4		6		-29.711541540	115.205059400	RAI	RRE	20/11/1992
87672	5455	<i>Calytrix eneabensis</i>	4		8		-29.602929180	115.215335600	NON	UCL	25/11/1993
93903	17286	<i>Guichenotia quasicalva</i>	2		2		-29.630930330	115.139308400	RDL	UCL	10/10/2002
100037	6418	<i>Leucopogon obtectus</i>	T	EN	1	B	-29.689319020	115.210614700	NON	UCL	27/02/1995
97086	1314	<i>Stawellia dimorphantha</i>	4		1	A	-29.557096730	115.094779600	NON	UCL	19/11/1992
97087	1314	<i>Stawellia dimorphantha</i>	4		1	B	-29.557096730	115.094779600	MRD	VER	19/11/1992
90023	12425	<i>Verticordia fragrans</i>	3		5		-29.707097000	115.209226000	NON	UCL	24/11/1993
90024	12425	<i>Verticordia fragrans</i>	3		6		-29.707097090	115.201448300	NON	UCL	24/11/1993
90026	12425	<i>Verticordia fragrans</i>	3		8		-29.690707980	115.205614700	NON	UCL	11/10/1989

Table 12 – TP List search results

Taxon	Status	Rank	IUCN Criteria	EPBC	DEC Region	DEC District	Distribution	Flowering Period
<i>Acacia vittata</i>	2				MWST	MOORA	Lake Logue, Arrowsmith, Mount Kokeby	
<i>Banksia elegans</i>	4				MWST	MOORA	Diamond of Desert Spring, Lake Indoon, Lake Arrowsmith,	Oct-Nov
<i>Calytrix eneabensis</i>	4				MWST	MOORA	Eneabba, Lake Indoon, Arrowsmith	Jul-Oct
<i>Diuris eburnea</i>	1				MWST	MOORA	Arrowsmith	Nov
<i>Eryngium pinnatifidum</i> subsp. <i>palustre</i>	3				SWAN	SWAN COASTAL	Serpentine, Kenwick, Upper Swan, Gingin, Forrestdale, Bullsbrook, Mandurah, Arrowsmith, Capel	-
<i>Guichenotia quasicalva</i>	2				MWST	GERALDTON, MOORA	Three Springs, Hutt River, Arrowsmith	Oct
<i>Haloragis foliosa</i>	3				MWST	GERALDTON, MOORA	Winchester, Arrowsmith, Leeman, Beekeepers Reserve, Cliff Head, Dongara	Oct
<i>Homalocalyx chapmanii</i>	2				MWST	GERALDTON, MOORA	Arrowsmith River, Geraldton, One Tree Hill, Three Springs	
<i>Hopkinsia anoectocolea</i>	3				MWST, WHTB	MOORA, CENTRAL WHEATBELT	Arrowsmith, Eneabba, Meckering, Cunderdin (Mortlock River), Tammin	-
<i>Paracaleana dixonii</i>	T	VU	D1	EN	MWST, SWAN	SWAN COASTAL, MOORA	Eneabba, Coomallo Creek, Sullivan Rock, Arrowsmith, Yandahooka, Moore River NP	Oct-Nov
<i>Stawellia dimorphantha</i>	4				MWST	MOORA	Eneabba/Arrowsmith region	Nov-Dec
<i>Stylidium torticarpum</i>	3				MWST	MOORA	Lesueur, Herschell Range, Arrowsmith River	Oct
<i>Synaphea oulopha</i>	1				MWST	MOORA	Eneabba, Arrowsmith, Arrino	Jun-Aug
<i>Triglochin protuberans</i>	3				GOLD, MWST, SCST	ALBANY, KALGOORLIE, GERALDTON, MOORA	Stirling Range NP, Malcolm, Yalgoo, Burnerbinmah Stn, Arrowsmith	Aug-Oct
<i>Verticordia dasystylis</i> subsp. <i>oestopola</i>	1				MWST	MOORA	Arrowsmith	Oct-Nov
<i>Verticordia luteola</i> var. <i>luteola</i>	3				MWST	GERALDTON, MOORA	Mt Adams, Three Springs, Arrowsmith, Casuarinas	Nov-Dec
<i>Verticordia luteola</i> var. <i>rosea</i>	1				MWST	MOORA	Eneabba, Arrowsmith	Dec-Jan
<i>Verticordia penicillaris</i>	4				MWST, WHTB	MOORA, GREAT SOUTHERN	Bindoo Hill, Moresby Range, Arrowsmith River, Eneabba, Kukerin	

Table 13 – WA Herbarium search results

SHEET_NO	TAXON	CONS_CODE	SITE	VEGETATION	LOCALITY	LAT	LONG	COLL_DATE
PERTH 03707504	<i>Acacia latipes</i> subsp. <i>licina</i>	3	Flat, white/yellowish sandy soil. Soil ponds water during winter. Burnt recently.	Acacia thicket.	N of Eneabba E of Brand Highway and 1.6 km W of intersection of Beekeepers Reserve Road and railway line	- 29.7082000	115.1858920	22 07 1994
PERTH 07290438	<i>Acacia latipes</i> subsp. <i>licina</i>	3	Flat. White sand.	Heath A to low heath C. Associated species: <i>Acacia</i> sp., <i>Banksia</i> sp., <i>Calothamnus</i> sp., <i>Conospermum</i> sp., <i>Eucalyptus todiana</i> , <i>Melaleuca</i> sp., <i>Restionaceae</i> sp.	1.6 km W of the rail crossing on Beekeepers Road, W of the Brand Highway (Population Katby 225)	- 29.7082500	115.1853880	04 12 2004
PERTH 05200172	<i>Banksia elegans</i>	4			Arowsmith, S of Dongara	- 29.5747200	115.0616660	09 1970
PERTH 05470781	<i>Banksia elegans</i>	4	On white sand.		35 km NW along Brand Highway from Eneabba.	- 29.5616600	115.1022220	15 11 1996
PERTH 1150197	<i>Banksia elegans</i>	4	Plain of yellow sand.	Heath dominated by <i>Banksia hookeriana</i> .	34 km N of Eneabba on Brand Highway.	- 29.5833300	115.1166660	11 10 1982
PERTH 08075263	<i>Beyeria gardneri</i>	3	Woodland: IN medium grained brown sand high in local landscape on flat terrain. Heath: On yellow sand in flat terrain of a broad basin ringed by <i>Eucalyptus erythrocorys</i> trees on limestone around Western and Southern Edges.	In Open Low Woodland A and Heath B. Associated species: Woodland: <i>Eucalyptus todiana</i> , <i>Banksia prionotes</i> saplings over <i>Banksia attenuata</i> , <i>Acacia spathulifolia</i> , <i>Hakea polyanthera</i> , <i>Scholtzia laxiflora</i> , <i>Daviesia divaricata</i> subsp. <i>divaricata</i> , <i>Banksia leptoph</i>	In an Environmentally Sensitive Area on Iluka Resources Eneabba tenement, ca 1.2 km S of Skippers Road and ca 3.8 km - 4.2 km W on access track	- 29.6477900	115.1046840	15 11 2008
PERTH 03510360	<i>Calytrix chrysantha</i>	4			along railway line, near Beekeepers Rd, NW of Eneabba	- 29.7083300	115.2000000	03 02 1992
PERTH 03553841	<i>Calytrix chrysantha</i>	4	Yellow sand flat.	Heath to 1.5 m with emergent <i>Banksia</i> spp., assoc. with <i>Conospermum</i> sp., <i>Eremaea</i> sp., <i>Verticordia densiflora</i> .	W side of Brand Highway along firebreak from 100 m S of intersection with Skipper Road, for 3.1 km S intermittent populations	- 29.6333300	115.2166660	25 11 1993
PERTH 06383971	<i>Calytrix chrysantha</i>	4	Alluvium. Guildford Formation-alluvium. Pleistocene. Deep sands.	Open <i>Banksia</i> woodland. Dominant sp. at site: <i>Eremaea acutifolia</i> . Vegetation height: 3 m. Number of spp. at site: 22.	Site 91, Beekeepers Reserve	- 29.7103300	115.1614790	16 01 1985
PERTH 06383726	<i>Calytrix chrysantha</i>	4	Alluvium. Guildford Formation-alluvium. Pleistocene. Deep sands.	Open <i>Banksia</i> woodland. Dominant sp. at site: <i>Eremaea acutifolia</i> . Vegetation height: 3 m. Number of spp. at site: 22.	Site 91, Beekeepers Reserve	- 29.7103300	115.1614790	16 12 1985
PERTH 02335212	<i>Calytrix ecalycata</i> subsp. <i>ecalycata</i>	3			About 1 mile along Water Supply road	- 29.5780500	115.0947220	22 09 1978
PERTH 03483207	<i>Calytrix eneabbensis</i>	4	White sand.		18 km N Eneabba	- 29.6669400	115.1916660	03 09 1985
PERTH 03510379	<i>Calytrix eneabbensis</i>	4	Landform: plain, Slope - 0. Soil: cream sand; Drainage: good.	Structure (Muir 1977): Scattered Low Trees / Scrub / Low Scrub B / Dwarf Scrub C / Dwarf Scrub D; Major spp: <i>Banksia attenuata</i> , <i>Acacia blakelyi</i> , <i>Stirlingia latifolia</i> ; long unburnt.	AMG-Zone 50 326243mE 6711668m N; Adjacent to railway, NW of Eneabba.	- 29.7127700	115.2036110	20 11 1992
PERTH 03553833	<i>Calytrix eneabbensis</i>	4	Dry yellow sand flat.	Open low woodland of <i>Eucalyptus todiana</i> & <i>Banksia</i> sp. with heath to 1 m, assoc. with <i>Beaufortia</i> sp., <i>Pileanthus</i> sp., <i>Conospermum</i> sp., <i>Verticordia densiflora</i> , <i>Dryandra carlinoides</i> , <i>Calothamnus sanguineus</i> .	2.7 km E along Barrons Road N of Eneabba N side of road where seismic line runs N, plants from 20 m N of road	- 29.6000000	115.2000000	25 11 1993
PERTH 1021206	<i>Calytrix superba</i>	4	Flat, sand over laterite.	Heath.	Irwini district, 11 km N of Green Head Road along Eneabba South Road. [Ca 25 km N of Eneabba]	- 29.5633300	115.2166660	24 01 1979
PERTH 06424295	<i>Dampiera tephrea</i>	2	Pleistocene coastal limestone-predominantly calcarenite and kankar. Limestone ridge. Rock cover: 5%. Slope: 5 degrees.	Open Woodland. Dominant sp. at site: <i>Acacia spathulifolia</i> . Vegetation height: 4 m. No. of spp. at site: 21.	Site 86, Beekeepers Reserve Collection	- 29.6680500	115.0850000	04 07 1985
PERTH 06424880	<i>Dampiera tephrea</i>	2	Coastal limestone. Rock cover: 20%. Pleistocene coastal limestone-predominantly calcarenite and kankar. Limestone ridge.	Shrubland. Dominant sp. at site: <i>Dryandra sessilis</i> . Vegetation height: 2 m. Number of spp. at site: 36.	Site 94, Beekeepers Reserve	- 29.7094400	115.1333330	04 06 1985
PERTH 06411967	<i>Grevillea erimecea</i>	3	Coastal limestone. Rock cover: 20%. Pleistocene coastal limestone-predominantly calcarenite and kankar. Limestone ridge.	Shrubland. Dominant sp. at site: <i>Dryandra sessilis</i> . Vegetation height: 2 m. Number of spp. at site: 38.	Site 94, Beekeepers Reserve	- 29.7095100	115.1333300	31 07 1985
PERTH 05767431	<i>Guichenotia quaequalva</i>	2	Riverbank. Fine grey river sand.	York Gum, <i>Grevillea exposita</i> , sedges and small annuals.	Pigeon Flat, 3 km S of Tin Well,	- 29.6333300	115.1366660	20 10 2000
PERTH 08075530	<i>Hemiandra</i> sp. Eneabba (H. Demariz 3887)	3	Grey sand in flat terrain on a low plain.	Low Heath C. With <i>Scholtzia laxiflora</i> (much higher % cover in disturbance area), <i>Hibbertia hypericoides</i> , <i>Hakea polyanthera</i> (P3), <i>Conospermum wycheleyi</i> subsp. <i>glabrum</i> , <i>Melaleuca leuropoma</i> (pink), <i>Lambertia multiflora</i> , <i>Leptospermum erubescens</i> , <i>Jacksonea</i> h	On Iluka Resources Eneabba tenement (Woodade N drill line), ca 16 km N of Skippers Road on Brand Highway then ca 200 m W on un-named access track, ca 500 m S via private airstrip	- 29.5906900	115.1487680	16 11 2008
PERTH 1742035	<i>Hopkinsia anoetocolea</i>	3	On sandy loam flat. Low-lying.	Very open shrubland.	Arowsmith Lake	- 29.5500000	115.0833330	09 12 1974
PERTH 1953354	<i>Hopkinsia anoetocolea</i>	3	Sandy beam flat. Low lying.	Very open shrubland.	Arowsmith Lake	- 29.5500000	115.0833330	09 12 1974
PERTH 2067153	<i>Hopkinsia anoetocolea</i>	3	On sandy flat near small stream.	Under <i>Melaleuca</i> shrubs, etc.	Arowsmith River, 22 km N of Eneabba on Brand Highway	- 29.6333300	115.2166660	30 09 1984

Arowsmith Level 1 Botanical Survey and Threatened Fauna Assessment Report

PERTH 03511022	<i>Hopkinsia anoectocolea</i>	3	near winter wet depression, grey sand.	dense heath.	Brand Highway, about 15km N of Arrowsmith River crossing, N of Eneabba.	29.5550000	115.0875000	29 09 1992
PERTH 05965349	<i>Hopkinsia anoectocolea</i>	3	River floodplain; deep sand subjected to flooding.		Brand Highway at Arrowsmith River.	29.6319400	115.2166660	20 11 1999
PERTH 06173691	<i>Hopkinsia anoectocolea</i>	3	Slight depression. Sandy soil with some clay.	Acacia - Hakea shrubland surrounded by Eucalyptus - Actinostrobus woodland.	Brand Highway 12.7 km SW of junction with Coast Road, c. 36 km NNW of Eneabba, Irwin District	29.5666600	115.0833330	06 10 1995
PERTH 07312555	<i>Hopkinsia anoectocolea</i>	3	Sandy floodplain beside river and on sandbanks, c. 10 m back from river.	In Melaleuca shrubland along river floodplain, surrounding area is Eucalypt. Banksia low woodland.	Arrowsmith River at Brand Highway, 10 m from river	29.6320900	115.2197800	26 11 2003
PERTH 07312547	<i>Hopkinsia anoectocolea</i>	3	Sandy floodplain beside river and on sandbanks, c. 10 m back from river.	In Melaleuca shrubland along river floodplain, surrounding area is Eucalypt- Banksia low woodland.	Arrowsmith River at Brand Highway, 10 m from river	29.6320900	115.2197800	26 11 2003
PERTH 07312288	<i>Hopkinsia anoectocolea</i>	3	Sloping banks of river flood plain.		Arrowsmith River at Brand Highway, 10 m from river, 100 m SW of Drummonds Bridge	29.6320900	115.2181130	26 11 2003
PERTH 06156002	<i>Hopkinsia anoectocolea</i>	3	Slight depression. Sandy soil with some clay.	Acacia - Hakea shrubland surrounded by Eucalyptus - Actinostrobus woodland.	Brand Highway 12.7 km SW of junction with Coast Road, c. 36 km NNW of Eneabba, Irwin District	29.5666600	115.0833330	06 10 1995
PERTH 01826018	<i>Hypocalymma tetrapterum</i>	3			N of Arrowsmith R. [River] on Dongara Road	29.5780500	115.0947220	28 06 1970
PERTH 08181985	<i>Leucopogon oblectus</i>	T	Plain, dry yellow sand.	Open Eucalyptus toditiana woodland over species-rich heath. Associated species: Melaleuca leuropoma, Petrophile macrostachya, Andersonia heterophylla, Jacksonia floribunda.	On E side of track to 'Pamella pipeline compressor station one', 1.5 km from intersection with Beekeepers road, N of Eneabba (Reserve C 39744)	29.7169400	115.1663880	16 11 2008
PERTH 08021406	<i>Pearsonia rudis</i>	3	Sand dune. Dry yellow sand.	Open Low Woodland of Eucalyptus toditiana. Banksia attenuata over Heath to Low Heath dominated by Hakea polyantha and Ecdicecolea monostachya.	S of Mt Adams Road,	29.5702200	115.1454160	07 11 2006
PERTH 08075425	<i>Pearsonia rudis</i>	3	Cream to yellow sand in gently undulating terrain on a low plain.	On track edge adjacent to Low Heath C. With Conospermum wycherleyi subsp. glabrum, Caloithamus sanguineus, Pileanthus filifolius, Melaleuca leuropoma (pink and white), Leptospermum spinescens, Beaufortia elegans, Schoitzia umbellifera, Hibbertia hyperico	On Iluka Resources Eneabba tenement, (access track to Arrowsmith N drill line), ca 6 km N along Brand Highway from Skippers Road intersection to un-named access track, (N of Arrowsmith River); Plants are at ca 2.8 km W	29.6151900	115.1552410	17 11 2008
PERTH 08075409	<i>Pearsonia rudis</i>	3	Grey brown sand in flat terrain on a low plain.	On track edge adjacent to Heath B over Very Open Low Sedges. With Caloithamus blepharosperrus, Banksia candolleana, Hakea polyantha (P3), Schoitzia umbellifera, Eremaea beaufortoides var. microphylla, Leptospermum erubescens, Dryandra shuttleworthiana	On Iluka Resources Eneabba tenement (Woodada N drill line) ca 14.5 N of Skippers Road on Brand Highway then ca 1.5 km E on un-named track	29.5913600	115.1757950	16 11 2008
PERTH 08075360	<i>Schoenus griffianus</i>	3	Grey sand in a low flat plain.	In disturbed area within Low Heath C. With Schoitzia laxiflora, Hibbertia hypericoidea, Hakea polyantha (P3), Conospermum wycherleyi subsp. glabrum, Melaleuca leuropoma (pink), Lambertia multiflora, Leptospermum erubescens, Jacksonia hakeoides, Leucopo	On Iluka Resources Eneabba tenement (Woodada N drill line) then ca 200 m W on un-named access track, then ca 500 m S via private airstrip. Plants are immediately W and E of the airstrip	29.5907900	115.1434110	16 11 2008
PERTH 1032739	<i>Stawella dimorphantha</i>	4	In sand.	In dense scrub of Acacia blakelyi with Ecdicecolea.	Near Lake Arrowsmith	29.5500000	115.0833330	09 12 1974
PERTH 03510174	<i>Stawella dimorphantha</i>	4	Landform: plain. Slope - 2; Soil: grey sand / yellow sand; Drainage: good.	Structure (Muir 1977): Open Low Woodland B/ Heath B/ Dwarf Scrub D/ Open Tall Sedges/ Very Open Low Sedges/ Very Open Herbs; Major spp: Banksia prionotes, B. attenuata, Ecdicecolea monostachya, long unburt	AMS-Zone 50 317504mE 6727533m N; N side Brand Hwy, NW of Arrowsmith River, N of Eneabba.	29.5686100	115.1161110	29 09 1992
PERTH 1778722	<i>Stawella dimorphantha</i>	4	Flat. Grey sand.	Low woodland with scrub beneath with Banksia prionotes, Eucalyptus toditiana, Xylomelum angustifolium, Acacia saligna, Acacia sp., Trymalium sp., Conostylis sp., Billardiera sp.	44-45 km S of Dongara on Brand Highway and 13.7 km N of turnoff to Western Flora (McQueens) Caravan Park	29.5500000	115.0833330	06 01 1992
PERTH 3244148	<i>Stawella dimorphantha</i>	4	Low depression between rises to NW & SE. white-grey sand.	Open low woodland of Nuytsia floribunda & Xylomelum sp. assoc. with Arthrocarisillifera, Scaevola sp., Verticordia grandis, Melaleuca sp., Eremaea sp., Lechen-aulita linearoides, Conosperma sp., Conospermum stoechadis, Terpsionia D	Brand Hwy 13.5-14.2 km NW of turnoff to Western Flora Caravan Park N of Eneabba & Drummonds Bridge	29.5500000	115.0833330	19 11 1992
PERTH 08269610	<i>Stylidium longitubum</i>	3	Wet-wet flat, brown clay loam.	Acacia and mallee shrubland over ephemeral herbs, including Stylidium despectum.	2 km N of railway line on track through UCL to Brand Highway, N of Beekeepers Nature Reserve,	29.63339100	115.1399720	21 09 2007
PERTH 01875752	<i>Stylidium pseudocaeptosum</i>	2			S of Dongara on Eneabba Road	29.5633300	115.1666660	07 09 1969
PERTH 01705172	<i>Synsphaea ulophya</i>	1	Downslope from lateritic breakaway, grey sand; gravelly loam.	Low heath.	Vacant Crown Land N of Arrowsmith River, E of Brand Highway, in Gravel	29.5780500	115.0947220	15 10 1981
PERTH 04968832	<i>Triglochin protuberans</i>	3	Low lying clay pan. Damp grey clay over laterite.	Low Forest B, Open Scrub, Open Low Scrub A, Open Low Scrub B, Dwarf Scrub C, Herbs with York gum (Euc. loxophleba), myrtaceous shrubs, Hakea, iverworts - Fossombronia - 2 spp., Asterella, Lethocolea and moss including Bryum pachythea, Cladia aggregata.	E along track near Arrowsmith River, 8.3 km N along railway line from Beekeepers Road, W of Brand Highway	29.6323700	115.1411690	09 10 1997
PERTH 08075204	<i>Verticordia argentea</i>	2	Cream to yellow sand on gently undulating terrain within a low plain.	On track in adjacent Open Low Woodland B over Very Open Low Sedges. With Eucalyptus toditiana, Xylomelum angustifolium, Banksia menziesii, B. attenuata, Schoitzia laxiflora, Hibbertia hypericoidea, Conospermum wycherleyi subsp. glabrum, S	On Iluka Resources Eneabba tenement, (Pamella West drill line), ca 4.5 km N of Coolimba / Eneabba Road. Accessed from Brand Highway intersection with Coolimba / Eneabba Road W ca 8 km, then N ca 4.5 km, then E ca 3 km, then N ca 450 m to the drill line	29.5913600	115.1757950	12 11 2008
PERTH 02029006	<i>Verticordia dasystylis subsp. oestopola</i>	1	In shallow gritty soil over granite rocks.		S of Arrowsmith River	29.5780500	115.0947220	21 10 1982
PERTH	<i>Verticordia fragrans</i>	3	Grey sand, sandplain.	Open woodland (Eucalyptus toditiana) over open heath.	Crown land 6.45 km S of Arrowsmith river on Brand Highway	-	115.2041660	11 10 1989

Table 14 – DEC threatened fauna search results

NAME	NAME_ID	FAMILY	GENUS	SPECIES	AUTHOR	VERNACULAR	KINGDOM	CONSV_CODE	CLASS
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Calyptorhynchus latirostris</i>	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby	Carnaby's Cockatoo (short-billed black-cockatoo)	Animalia	T	BIRD
<i>Leipoa ocellata</i>	24557	Megapodiidae	Leipoa	ocellata	Gould	Malleefowl	Animalia	T	BIRD
<i>Leipoa ocellata</i>	24557	Megapodiidae	Leipoa	ocellata	Gould	Malleefowl	Animalia	T	BIRD
<i>Falco peregrinus</i>	25624	Falconidae	Falco	peregrinus	Tunstall	Peregrine Falcon	Animalia	S	BIRD
<i>Apus pacificus</i>	25554	Apodidae	Apus	pacificus	(Latham)	Fork-tailed Swift	Animalia	IA	BIRD
<i>Merops ornatus</i>	24598	Meropidae	Merops	ornatus	Latham	Rainbow Bee-eater	Animalia	IA	BIRD
<i>Merops ornatus</i>	24598	Meropidae	Merops	ornatus	Latham	Rainbow Bee-eater	Animalia	IA	BIRD
<i>Merops ornatus</i>	24598	Meropidae	Merops	ornatus	Latham	Rainbow Bee-eater	Animalia	IA	BIRD
<i>Merops ornatus</i>	24598	Meropidae	Merops	ornatus	Latham	Rainbow Bee-eater	Animalia	IA	BIRD
<i>Hemisaga vepreculae</i>	33976	Tettigoniidae	Hemisaga	vepreculae		cricket	Animalia	3	INVERT
<i>Hylaeus globuliferus</i>	33977	Colletidae	Hylaeus	globuliferus		bee	Animalia	3	INVERT
<i>Ardeotis australis</i>	24610	Otididae	Ardeotis	australis	(J.E. Gray)	Australian Bustard	Animalia	4	BIRD
<i>Macropus irma</i>	24133	Macropodidae	Macropus	irma	(Jourdan)	Western Brush Wallaby	Animalia	4	MAMMAL

NatureMap Species List Report EP 413

Created By Guest user on 14/09/2012

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°02' 36" E,29°37' 37" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Rare or likely to become extinct	6	13
Protected under international agreement	7	10
Priority 1	4	16
Priority 2	7	16
Priority 3	19	67
Priority 4	11	88
Non-conservation taxon	838	1917
TOTAL	892	2127

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo))		T	
2.	17605 <i>Eleocharis keigheryi</i>		T	
3.	17150 <i>Eremophila glabra</i> subsp. <i>chlorella</i>		T	
4.	24557 <i>Leipoa ocellata</i> (Malleefowl)		T	
5.	6418 <i>Leucopogon obtectus</i> (Hidden Beard-heath)		T	
6.	13867 <i>Paracaleana dixonii</i>		T	
Protected under international agreement				
7.	25554 <i>Apus pacificus</i> (Fork-tailed Swift)		IA	
8.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
9.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
10.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)		IA	
11.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
12.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
13.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
Priority 1				
14.	30715 <i>Stylidium carnosum</i> subsp. <i>Narrow leaves</i> (J.A. Wege 490)		P1	
15.	15531 <i>Synaphea oulopha</i>		P1	
16.	12410 <i>Verticordia dasystylis</i> subsp. <i>oestopoa</i>		P1	
17.	14688 <i>Verticordia luteola</i> var. <i>rosea</i>		P1	
Priority 2				
18.	14153 <i>Acacia vittata</i>		P2	
19.	4560 <i>Comesperma rhadinocarpum</i> (Slender-fruited Comesperma)		P2	
20.	7481 <i>Dampiera tephrea</i>		P2	
21.	17286 <i>Guichenotia quasicalva</i>		P2	
22.	7779 <i>Stylidium pseudocaeptosum</i>		P2	
23.	17266 <i>Thryptomene</i> sp. <i>Lancelin</i> (M.E. Trudgen 14000)		P2	
24.	12391 <i>Verticordia argentea</i>		P2	
Priority 3				
25.	14612 <i>Acacia latipes</i> subsp. <i>licina</i>		P3	
26.	13075 <i>Acacia telmica</i>		P3	
27.	6948 <i>Anthocercis intricata</i>		P3	
28.	34236 <i>Beyeria cinerea</i> subsp. <i>cinerea</i>		P3	
29.	4596 <i>Beyeria gardneri</i>		P3	
30.	19979 <i>Calytrix ecalycata</i> subsp. <i>ecalycata</i>		P3	
31.	1999 <i>Grevillea erinacea</i>		P3	
32.	6173 <i>Haloragis foliosa</i>		P3	
33.	19411 <i>Hemiandra</i> sp. <i>Eneabba</i> (H. Demarz 3687)		P3	
34.	6869 <i>Hemigenia saligna</i>		P3	
35.	17742 <i>Hopkinsia anoectocolea</i>		P3	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
			P3	
36.	5828 <i>Hypocalymma tetrapterum</i>		P3	
37.	2271 <i>Persoonia rudis</i>		P3	
38.	17606 <i>Schoenus griffinianus</i>		P3	
39.	7756 <i>Stylidium longitubum</i> (Jumping Jacks)		P3	
40.	13127 <i>Stylidium maritimum</i>		P3	
41.	19038 <i>Triglochin protuberans</i>		P3	
42.	12425 <i>Verticordia fragrans</i>		P3	
43.	14715 <i>Verticordia luteola</i> var. <i>luteola</i>		P3	
Priority 4				
44.	1816 <i>Banksia elegans</i> (Elegant Banksia)		P4	
45.	5447 <i>Calytrix chrysantha</i>		P4	
46.	5455 <i>Calytrix eneabensis</i>		P4	
47.	5480 <i>Calytrix superba</i> (Superb Starflower)		P4	
48.	13544 <i>Eucalyptus zopherophloia</i> (Blackbutt Mallee)		P4	
49.	2054 <i>Grevillea olivacea</i> (Olive Grevillea)		P4	
50.	6233 <i>Hydrocotyle lemnooides</i> (Aquatic Pennywort)		P4	
51.	36203 <i>Liparophyllum congestiflorum</i>		P4	
52.	24180 <i>Macroderma gigas</i> (Ghost Bat)		P4	
53.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
54.	1314 <i>Stawellia dimorphantha</i> (Arrowsmith Stilt-lily)		P4	
Non-conservation taxon				
55.	<i>Ablabesmyia notabilis</i>			
56.	3197 <i>Acacia aciphylla</i>			
57.	3200 <i>Acacia acuminata</i> (Jam)			
58.	15430 <i>Acacia alata</i> var. <i>tetrantha</i>			
59.	3231 <i>Acacia auronitens</i>			
60.	3242 <i>Acacia blakelyi</i>			
61.	15472 <i>Acacia cavealis</i>			
62.	3265 <i>Acacia comans</i>			
63.	3303 <i>Acacia dilatata</i>			
64.	3332 <i>Acacia fagonioides</i>			
65.	18442 <i>Acacia hopperiana</i>			
66.	3376 <i>Acacia idiomorpha</i>			
67.	11611 <i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>			
68.	3412 <i>Acacia latipes</i>			
69.	15476 <i>Acacia latipes</i> subsp. <i>latipes</i>			
70.	3419 <i>Acacia ligulata</i> (Umbrella Bush)			
71.	3453 <i>Acacia myrtifolia</i>			
72.	15291 <i>Acacia neurophylla</i> subsp. <i>neurophylla</i>			
73.	3525 <i>Acacia rostellifera</i> (Summer-scented Wattle)			
74.	3527 <i>Acacia saligna</i> (Orange Wattle)			
75.	30033 <i>Acacia saligna</i> subsp. <i>lindleyi</i>			
76.	3549 <i>Acacia spathulifolia</i>			
77.	3604 <i>Acacia xanthina</i> (White-stemmed Wattle)			
78.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
79.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill)			
80.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
81.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
82.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
83.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
84.	1775 <i>Adenanthos cygnorum</i> (Common Woollybush)			
85.	11837 <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> (Common Woollybush)			
86.	4582 <i>Adriana quadripartita</i> (Bitter Bush)			
87.	<i>Aedes</i> sp. 3			Y
88.	<i>Agraptocorixa hirtifrons</i>			
89.	<i>Ainudrilus</i> sp. <i>D</i> (Arro)			Y
90.	1056 <i>Alexgeorgea nitens</i>			
91.	1721 <i>Allocasuarina campestris</i>			
92.	1732 <i>Allocasuarina humilis</i> (Dwarf Sheoak)			
93.	<i>Allodessus bistrigatus</i>			
94.	<i>Allotrissocladius</i> sp. <i>M</i>			
95.	<i>Alona cambouei</i>			
96.	<i>Alona</i> cf. <i>costata</i>			
97.	<i>Alona</i> cf. <i>pulchella</i>			Y
98.	<i>Alona</i> cf. <i>rectangula</i>			
99.	<i>Alona diaphana</i>			
100.	<i>Alona diaphana</i> <i>vermiculata</i>			
101.	<i>Alona macrocopa</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
102.	<i>Alona rigidicaudis</i> s.l.			
103.	189 <i>Alopecurus geniculatus</i> (Marsh Foxtail)	Y		
104.	4905 <i>Alyogyne hakeifolia</i>			
105.	4906 <i>Alyogyne huegelii</i> (Lilac Hibiscus)			
106.	15458 <i>Alyogyne huegelii</i> var. <i>huegelii</i>			
107.	6565 <i>Alyxia buxifolia</i> (Dysentery Bush)			
108.	126 <i>Amphibolis antarctica</i> (Sea Nymph)			
109.	127 <i>Amphibolis griffithii</i>			
110.	200 <i>Amphipogon turbinatus</i>			
111.	2380 <i>Amyema miquelii</i> (Stalked Mistletoe)			
112.	2383 <i>Amyema preissii</i> (Wireleaf Mistletoe)			
113.	24312 <i>Anas gracilis</i> (Grey Teal)			
114.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
115.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
116.	6311 <i>Andersonia heterophylla</i>			
117.	7832 <i>Angianthus milnei</i> (Cone-spike Angianthus)			
118.	7833 <i>Angianthus preissianus</i>			
119.	11434 <i>Anigozanthos humilis</i> subsp. <i>humilis</i>			
120.	11565 <i>Anigozanthos manglesii</i> subsp. <i>quadrans</i>			
121.	<i>Anisops gratus</i>			
122.	<i>Anisops thienemanni</i>			
123.	<i>Anopheles annulipes</i>			
124.	2332 <i>Anthobolus foveolatus</i>			
125.	11725 <i>Anthocercis ilicifolia</i> subsp. <i>ilicifolia</i>			
126.	6949 <i>Anthocercis littorea</i> (Yellow Tailflower)			
127.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
128.	<i>Antiporus</i> sp.			
129.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
130.	7838 <i>Arctotheca calendula</i> (Cape Weed)	Y		
131.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
132.	1264 <i>Arnocrinum preissii</i>			
133.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
134.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
135.	<i>Asplanchnopus multiceps</i>			
136.	7851 <i>Asteridea pulverulenta</i> (Common Bristle Daisy)			
137.	6332 <i>Astroloma microdonta</i> (Sandplain Cranberry)			
138.	16941 <i>Astroloma pedicellatum</i>			
139.	6337 <i>Astroloma stomarrhena</i> (Red Swamp Cranberry)			
140.	6339 <i>Astroloma xerophyllum</i>			
141.	2452 <i>Atriplex cinerea</i> (Grey Saltbush)			
142.	<i>Australocyclops palustrium</i>			
143.	<i>Austrolestes analis</i>			
144.	<i>Austrolestes annulosus</i>			
145.	17234 <i>Austrostipa compressa</i>			
146.	17257 <i>Austrostipa variabilis</i>			
147.	<i>Austrosuccinea</i> sp.			
148.	5350 <i>Baeckea grandiflora</i> (Large-flowered Baeckea)			
149.	1800 <i>Banksia attenuata</i> (Slender Banksia)			
150.	1809 <i>Banksia candolleana</i> (Propeller Banksia)			
151.	32576 <i>Banksia dallanneyi</i> (Couch Honeypot)			
152.	32578 <i>Banksia dallanneyi</i> subsp. <i>media</i>			
153.	1821 <i>Banksia hookeriana</i> (Hooker's Banksia)			
154.	1823 <i>Banksia incana</i>			
155.	1828 <i>Banksia leptophylla</i>			
156.	11386 <i>Banksia leptophylla</i> var. <i>melletica</i>			
157.	1834 <i>Banksia menziesii</i> (Firewood Banksia)			
158.	1842 <i>Banksia prionotes</i> (Acorn Banksia)			
159.	32077 <i>Banksia sessilis</i> var. <i>cygnorum</i>			
160.	32074 <i>Banksia shuttleworthiana</i> (Bearded Dryandra)			
161.	32032 <i>Banksia tridentata</i> (Yellow Honeypot)			
162.	38765 <i>Battarrea stevenii</i>			
163.	17761 <i>Beaufortia aestiva</i>			
164.	5382 <i>Beaufortia elegans</i>			
165.	<i>Bennelongia australis</i>			
166.	<i>Berosus</i> sp.			
167.	4594 <i>Beyeria cinerea</i>			
168.	34237 <i>Beyeria cinerea</i> subsp. <i>borealis</i>			
169.	<i>Bezzia</i> sp. (not 1 or 2)			
170.	3154 <i>Billardiera coriacea</i>			
171.	<i>Bithynia</i> sp. nov. 1			Y

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
172.	24319 <i>Biziura lobata</i> (Musk Duck)			
173.	<i>Boeckella triarticulata</i>			
174.	4406 <i>Boronia busselliana</i>			
175.	4413 <i>Boronia crenulata</i> (Aniseed Boronia)			
176.	4414 <i>Boronia cymosa</i> (Granite Boronia)			
177.	11381 <i>Boronia ramosa</i> subsp. <i>anethifolia</i>			
178.	1273 <i>Borya sphaerocephala</i> (Pincushions)			
179.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
180.	30133 <i>Brachyloma jillup</i>			
181.	7867 <i>Brachyscome bellidioides</i>			
182.	<i>Branchinella</i> sp. nov. 2 (<i>complexidigitata</i>)			Y
183.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
184.	245 <i>Briza minor</i> (Shivery Grass)	Y		
185.	252 <i>Bromus madritensis</i> (Madrid Brome)	Y		
186.	253 <i>Bromus rubens</i> (Red Brome)	Y		
187.	26520 <i>Brongniartella australis</i>			
188.	1366 <i>Bulbine semibarbata</i> (Leek Lily)			
189.	20230 <i>Byblis lamellata</i>			
190.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
191.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
192.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
193.	18036 <i>Caladenia bicallata</i> subsp. <i>cleistogama</i>			
194.	1582 <i>Caladenia crebra</i> (Arrowsmith Spider Orchid)			
195.	11136 <i>Caladenia denticulata</i>			
196.	37043 <i>Caladenia denticulata</i> subsp. <i>Arrowsmith</i> (G. Brockman GBB 2441)			Y
197.	1599 <i>Caladenia latifolia</i> (Pink Fairy Orchid)			
198.	17589 <i>Caladenia occidentalis</i>			
199.	19863 <i>Caladenia</i> x <i>coactescens</i>			
200.	<i>Calamoecia</i> sp. 342 (<i>ampulla</i> variant)			
201.	2846 <i>Calandrinia calyptata</i> (Pink Purslane)			
202.	2848 <i>Calandrinia corrigioloides</i> (Strap Purslane)			
203.	2853 <i>Calandrinia eremaea</i> (Twining Purslane)			
204.	2854 <i>Calandrinia granulifera</i> (Pygmy Purslane)			
205.	2856 <i>Calandrinia liniflora</i> (Parakeelya)			
206.	20478 <i>Calandrinia</i> sp. <i>Blackberry</i> (D.M. Porter 171)			
207.	4717 <i>Callitriche stagnalis</i> (Common Starwort)	Y		
208.	36560 <i>Callitris arenaria</i> (Sandplain Cypress)			
209.	36600 <i>Callitris pyramidalis</i> (Swamp Cypress)			
210.	7891 <i>Calocephalus francisii</i> (Fine-leaf Beauty-heads)			
211.	5411 <i>Calothamnus hirsutus</i>			
212.	35756 <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>			
213.	5429 <i>Calothamnus sanguineus</i> (Silky-leaved Blood flower)			
214.	5431 <i>Calothamnus torulosus</i>			
215.	7903 <i>Calotis hispidula</i> (Bindy Eye)			
216.	5450 <i>Calytrix depressa</i>			
217.	12771 <i>Calytrix ecalycata</i>			
218.	5476 <i>Calytrix sapphirina</i>			
219.	19888 <i>Calytrix</i> sp. <i>Eneabba</i> (B.J. Lepschi & T.R. Lally BJL3617)			
220.	5479 <i>Calytrix strigosa</i>			
221.	32335 <i>Campylopus bicolor</i>			
222.	<i>Candonocypris novaezealandiae</i>			
223.	2796 <i>Carpobrotus modestus</i> (Inland Pigface)			
224.	2798 <i>Carpobrotus virescens</i> (Coastal Pigface)			
225.	11351 <i>Cassytha aurea</i> var. <i>hirta</i>			
226.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
227.	11857 <i>Cassytha glabella</i> forma <i>glabella</i>			
228.	2953 <i>Cassytha melantha</i> (Large Dodder-laurel)			
229.	2956 <i>Cassytha pomiformis</i> (Dodder Laurel)			
230.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
231.	11799 <i>Cassytha racemosa</i> forma <i>racemosa</i>			
232.	1742 <i>Casuarina obesa</i> (Swamp Sheoak)			
233.	26556 <i>Caulerpa cactoides</i>			
234.	26586 <i>Caulocystis uvifera</i>			
235.	1120 <i>Centrolepis alepyroides</i>			
236.	1124 <i>Centrolepis cephaloformis</i>			
237.	1125 <i>Centrolepis drummondiana</i>			
238.	1129 <i>Centrolepis glabra</i> (Smooth Centrolepis)			
239.	1134 <i>Centrolepis polygyna</i> (Wiry Centrolepis)			
240.	<i>Cephalodella forficula</i>			
241.	<i>Cephalodella gibba</i>			

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242.	7923 <i>Cephalosorus carpesioides</i>			
243.	24187 <i>Chalinolobus morio</i> (Chocolate Wattled Bat)			
244.	8788 <i>Chamaescilla versicolor</i>			
245.	5498 <i>Chamaelaucium uncinatum</i> (Geraldton Wax)			
246.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
247.	3169 <i>Cheiranthra preissiana</i>			
248.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck)			
249.	<i>Chironomus aff. alternans</i> (V24)			
250.	<i>Chironomus tepperi</i>			
251.	29619 <i>Chondrophycus brandenii</i>			
252.	17706 <i>Chordifex sinuosus</i>			
253.	7928 <i>Chrysanthemum coronarium</i>	Y		
254.	12612 <i>Chrysocephalum apiculatum</i>			
255.	<i>Chydorus</i> sp.			
256.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
257.	<i>Cladopelma curtivalva</i>			
258.	26663 <i>Cladurus elatus</i>			
259.	10804 <i>Clematis linearifolia</i>			
260.	26679 <i>Codium perrinae</i>			
261.	26688 <i>Coeloclonium tasmanicum</i>			
262.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
263.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
264.	4552 <i>Comesperma confertum</i>			
265.	4553 <i>Comesperma drummondii</i> (Drummond's Milkwort)			
266.	4555 <i>Comesperma integerrimum</i>			
267.	4561 <i>Comesperma scoparium</i> (Broom Milkwort)			
268.	40872 <i>Commersonia borealis</i>			
269.	15511 <i>Conospermum boreale</i>			
270.	15512 <i>Conospermum boreale</i> subsp. <i>ascendens</i>			
271.	15513 <i>Conospermum boreale</i> subsp. <i>boreale</i>			
272.	1859 <i>Conospermum brachyphyllum</i>			
273.	15041 <i>Conospermum canaliculatum</i>			
274.	1882 <i>Conospermum stoechadis</i> (Common Smokebush)			
275.	15521 <i>Conospermum unilaterale</i>			
276.	15524 <i>Conospermum wycherleyi</i> subsp. <i>glabrum</i>			
277.	6349 <i>Conostephium preissii</i>			
278.	11414 <i>Conostylis aculeata</i> subsp. <i>breviflora</i>			
279.	1420 <i>Conostylis androstemma</i> (Trumpets)			
280.	1423 <i>Conostylis aurea</i> (Golden Conostylis)			
281.	12027 <i>Conostylis candicans</i> subsp. <i>calcicola</i>			
282.	11438 <i>Conostylis candicans</i> subsp. <i>candicans</i>			
283.	1428 <i>Conostylis canteriata</i>			
284.	11773 <i>Conostylis crassinervia</i> subsp. <i>absens</i>			
285.	11938 <i>Conostylis crassinervia</i> subsp. <i>crassinervia</i>			
286.	1435 <i>Conostylis hiemalis</i>			
287.	1442 <i>Conostylis neocymosa</i>			
288.	1446 <i>Conostylis prolifera</i> (Mat Cottonheads)			
289.	1448 <i>Conostylis resinosa</i>			
290.	1456 <i>Conostylis stylioides</i>			
291.	1458 <i>Conostylis teretiuscula</i>			
292.	1459 <i>Conostylis tomentosa</i>			
293.	19880 <i>Convolvulus angustissimus</i>			
294.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
295.	24416 <i>Corvus bennetti</i> (Little Crow)			
296.	25592 <i>Corvus coronoides</i> (Australian Raven)			
297.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i>			
298.	<i>Corynoneura</i> sp. (V49)			
299.	7943 <i>Cotula australis</i> (Common Cotula)			
300.	7944 <i>Cotula bipinnata</i> (Ferny Cotula)	Y		
301.	7945 <i>Cotula coronopifolia</i> (Waterbuttons)	Y		
302.	7946 <i>Cotula cotuloides</i> (Smooth Cotula)			
303.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
304.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
305.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
306.	3138 <i>Crassula decumbens</i> (Rufous Stonecrop)			
307.	3139 <i>Crassula exserta</i>			
308.	3142 <i>Crassula natans</i>	Y		
309.	4802 <i>Cryptandra mutila</i>			
310.	4809 <i>Cryptandra pungens</i>			
311.	4810 <i>Cryptandra scoparia</i>			

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312.	30893 <i>Cryptoblepharus buchananii</i>			
313.	<i>Cryptochironomus griseidorsum</i>			
314.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragons)			
315.	24881 <i>Ctenophorus maculatus</i> subsp. <i>maculatus</i>			
316.	24882 <i>Ctenophorus nuchalis</i> (Central Netted Dragon)			
317.	25039 <i>Ctenotus fallens</i>			
318.	<i>Culex ?palpalis</i>			Y
319.	<i>Culicoides</i> sp.			
320.	17117 <i>Cullen cinereum</i>			
321.	25087 <i>Cyclodomorphus celatus</i>			
322.	24322 <i>Cygnus atratus</i> (Black Swan)			
323.	815 <i>Cyperus tenellus</i> (Tiny Flatsedge)	Y		
324.	<i>Cypretta baylyi</i>			
325.	<i>Cypretta</i> sp.			
326.	<i>Cypricercus salinus</i>			
327.	<i>Cypricercus</i> sp. 442			
328.	<i>Cyprinotus kimberleyensis</i>			Y
329.	26720 <i>Cystophora grevillei</i>			
330.	26722 <i>Cystophora monilifera</i>			
331.	156 <i>Damasonium minus</i> (Starfruit)			
332.	7443 <i>Dampiera haematotricha</i>			
333.	11326 <i>Dampiera incana</i> var. <i>fuscescens</i>			
334.	7459 <i>Dampiera oligophylla</i> (Sparse-leaved Dampiera)			
335.	7475 <i>Dampiera spicigera</i> (Spiked Dampiera)			
336.	<i>Daphnia cf. cephalata</i>			
337.	5518 <i>Darwinia neildiana</i> (Fringed Bell)			
338.	5529 <i>Darwinia speciosa</i>			
339.	26753 <i>Dasyphila preissii</i>			
340.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
341.	3807 <i>Daviesia divaricata</i> (Marno)			
342.	18560 <i>Daviesia divaricata</i> subsp. <i>divaricata</i>			
343.	3816 <i>Daviesia incrassata</i>			
344.	12329 <i>Daviesia nudiflora</i> subsp. <i>hirtella</i>			
345.	16585 <i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>			
346.	3837 <i>Daviesia quadrilatera</i>			
347.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i>			
348.	17663 <i>Desmocladus asper</i>			
349.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
350.	<i>Dicrotendipes 'CA1'</i> (was <i>lindae</i>)			
351.	<i>Dicrotendipes conjunctus</i>			
352.	26766 <i>Dictyopteris muelleri</i>			
353.	29537 <i>Dictyota fastigiata</i>			
354.	29936 <i>Dictyota gunniana</i>			
355.	32346 <i>Didymodon torquatus</i>			
356.	<i>Diplacodes bipunctata</i>			
357.	24938 <i>Diplodactylus ornatus</i>			
358.	4453 <i>Diplolaena angustifolia</i> (Yanchep Rose)			
359.	4455 <i>Diplolaena ferruginea</i>			
360.	15273 <i>Diplolaena leemaniana</i>			
361.	4746 <i>Diplopeltis huegelii</i>			
362.	18589 <i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>			
363.	18542 <i>Diplopeltis huegelii</i> subsp. <i>subintegra</i>			
364.	1634 <i>Diuris laxiflora</i> (Bee Orchid)			
365.	1638 <i>Diuris setacea</i> (Bristly Donkey Orchid)			
366.	4754 <i>Dodonaea aptera</i> (Coast Hop-bush)			
367.	4766 <i>Dodonaea inaequifolia</i>			
368.	26795 <i>Doxodasya bolbochaete</i>			
369.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
370.	13201 <i>Drosera eneabba</i>			
371.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			
372.	13212 <i>Drosera erythrorhiza</i> subsp. <i>magna</i>			
373.	3098 <i>Drosera glanduligera</i> (Pimpernel Sundew)			
374.	8910 <i>Drosera humilis</i>			
375.	3105 <i>Drosera leucoblasta</i> (Wheel Sundew)			
376.	3106 <i>Drosera macrantha</i> (Bridal Rainbow)			
377.	14298 <i>Drosera macrantha</i> subsp. <i>macrantha</i>			
378.	13216 <i>Drosera menziesii</i> subsp. <i>penicillaris</i>			
379.	3117 <i>Drosera paleacea</i> (Dwarf Sundew)			
380.	29178 <i>Drosera porrecta</i>			
381.	3128 <i>Drosera ramellosa</i> (Branched Sundew)			

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382.	13185 <i>Drosera pilos</i>			
383.	24650 <i>Drymodes brunneopygia</i> (Southern Scrub-robin)			
384.	<i>Dunhevedia crassa</i>			
385.	32351 <i>Eccremidium pulchellum</i>			
386.	26803 <i>Echinothamnion hystrix</i>			
387.	25251 <i>Echiopsis curta</i> (Bardick)			
388.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
389.	5187 <i>Elatine gratioloides</i> (Waterwort)			
390.	2989 <i>Emblingia calceoliflora</i>			
391.	<i>Enochrus maculiceps</i>			
392.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
393.	<i>Ephemeroporus barroisi</i> s.l.			
394.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
395.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
396.	369 <i>Eragrostis australasica</i> (Canegrass)			
397.	13952 <i>Eremaea asterocarpa</i> subsp. <i>histoclada</i>			
398.	13962 <i>Eremaea atala</i>			
399.	5537 <i>Eremaea beaufortioides</i>			
400.	14100 <i>Eremaea beaufortioides</i> var. <i>microphylla</i>			
401.	5538 <i>Eremaea brevifolia</i>			
402.	13951 <i>Eremaea hadra</i>			
403.	17459 <i>Eremaea violacea</i> subsp. <i>raphiophylla</i>			
404.	36239 <i>Eremaea violacea</i> subsp. <i>violacea</i>			
405.	13956 <i>Eremaea x phoenicea</i>			
406.	7215 <i>Eremophila glabra</i> (Tar Bush)			
407.	17175 <i>Eremophila glabra</i> subsp. <i>albicans</i>			
408.	14193 <i>Eremophila glabra</i> subsp. <i>carcosa</i>			
409.	14340 <i>Eremophila glabra</i> subsp. <i>glabra</i>			
410.	14191 <i>Eremophila glabra</i> subsp. <i>tomentosa</i>			
411.	7231 <i>Eremophila lehmanniana</i>			
412.	17168 <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>			
413.	<i>Eretes australis</i>			
414.	14376 <i>Erymophyllum ramosum</i> subsp. <i>involucratum</i>			
415.	12740 <i>Erymophyllum tenellum</i>			
416.	6219 <i>Eryngium pinnatifidum</i> (Blue Devils)			
417.	15446 <i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>			
418.	35345 <i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> (Blunt-budded River Red Gum)			
419.	11978 <i>Eucalyptus celastroides</i> subsp. <i>virella</i>			
420.	13536 <i>Eucalyptus decipiens</i> subsp. <i>decipiens</i>			
421.	15494 <i>Eucalyptus diminuta</i>			
422.	15804 <i>Eucalyptus dolichocera</i>			
423.	5638 <i>Eucalyptus erythrocorys</i> (Illyarrie)			
424.	5648 <i>Eucalyptus flocktoniae</i> (Merrit)			
425.	5649 <i>Eucalyptus foecunda</i> (Narrow-leaved Red Mallee)			
426.	5673 <i>Eucalyptus horistes</i>			
427.	5702 <i>Eucalyptus loxophleba</i> (York Gum)			
428.	11295 <i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> (York Gum)			
429.	5722 <i>Eucalyptus obtusiflora</i> (Dongara Mallee)			
430.	19815 <i>Eucalyptus obtusiflora</i> subsp. <i>dongarraensis</i>			
431.	5730 <i>Eucalyptus oraria</i> (Ooragmandee)			
432.	5763 <i>Eucalyptus rudis</i> (Flooded Gum)			
433.	5790 <i>Eucalyptus todtiana</i> (Coastal Blackbutt)			
434.	15137 <i>Euchiton sphaericus</i>			
435.	<i>Euchlanis dilatata</i> <i>lucksiana</i>			
436.	4648 <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	Y		
437.	10977 <i>Exocarpos aphyllus</i> (Leafless Ballart)			
438.	10765 <i>Exocarpos sparteus</i> (Broom Ballart)			
439.	25621 <i>Falco berigora</i> (Brown Falcon)			
440.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
441.	5209 <i>Frankenia pauciflora</i> (Seaheath)			
442.	25727 <i>Fulica atra</i> (Eurasian Coot)			
443.	906 <i>Gahnia lanigera</i> (Little Sedge)			
444.	7323 <i>Galium murale</i> (Small Goosegrass)	Y		
445.	3894 <i>Gastrolobium callistachys</i> (Rock Poison)			
446.	3916 <i>Gastrolobium polystachyum</i> (Horned Poison)			
447.	24959 <i>Gehyra variegata</i>			
448.	4483 <i>Geleznovia verrucosa</i>			
449.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
450.	32384 <i>Gigaspermum repens</i>			
451.	33620 <i>Glischrocaryon angustifolium</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
452.	7061 <i>Glossostigma drummondii</i> (Mudmat)			
453.	<i>Glyptophysa</i> sp			
454.	29267 <i>Gompholobium muticum</i>			
455.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
456.	11584 <i>Gonocarpus confertifolius</i> var. <i>confertifolius</i>			
457.	7495 <i>Goodenia berardiana</i>			
458.	29362 <i>Goodenia coerulea</i>			
459.	7501 <i>Goodenia corynocarpa</i>			
460.	12551 <i>Goodenia micrantha</i>			
461.	7538 <i>Goodenia pulchella</i>			
462.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
463.	<i>Graptoleberis testudinaria</i>			
464.	14282 <i>Gratiola pubescens</i>			
465.	1956 <i>Grevillea argyrophylla</i> (Silvery-leaved Grevillea)			
466.	1965 <i>Grevillea biternata</i>			
467.	1973 <i>Grevillea candelabroides</i>			
468.	13453 <i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i>			
469.	1989 <i>Grevillea dielsiana</i> (Diels Grevillea)			
470.	15814 <i>Grevillea exposita</i>			
471.	2032 <i>Grevillea leucopteris</i> (White Plume Grevillea)			
472.	15838 <i>Grevillea preissii</i> subsp. <i>glabrilimba</i>			
473.	17745 <i>Grevillea shuttleworthiana</i> subsp. <i>canarina</i>			
474.	2115 <i>Grevillea umbellulata</i>			
475.	5011 <i>Guichenotia ledifolia</i>			
476.	5012 <i>Guichenotia macrantha</i> (Large-flowered Guichenotia)			
477.	5013 <i>Guichenotia micrantha</i> (Small Flowered Guichenotia)			
478.	<i>Gyraulus</i> sp.			Y
479.	2784 <i>Gyrostemon ramulosus</i> (Corkybark)			
480.	2788 <i>Gyrostemon subnudus</i>			
481.	1473 <i>Haemodorum simulans</i>			
482.	1475 <i>Haemodorum spicatum</i> (Mardja)			
483.	438 <i>Hainardia cylindrica</i> (Common Barbgrass)	Y		
484.	2131 <i>Hakea auriculata</i>			
485.	2136 <i>Hakea candolleana</i>			
486.	2143 <i>Hakea conchifolia</i> (Shell-leaved Hakea)			
487.	2146 <i>Hakea costata</i> (Ribbed Hakea)			
488.	11924 <i>Hakea cygna</i> subsp. <i>cygna</i> (Swan Fruit Hakea)			
489.	16908 <i>Hakea eneabba</i>			
490.	2166 <i>Hakea incrassata</i> (Marble Hakea)			
491.	2175 <i>Hakea lissocarpha</i> (Honey Bush)			
492.	2179 <i>Hakea marginata</i>			
493.	17726 <i>Hakea polyanthema</i>			
494.	2196 <i>Hakea preissii</i> (Needle Tree)			
495.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
496.	2198 <i>Hakea pycnoneura</i>			
497.	2203 <i>Hakea ruscifolia</i> (Candle Hakea)			
498.	2214 <i>Hakea trifurcata</i> (Two-leaf Hakea)			
499.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
500.	6696 <i>Halgania sericiflora</i>			
501.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
502.	<i>Haliplus</i> sp.			
503.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
504.	<i>Hellyethira litua</i>			
505.	<i>Hemianax papuensis</i>			
506.	16934 <i>Hemiandra glabra</i> subsp. <i>glabra</i>			
507.	6839 <i>Hemiandra pungens</i> (Snakebush)			
508.	6840 <i>Hemiandra rubriflora</i>			
509.	<i>Hemicordulia tau</i>			
510.	6842 <i>Hemigenia barbata</i>			
511.	41020 <i>Hemiphora bartlingii</i> (Woolly Dragon)			
512.	26915 <i>Hennedya crista</i>			
513.	26925 <i>Heterocladia caudata</i>			
514.	5108 <i>Hibbertia acerosa</i> (Needle Leaved Guinea Flower)			
515.	5112 <i>Hibbertia aurea</i>			
516.	5134 <i>Hibbertia huegelii</i>			
517.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
518.	5153 <i>Hibbertia pachyrrhiza</i>			
519.	5157 <i>Hibbertia polystachya</i>			
520.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
521.	5173 <i>Hibbertia subvaginata</i>			

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522.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
523.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
524.	12007 <i>Hybanthus floribundus</i> subsp. <i>floribundus</i>			
525.	<i>Hyderodes crassus</i>			
526.	<i>Hydrachna</i> sp.			
527.	6229 <i>Hydrocotyle diantha</i>			
528.	6236 <i>Hydrocotyle pilifera</i>			
529.	452 <i>Hyparrhenia hirta</i> (Tambookie Grass)	Y		
530.	5181 <i>Hypericum japonicum</i> (Matted St John's Wort)			
531.	35070 <i>Hypocalymma angustifolium</i> subsp. <i>Swan Coastal Plain</i> (G.J. Keighery 16777)			
532.	5829 <i>Hypocalymma xanthopetalum</i>			
533.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
534.	1500 <i>Hypoxis glabella</i> (Tiny Star)			
535.	<i>Ilyocypris 'spiculata' ms</i>			
536.	<i>Ilyodromus</i> aff. <i>amplicolis</i>			Y
537.	<i>Ischnura heterosticta heterosticta</i>			
538.	<i>Isidorella</i> sp.			
539.	11 <i>Isoetes drummondii</i> (Quillwort)			
540.	911 <i>Isolepis congrua</i>			
541.	912 <i>Isolepis cyperoides</i>			
542.	917 <i>Isolepis marginata</i> (Coarse Club-rush)	Y		
543.	2219 <i>Isopogon adenanthoides</i> (Spider Coneflower)			
544.	2227 <i>Isopogon divergens</i> (Spreading Coneflower)			
545.	2239 <i>Isopogon tridens</i> (Three-toothed Coneflower)			
546.	7398 <i>Isotoma pusilla</i> (Small Isotome)			
547.	3992 <i>Isotropis cuneifolia</i> (Granny Bonnets)			
548.	3998 <i>Jacksonia angulata</i>			
549.	14783 <i>Jacksonia calcicola</i>			
550.	4015 <i>Jacksonia hakeoides</i>			
551.	19632 <i>Johnsonia pubescens</i> subsp. <i>pubescens</i>			
552.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
553.	1180 <i>Juncus capitatus</i> (Capitate Rush)	Y		
554.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
555.	<i>Keratella procurva</i>			
556.	<i>Keratella shieli</i>			
557.	5022 <i>Keraudrenia hermanniifolia</i>			
558.	<i>Kiefferulus martini</i>			
559.	<i>Kurzia latissima</i>			
560.	3664 <i>Labichea cassioides</i>			
561.	11289 <i>Labichea lanceolata</i> subsp. <i>lanceolata</i>			
562.	<i>Lacrimicypris kumpar ms</i>			
563.	<i>Lancetes lanceolatus</i>			
564.	25638 <i>Larus pacificus</i> (Pacific Gull)			
565.	9099 <i>Lasiopetalum angustifolium</i> (Narrow Leaved Lasiopetalum)			
566.	5031 <i>Lasiopetalum drummondii</i>			
567.	14247 <i>Lasiopetalum</i> sp. <i>Coorow</i> (E. Ried 101)			
568.	<i>Latonopsis brehmi</i>			
569.	26999 <i>Laurencia clavata</i>			
570.	27001 <i>Laurencia filiformis</i>			
571.	4959 <i>Lawrencia squamata</i>			
572.	4960 <i>Lawrencia viridigrisea</i>			
573.	1305 <i>Laxmannia omnifertilis</i>			
574.	11679 <i>Laxmannia sessiliflora</i> subsp. <i>drummondii</i>			
575.	<i>Lecane bulla</i>			
576.	<i>Lecane</i> cf. <i>haliclysta</i>			Y
577.	<i>Lecane latissima</i>			
578.	<i>Lecane quadridentata</i>			
579.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
580.	7574 <i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
581.	7577 <i>Lechenaultia hirsuta</i> (Hairy Leschenaultia)			
582.	7580 <i>Lechenaultia linarioides</i> (Yellow Leschenaultia)			
583.	7586 <i>Lechenaultia stenosepala</i> (Narrow-sepaled Leschenaultia)			
584.	18074 <i>Lepidobolus preissianus</i> subsp. <i>preissianus</i>			
585.	930 <i>Lepidosperma costale</i>			
586.	118 <i>Lepilaena australis</i> (Austral Water Mat)			
587.	17852 <i>Leptorhynchus scaber</i> (Lanky Buttons)			
588.	15428 <i>Leptosema aphyllum</i>			
589.	5853 <i>Leptospermum oligandrum</i>			
590.	5857 <i>Leptospermum spinescens</i>			
591.	25133 <i>Lerista elegans</i>			

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592.	25148 <i>Lerista lineopunctulata</i>			
593.	6401 <i>Leucopogon hamulosus</i>			
594.	6405 <i>Leucopogon insularis</i>			
595.	6430 <i>Leucopogon planifolius</i>			
596.	29052 <i>Leucopogon</i> sp. <i>Arrowsmith</i> (M. Hislop 2509)			
597.	34157 <i>Leucopogon</i> sp. <i>Northern ciliate</i> (R. Davis 3393)			
598.	29053 <i>Leucopogon</i> sp. <i>South Eneabba</i> (E.A. Griffin 8027)			
599.	7670 <i>Levenhookia dubia</i> (<i>Hairy Stylewort</i>)			
600.	7672 <i>Levenhookia octomaculata</i> (<i>Eight-spotted Stylewort</i>)			
601.	7677 <i>Levenhookia stipitata</i> (<i>Common Stylewort</i>)			
602.	25005 <i>Lialis burtonis</i>			
603.	24581 <i>Lichenostomus virescens</i> (<i>Singing Honeyeater</i>)			
604.	25661 <i>Lichmera indistincta</i> (<i>Brown Honeyeater</i>)			
605.	<i>Limnocythere dorsosicula</i>			
606.	<i>Limnocythere</i> sp. 447 (<i>aff. porphyretica</i>)			
607.	<i>Limnoxenus zelandicus</i>			
608.	36160 <i>Liparophyllum capitatum</i>			
609.	7407 <i>Lobelia rhytidosperra</i> (<i>Wrinkled-seeded Lobelia</i>)			
610.	16798 <i>Logania litoralis</i>			
611.	6512 <i>Logania spermacocea</i>			
612.	1227 <i>Lomandra hastilis</i>			
613.	18049 <i>Lyginia imberbis</i>			
614.	2396 <i>Lysiana casuarinae</i>			
615.	36375 <i>Lysimachia arvensis</i> (<i>Pimpernel</i>)	Y		
616.	34736 <i>Lysinema pentapetalum</i>			
617.	2839 <i>Macarthuria australis</i>			
618.	<i>Macrothrix breviseta</i>			
619.	<i>Macrotrachela</i> sp.			
620.	24326 <i>Malacorhynchus membranaceus</i> (<i>Pink-eared Duck</i>)			
621.	25651 <i>Malurus lamberti</i> (<i>Variogated Fairy-wren</i>)			
622.	25652 <i>Malurus leucopterus</i> (<i>White-winged Fairy-wren</i>)			
623.	24551 <i>Malurus pulcherrimus</i> (<i>Blue-breasted Fairy-wren</i>)			
624.	25654 <i>Malurus splendens</i> (<i>Splendid Fairy-wren</i>)			
625.	17633 <i>Marianthus erubescens</i>			
626.	17632 <i>Marianthus ringens</i>			
627.	77 <i>Marsilea mutica</i>			
628.	<i>Megaporus howitti</i>			
629.	<i>Megaporus</i> sp.			
630.	19381 <i>Melaleuca caeca</i>			
631.	5887 <i>Melaleuca cardiophylla</i> (<i>Tangling Melaleuca</i>)			
632.	5893 <i>Melaleuca concreta</i>			
633.	13271 <i>Melaleuca huegelii</i> subsp. <i>huegelii</i>			
634.	5922 <i>Melaleuca lanceolata</i> (<i>Rottnest Teatree</i>)			
635.	5925 <i>Melaleuca lateriflora</i> (<i>Gorada</i>)			
636.	18112 <i>Melaleuca leuropoma</i>			
637.	18435 <i>Melaleuca longistaminea</i>			
638.	5936 <i>Melaleuca megacephala</i>			
639.	9183 <i>Melaleuca nematophylla</i> (<i>Wiry Honey-myrtle</i>)			
640.	5959 <i>Melaleuca rhapsiophylla</i> (<i>Swamp Paperbark</i>)			
641.	19365 <i>Melaleuca ryeae</i>			
642.	5972 <i>Melaleuca strobophylla</i>			
643.	18598 <i>Melaleuca systema</i>			
644.	5983 <i>Melaleuca trichophylla</i>			
645.	5986 <i>Melaleuca urceolaris</i>			
646.	13280 <i>Melaleuca viminea</i> subsp. <i>viminea</i>			
647.	25184 <i>Menetia greyii</i>			
648.	<i>Mesocyclops brooksi</i>			
649.	955 <i>Mesomelaena pseudostygia</i>			
650.	<i>Microcyclops varicans</i>			
651.	<i>Miconecta</i> sp.			
652.	<i>Microvelia oceanica</i>			
653.	8105 <i>Millotia myosotidifolia</i>			
654.	4100 <i>Mirbelia spinosa</i>			
655.	4104 <i>Mirbelia trichocalyx</i>			
656.	29418 <i>Monoculus monstrosus</i>	Y		
657.	19584 <i>Monotaxis bracteata</i>			
658.	2412 <i>Muehlenbeckia adpressa</i> (<i>Climbing Lignum</i>)			
659.	7289 <i>Myoporum caprarioides</i> (<i>Slender Myoporum</i>)			
660.	11080 <i>Myosurus australis</i>			
661.	8114 <i>Myriocephalus appendiculatus</i> (<i>White-tip Myriocephalus</i>)			

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662.	14187 <i>Myriocephalus occidentalis</i>			
663.	17925 <i>Myriocephalus oldfieldii</i>			
664.	27090 <i>Myriodesma quercifolium</i>			
665.	27091 <i>Myriodesma serrulatum</i>			
666.	6192 <i>Myriophyllum drummondii</i>			
667.	<i>Neothrix armata</i>			
668.	<i>Neothrix paucisetosa</i>			
669.	492 <i>Neurachne alopecuroidea</i> (Foftail Mulga Grass)			
670.	<i>Nilobezzia</i> sp. 1			
671.	2401 <i>Nuytsia floribunda</i> (Christmas Tree)			
672.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
673.	<i>Oecetis</i> sp.			
674.	2364 <i>Olax aurantia</i>			
675.	2367 <i>Olax scalariformis</i>			
676.	15449 <i>Olearia dampieri</i> subsp. <i>dampieri</i>			
677.	8149 <i>Olearia rudis</i> (Rough Daisybush)			
678.	<i>Onychohydrus scutellaris</i>			
679.	18256 <i>Opercularia spermacocea</i>			
680.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
681.	12782 <i>Ophioglossum gramineum</i>			
682.	11749 <i>Orthrosanthus laxus</i> var. <i>laxus</i> (Morning Iris)			
683.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
684.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
685.	27116 <i>Padina elegans</i>			
686.	<i>Paraborniola tonnoiri</i>			
687.	<i>Paralimnophyes pullulus</i>			
688.	<i>Paramerina levidensis</i>			
689.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
690.	12670 <i>Parietaria cardiostegia</i>			
691.	30476 <i>Patersonia occidentalis</i> var. <i>latifolia</i>			
692.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
693.	27121 <i>Penicillium nodulosum</i>			
694.	2254 <i>Persoonia acicularis</i>			
695.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
696.	20368 <i>Petrophile axillaris</i>			
697.	2286 <i>Petrophile brevifolia</i>			
698.	2290 <i>Petrophile conifera</i>			
699.	2294 <i>Petrophile drummondii</i>			
700.	2301 <i>Petrophile macrostachya</i>			
701.	10784 <i>Petrophile scabriuscula</i>			
702.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
703.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
704.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
705.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
706.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
707.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
708.	4685 <i>Phyllanthus scaber</i>			
709.	5231 <i>Pimelea angustifolia</i> (Narrow-leaved Pimelea)			
710.	5232 <i>Pimelea argentea</i> (Silvery Leaved Pimelea)			
711.	5243 <i>Pimelea ferruginea</i>			
712.	5244 <i>Pimelea floribunda</i>			
713.	5246 <i>Pimelea gilgiana</i>			
714.	11402 <i>Pimelea imbricata</i> var. <i>piligera</i>			
715.	5261 <i>Pimelea rosea</i> (Rose Banjine)			
716.	19744 <i>Pittosporum angustifolium</i>			
717.	6811 <i>Pityrodia hemigenioides</i>			
718.	11785 <i>Plantago coronopus</i> subsp. <i>commutata</i>	Y		
719.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
720.	6262 <i>Platysace xerophila</i>			
721.	27151 <i>Platythalia angustifolia</i>			
722.	<i>Pleuroxus inermis</i>			
723.	<i>Plurispina chauliodis</i>			
724.	577 <i>Poa poliformis</i> (Coastal Poa)			
725.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
726.	8183 <i>Podotheca chrysantha</i> (Yellow Podotheca)			
727.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
728.	24907 <i>Pogona minor</i> subsp. <i>minor</i>			
729.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
730.	<i>Polyarthra dolichoptera</i>			
731.	<i>Polypedium nubifer</i>			

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732.	27168 <i>Polysiphonia amphibolis</i>			
733.	27173 <i>Polysiphonia decipiens</i>			
734.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
735.	125 <i>Posidonia sinuosa</i>			
736.	15425 <i>Prasophyllum calcicola</i>			
737.	1674 <i>Prasophyllum giganteum</i> (Bronze Leek Orchid)			
738.	<i>Pristina longiseta</i>			
739.	<i>Procladius paludicola</i>			
740.	<i>Procladius villosimanus</i>			
741.	27190 <i>Protokuetzingia australasica</i>			
742.	<i>Pseudochydorus globuosus</i>			Y
743.	19036 <i>Pterostylis</i> sp. exerted labellum (A.C. Beaglehole 12194)			
744.	19222 <i>Pterostylis</i> sp. mid-west coast (G. Brockman GBB134)			
745.	2717 <i>Ptilotus divaricatus</i> (Climbing Mulla Mulla)			
746.	2742 <i>Ptilotus manglesii</i> (Pom Poms)			
747.	40841 <i>Ptilotus stirlingii</i> subsp. <i>stirlingii</i>			
748.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
749.	41063 <i>Quoya loxocarpa</i>			
750.	41080 <i>Quoya verbascina</i> (Golden Bush)			
751.	<i>Rak labrosus</i>			Y
752.	<i>Rak</i> sp. nov. b (Venemores)			
753.	25271 <i>Ramphotyphlops australis</i>			
754.	2935 <i>Ranunculus pumilio</i> (Smallflower Buttercup)			
755.	11190 <i>Ranunculus pumilio</i> var. <i>pumilio</i>			
756.	8197 <i>Reichardia tingitana</i> (False Sowthistle)	Y		
757.	11240 <i>Rhagodia preissii</i> subsp. <i>obovata</i>			
758.	<i>Rhantus suturalis</i>			
759.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
760.	13300 <i>Rhodanthe citrina</i>			
761.	13249 <i>Rhodanthe oppositifolia</i> subsp. <i>oppositifolia</i>			
762.	13254 <i>Rhodanthe stricta</i>			
763.	19942 <i>Ricinocarpos undulatus</i>			
764.	14107 <i>Samolus repens</i> var. <i>paucifolius</i>			
765.	2356 <i>Santalum acuminatum</i> (Quandong)			
766.	27236 <i>Sargassum decurrens</i>			
767.	27264 <i>Scaberia agardhii</i>			
768.	7613 <i>Scaevola glandulifera</i> (Viscid Hand-flower)			
769.	7614 <i>Scaevola globulifera</i>			
770.	7619 <i>Scaevola lanceolata</i>			
771.	7634 <i>Scaevola phlebopetala</i> (Velvet Fanflower)			
772.	29356 <i>Scaevola repens</i> subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8445)			
773.	7643 <i>Scaevola sericophylla</i>			
774.	13152 <i>Scaevola thesioides</i> subsp. <i>thesioides</i>			
775.	984 <i>Schoenus curvifolius</i>			
776.	992 <i>Schoenus grandiflorus</i> (Large Flowered Bogrush)			
777.	994 <i>Schoenus humilis</i>			
778.	1006 <i>Schoenus odontocarpus</i>			
779.	1009 <i>Schoenus pleiostemoneus</i>			
780.	16274 <i>Schoenus</i> sp. A3 Ciliate Sheaths (K.R. Newbey 9402)			
781.	16254 <i>Schoenus</i> sp. G Broad Sheath (K.L. Wilson 2633)			
782.	6034 <i>Scholtzia laxiflora</i>			
783.	16838 <i>Scholtzia</i> sp. Eneabba (S. Maley 8)			
784.	36057 <i>Scholtzia</i> sp. Winchester (C. Chapman s.n. PERTH 05625386)			
785.	6041 <i>Scholtzia umbellifera</i>			
786.	27273 <i>Scytothalia dorycarpa</i>			
787.	6544 <i>Sebaea ovata</i> (Yellow Sebaea)			
788.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
789.	25884 <i>Senecio pinnatifolius</i> var. <i>latilobus</i>			
790.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
791.	4980 <i>Sida hookeriana</i>			
792.	<i>Sigara truncatipala</i>			
793.	<i>Simocephalus elizabethae</i>			
794.	<i>Simocephalus victoriensis</i>			
795.	<i>Sinatherina semibullata</i>			
796.	7025 <i>Solanum oldfieldii</i>			
797.	7037 <i>Solanum symonii</i>			
798.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
799.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
800.	17551 <i>Sphaerolobium drummondii</i>			
801.	10800 <i>Sphaerolobium pulchellum</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
802.	27310 <i>Spyridia filamentosa</i>			
803.	4828 <i>Spyridium globulosum</i> (Basket Bush)			
804.	4713 <i>Stachystemon axillaris</i> (Leafy Stachystemon)			
805.	4733 <i>Stackhousia monogyna</i>			
806.	2918 <i>Stellaria media</i> (Chickweed)	Y		
807.	15065 <i>Stenanthemum notiale</i> subsp. <i>notiale</i>			
808.	<i>Sternopriscus</i> sp.			
809.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
810.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
811.	7679 <i>Stylidium adpressum</i> (Trigger-on-stilts)			
812.	30276 <i>Stylidium bicolor</i>			
813.	7709 <i>Stylidium crossocephalum</i> (Posy Triggerplant)			
814.	7712 <i>Stylidium despectum</i> (Dwarf Triggerplant)			
815.	7713 <i>Stylidium dichotomum</i> (Pins-and-needles)			
816.	12848 <i>Stylidium diuroides</i> subsp. <i>paucifoliatum</i>			
817.	7720 <i>Stylidium elongatum</i> (Tall Triggerplant)			
818.	18420 <i>Stylidium flagellum</i>			
819.	25801 <i>Stylidium hesperium</i>			
820.	17412 <i>Stylidium kalbarriense</i>			
821.	7760 <i>Stylidium maitlandianum</i> (Fountain Triggerplant)			
822.	25837 <i>Stylidium purpureum</i>			
823.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
824.	20521 <i>Stylidium rigidulum</i>			
825.	17510 <i>Stylidium</i> sp. Kalbarri (A. Carr 145)			
826.	17578 <i>Stylidium udusicola</i>			
827.	3181 <i>Stylobasium australe</i>			
828.	3182 <i>Stylobasium spathulatum</i> (Pebble Bush)			
829.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck)			
830.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
831.	2791 <i>Tersonia cyathiflora</i> (Button Creeper)			
832.	<i>Testudinella patina</i>			
833.	1035 <i>Tetralia microcarpa</i>			
834.	4528 <i>Tetralia confertifolia</i>			
835.	1702 <i>Thelymitra campanulata</i> (Shirt Orchid)			
836.	5084 <i>Thomasia grandiflora</i> (Large Flowered Thomasia)			
837.	17322 <i>Thomasia rulingioides</i>			
838.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
839.	6064 <i>Thryptomene racemulosa</i>			
840.	6067 <i>Thryptomene strongylophylla</i>			
841.	1319 <i>Thysanotus arenarius</i>			
842.	1320 <i>Thysanotus asper</i> (Hairy Fringe Lily)			
843.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
844.	1348 <i>Thysanotus rectantherus</i>			
845.	1353 <i>Thysanotus spiniger</i>			
846.	1357 <i>Thysanotus thyrsoides</i>			
847.	1358 <i>Thysanotus triandrus</i>			
848.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
849.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
850.	1368 <i>Trachyandra divaricata</i>	Y		
851.	19042 <i>Trachymene coerulea</i> subsp. <i>leucopetala</i>			
852.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
853.	1483 <i>Tribonanthes longipetala</i>			
854.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
855.	1362 <i>Tricoryne humilis</i>			
856.	29481 <i>Tricoryne</i> sp. <i>Eneabba</i> (E.A. Griffin 1200)			
857.	17542 <i>Trifolium arvense</i> var. <i>arvense</i>	Y		
858.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
859.	4295 <i>Trifolium dubium</i> (Suckling Clover)	Y		
860.	4297 <i>Trifolium glomeratum</i> (Cluster Clover)	Y		
861.	15509 <i>Trifolium tomentosum</i> var. <i>tomentosum</i>	Y		
862.	147 <i>Triglochin mucronata</i>			
863.	148 <i>Triglochin muelleri</i>			
864.	19174 <i>Triglochin</i> sp. <i>A Flora of Australia</i> (G.J. Keighery 2477)			
865.	<i>Triplectides australis</i>			
866.	4737 <i>Tripterococcus brunonis</i> (Winged Stackhousia)			
867.	11665 <i>Trymalium ledifolium</i> var. <i>ledifolium</i>			
868.	7153 <i>Utricularia tenella</i>			
869.	2920 <i>Vaccaria hispanica</i> (Cow Soapwort)	Y		
870.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
871.	7112 <i>Veronica plebeia</i> (Creeping Speedwell)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
872.	7666 <i>Verreauxia reinwardtii</i> (Common Verreauxia)			
873.	12396 <i>Verticordia blepharophylla</i>			
874.	12411 <i>Verticordia densiflora</i> var. <i>cespitosa</i>			
875.	15432 <i>Verticordia densiflora</i> var. <i>densiflora</i>			
876.	6083 <i>Verticordia grandis</i> (Scarlet Featherflower)			
877.	15433 <i>Verticordia huegelii</i> var. <i>huegelii</i>			
878.	10822 <i>Verticordia nobilis</i>			
879.	6103 <i>Verticordia ovalifolia</i>			
880.	6107 <i>Verticordia pennigera</i>			
881.	6109 <i>Verticordia picta</i> (Painted Featherflower)			
882.	4325 <i>Viminaria juncea</i> (Swishbush)			
883.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
884.	7386 <i>Wahlenbergia gracilentia</i> (Annual Bluebell)			
885.	8281 <i>Waitzia podolepis</i>			
886.	6658 <i>Wilsonia backhousei</i> (Narrow-leaf Wilsonia)			
887.	27364 <i>Wollastoniella myriophylloides</i>			
888.	<i>Xanthagrion erythroneurum</i>			
889.	1252 <i>Xanthorrhoea drummondii</i>			
890.	<i>Zonocyprretta kalimna</i>			
891.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye)			
892.	4390 <i>Zygophyllum fruticosum</i> (Shrubby Twinleaf)			

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 wholly 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.



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.

Report created: 08/10/12 11:32:10

[Summary](#)

[Details](#)

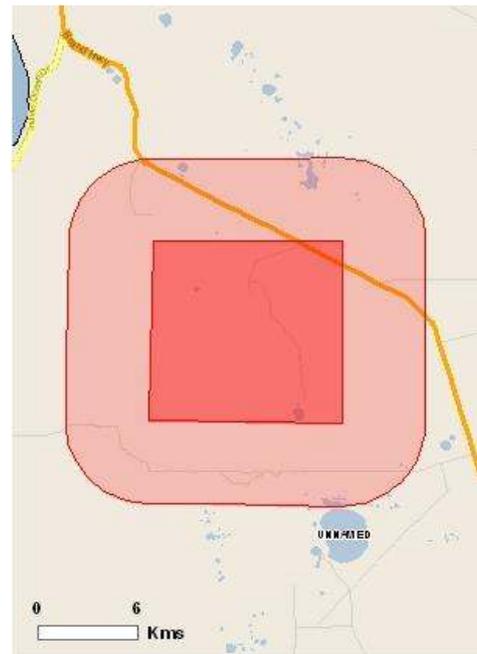
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 5.0Km



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:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	12
Listed Migratory Species:	8

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	5
Whales and Other Cetaceans:	None
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:	2
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Beekeepers-Lesueur-Coomallo Area and Nambung National Park	WA	Nominated place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Insects		
Synemon gratiosa Graceful Sun Moth [66757]	Endangered	Species or species habitat may occur within area
Plants		
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Conostylis dielsii subsp. teres Irwin Conostylis [3614]	Endangered	Species or species habitat likely to occur within area
Conostylis micrantha Small-flowered Conostylis [17635]	Endangered	Species or species habitat may occur within area
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat known to occur within area
Paracaleana dixonii Hopper & A.P.Br. nom. inval. Sandplain Duck Orchid [82050]	Endangered	Species or species habitat likely to occur within area
Stawellia dimorphantha Arrowsmith Stilt-lily [3433]	Vulnerable	Species or species habitat likely to occur within area
Wurmbea tubulosa Long-flowered Nancy [12739]	Endangered	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

Migratory Terrestrial Species

Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	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

Other Matters Protected by the EPBC Act

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

Name	Threatened	Type of Presence
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
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		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		
Arrowsmith Lake Area	WA	Registered
Beekeepers Reserve	WA	Registered

State and Territory Reserves [[Resource Information](#)]

Name	State
Beekeepers	WA
Unnamed WA39744	WA
Unnamed WA47436	WA

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 Resources 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
Sus scrofa Pig [6]		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		

Name	Status	Type of Presence
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Coordinates

-29.58202 115.06512,-29.5818 115.16818,-29.68204 115.16812,-29.6807 115.06307,
-29.58202 115.06512

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 B Threatened and Priority Flora and Fauna

Table 15 – Likelihood of occurrence of threatened and Priority flora within the study area

Taxon	Common name		Status		Previous recording		Habitat characteristics	Likelihood of occurrence
	EPBC	WCA	Inwin	10 km buffer				
<i>Acacia latipes</i> subsp. <i>licina</i>	P3		Y	Y			Acacia thickets and heaths. Flat, white/yellowish sandy soil, granitic soils. Limestone hills, sandplains. Soil ponds water during winter. Burnt recently.	Likely to occur
<i>Acacia telmica</i>	P3		Y	Y			Sand, loam or loamy clay. Low-lying seasonally moist areas.	May occur
<i>Acacia vittata</i>	P2		Y	Y			Grey sand, sandy clay. Margins of seasonal lakes.	May occur
<i>Anthoecoris intricata</i>	P3		Y	Y			Sand or loam over limestone. Consolidated sand dunes.	May occur
<i>Banksia cypholoba</i>	P3		-	Y			Sand and gravelly loam.	May occur
<i>Banksia elegans</i>	P4		Y	Y			Shrub thickets and heaths. Yellow, white or red sand. Sandplains, low consolidated dunes.	Confirmed present
<i>Banksia scabrella</i>	P4		Y	Y			White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.	Likely to occur
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3		-	Y			Woodland: In medium grained brown sand in local landscape on flat terrain. Heath: On yellow sand in flat terrain of a broad basin ringed by Eucalyptus erythrocorys trees on limestone around Western and Southern Edges.	May occur
<i>Beyeria gardneri</i>	P3		Y	Y				Likely to occur
<i>Calectasia palustris</i>	P1		Y	Y			White or grey sand. Seasonally inundated swamplands.	Unlikely to occur
<i>Calytrix chrysantha</i>	P4		Y	Y			Banksia woodland over heath. White, grey or yellow/brown sand. Flats. Alluvium. Guildford Formation-alluvium. Pleistocene. Deep sands	Likely to occur
<i>Calytrix ecalycata</i> subsp. <i>ecalycata</i>	P3		Y	Y			Yellow or white sand, sandy gravel, clay loam, granite, sandstone. Uplands, valley flats, ridges, hills, road verges.	May occur
<i>Calytrix eneabensis</i>	P4		Y	Y			Low open woodland. White, grey or yellow sand over laterite. Sandplains.	Likely to occur
<i>Calytrix superba</i>	P4		Y	Y			Heath. Sand over laterite. Flats.	May occur
<i>Centrolepis caespitosa</i>	E		-	-			White sand, clay. Salt flats, wet areas.	Unlikely to occur
<i>Comesperma griffinii</i>	P2		Y	Y			Yellow or grey sand. Plains.	Likely to occur

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Taxon	Common name	Status		Previous recording		Habitat characteristics	Likelihood of occurrence
		EPBC	WCA	Irwin	10 km buffer		
<i>Comesperma rhadinocarpum</i>	slender-fruited comesperma	E	P2	Y	Y	Sandy soils.	Likely to occur
<i>Conostylis dielsii</i> subsp. <i>teres</i>		E	T (VU)	Y	-	White, grey or yellow sand, gravel. Low open woodland.	Likely to occur
<i>Conostylis micrantha</i>		E	T (VU)	Y	-	White or grey sand. Sandplains.	Likely to occur
<i>Dampiera tephrea</i>			P2	Y	Y	Limestone ridges, coastal limestone. Banksia shrubland. Sand, gravelly loam.	Likely to occur
<i>Desmodcladus elongatus</i>			P4	-	Y	White or grey sand. Dry kwongan.	Likely to occur
<i>Diuris eburnea</i>			P1	Y	Y		Unknown
<i>Eleocharis keigheryi</i>			T (VU)	-	Y	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	May occur
<i>Eremophila glabra</i> subsp. <i>chlorella</i>			T (CR)	-	Y	Sandy clay. Winter-wet depressions.	May occur
<i>Eucalyptus impensa</i>		E	T (CR)	-	-	Yellow sand. Lateritic hills.	Unlikely to occur
<i>Eucalyptus macrocarpa</i> subsp. <i>elachantha</i>	small-leaved mottlecah		P4	Y	Y	White or grey sand over laterite. Hillslopes, ridges, sandplains.	May occur
<i>Eucalyptus macrocarpa</i> x <i>pyriformis</i>			P3	Y	Y		Unknown
<i>Eucalyptus zopherophloia</i>	blackbutt mallee		P4	Y	Y	Grey/white sand with limestone rubble. Coastal areas.	Unlikely to occur
<i>Grevillea erinacea</i>			P3	Y	Y	Amongst medium trees, or low trees; in gravelly soil, or sand; occupying heathlands, sandplains. White, grey or yellow sand, often with lateritic gravel.	Confirmed present
<i>Grevillea olivacea</i>	olive grevillea		P4	Y	Y	Amongst medium trees, or low trees; in gravelly soil, or sand, or loam; occupying limestone cave entrance, lateritic sandplain, limestone swamp flats. White or grey sand. Coastal dunes, limestone rocks	Unlikely to occur
<i>Guichenotia alba</i>			P3	Y	Y	Sandy & gravelly soils. Low-lying flats, depressions.	May occur
<i>Guichenotia quasicalva</i>			P2	Y	Y	Sandy clay over laterite, river sand. Drainage lines.	Confirmed present
<i>Haloragis foliosa</i>			P3	Y	Y	White/grey sand over limestone.	May occur
<i>Hemiandra gardneri</i>		E	T (CR)	-	-	Grey or yellow sand, clayey sand. Sandplains.	May occur
<i>Hemiandra</i> sp. <i>Eneabba</i> (H. Demarz 3687)			P3	Y	Y	Low heath on grey sands on flat plain. Disturbed sites.	Likely to occur
<i>Hemigenia saligna</i>			P3	Y	Y	Lateritic & sandy soils.	May occur
<i>Hopkinsia anoetocolea</i>			P3	Y	Y	White or grey sand, often saline, sandy loams. Winter-wet	Confirmed present

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Taxon	Common name	Status			Previous recording 10 km buffer	Habitat characteristics	Likelihood of occurrence
		EPBC	WCA	Irwin			
<i>Hydrocotyle lemnooides</i>	aquatic pennywort		P4	-	Y	Swamps	Unlikely to occur
<i>Hypocalymma tetrapterum</i>			P3	Y	Y	Grey sand, loam, lateritic gravel. Riverbanks, breakaways.	May occur
<i>Lasiopetalum lineare</i>			P3	Y	Y	Lateritic breakaways, rises, sandplains.	May occur
<i>Leucopogon oblectus</i>	hidden beard-heath	E	T (EN)	Y	Y	Open <i>Eucalyptus todtiana</i> woodland over species-rich heath. Grey sands.	Likely to occur
<i>Liparophyllum congestiflorum</i>			P4	Y	Y		Unknown
<i>Paracaleana dixonii</i>		E	T (EN)	Y	Y	Grey sand over granite.	Unlikely to occur
<i>Persoonia filiformis</i>			P2	Y	Y	Yellow or white sand over laterite.	May occur
<i>Persoonia rudis</i>			P3	Y	Y	Heath to low open woodland over heath. White, grey or yellow sand, often over laterite.	Confirmed present
<i>Schoenus griffinianus</i>			P3	Y	Y	Low heath on white and grey sands on low flat plain.	Confirmed present
<i>Schoenus</i> sp. Eneabba (F. Obbens & C. Godden 1154)			P2	Y	Y	Grey, yellow or white sand. Undulating sandplains, mid slopes, tops of rises.	Likely to occur
<i>Stawellia dimorphantha</i>	Arrowsmith stillit-illy	V	P4	Y	Y	Low woodland to shrubland. White, grey, yellow sand.	Confirmed present
<i>Styidium carnosum</i> subsp. Narrow leaves (J.A. Wege 490)			P1	Y	Y		Unknown
<i>Styidium longitubum</i>	jumping jacks		P3	Y	Y	Acacia and mallee shrubland over ephemeral herbs. Sandy clay to clay. Seasonal wetlands.	May occur
<i>Styidium maritimum</i>			P3	-	Y	Sand over limestone. Dune slopes and flats. Coastal heath and shrubland, open <i>Banksia</i> woodland.	Unlikely to occur
<i>Styidium pseudocaesptosum</i>			P2	Y	Y	White, grey or yellow sand over laterite. Breakaways and hillslopes.	May occur
<i>Styidium torticarpum</i>			P3	Y	Y	Sandy clay and clay loam over laterite. Adjacent to creeklines, depressions, and beneath breakaways. Heath or mallee shrubland.	May occur
<i>Synaphea aephynsa</i>			P3	Y	Y	Gravelly laterite, sand over laterite.	Unlikely to occur
<i>Synaphea oulopha</i>			P1	Y	Y	Low heath. Grey sand, gravelly loam, clay. Lateritic breakaways & rises.	Unlikely to occur
<i>Thryptomene</i> sp. Trudgen 14000	Lancelin (M.E.)		P2	Y	Y	Calcareous sand.	Unlikely to occur

Taxon	Common name	Status		Previous recording		Habitat characteristics	Likelihood of occurrence
		EPBC	WCA	Irwin	10 km buffer		
<i>Triglochin protuberans</i>			P3	Y	Y	Low open shrubland. Winter-wet sites, claypans, near salt lakes, margins of pools.	May occur
<i>Verticordia argentea</i>			P2	Y	Y	Low open woodland. White, grey or yellow sand. Sand ridges, undulating plains.	Likely to occur
<i>Verticordia aurea</i>			P4	-	Y	Deep sand. Sandplains.	Likely to occur
<i>Verticordia dasystylis</i> subsp. <i>oestopoa</i>			P1	Y	Y	Gritty soils over granite. Outcrops.	Unlikely to occur
<i>Verticordia fragrans</i>			P3	Y	Y	Banksia woodland, open scrub. White, grey or yellow sand, clay loam. Low-lying areas, sandplains.	Confirmed present
<i>Verticordia luteola</i> var. <i>luteola</i>			P3	Y	Y	Grey sand over gravel. Flats.	May occur
<i>Verticordia luteola</i> var. <i>rosea</i>			P1	Y	Y	Shrubland with scattered trees. White sand. Flats.	Likely to occur
<i>Wurmbea tubulosa</i>	long flowered nancy	E	T (VU)	Y	-	Clay, loam. River banks, seasonally-wet places.	May occur

Previous recording information sources: AVH, WAHERB, TPFL, NatureMap

EPBC – Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*

E Endangered
V Vulnerable

WC Act – Western Australian conservation status of each taxon under the *Wildlife Conservation Act 1950*

T (CR) Threatened (Critically Endangered)
T (E) Threatened (Endangered)
T (V) Threatened (Vulnerable)
P1 Priority 1
P2 Priority 2
P3 Priority 3
P4 Priority 4

Table 16 – Likelihood of occurrence of threatened and Priority fauna within the study area

Species	Status		Habitat	Likelihood
	EPBC	WCA		
BIRDS				
<i>Calyptorhynchus latirostris</i>	E	T	<p>Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain Salmon Gum and Wandoo, and in shrubland or kwongan heathland dominated by <i>Hakea</i>, <i>Dryandra</i>, <i>Banksia</i> and <i>Grevillea</i> species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. The species is a seasonal visitor to pine plantations in areas that receive high rainfall, and is a less frequent visitor to forests containing Marri, Jarrah or Karri. It is occasionally recorded in casuarina woodlands, or in 'mallee country', and is sometimes seen in towns or on roadside verges. It is also a conspicuous visitor to gardens around Perth that contain native plants with hard fruits. (Department of Sustainability, Environment, Water, Population and Communities, 2012)</p> <p>The Malleefowl occurs in semi-arid and arid zones of temperate Australia, where it occupies shrublands and low woodlands that are dominated by mallee vegetation. It also occurs in other habitat types including eucalypt or native pine <i>Callitris</i> woodlands, acacia shrublands, Broombush <i>Melaleuca uncinata</i> vegetation or coastal heathlands.</p> <p>The shrublands and low woodlands communities where Malleefowl occur are dominated by multi-stemmed species of eucalypts (such as <i>Eucalyptus socialis</i>, <i>E. dumosa</i> or <i>E. incrassata</i>) and occur on sandy or loamy soils that receive 200 to 450 mm of rainfall each year. They have a dense but discontinuous canopy, a dense understorey of shrubs (including species of <i>Acacia</i>, <i>Cassia</i>, <i>Bossiaea</i> and <i>Beyeria</i>) or grass (especially species of <i>Triodia</i>) and herbs, and abundant leaf litter.</p> <p>The other habitat types where Malleefowl occur include eucalypt woodlands (dominated by species such as <i>Eucalyptus sideroxylon</i>, <i>E. baxteri</i>, <i>E. araneosa</i>, <i>E. wandoo</i>, <i>E. leucoxylo</i>, <i>E. reutunca</i>, <i>E. microcarpa</i>, <i>E. astrings</i>, <i>E. populnea</i>, <i>E. camaldulensis</i> or <i>Corymbia callophylla</i>), native pine <i>Callitris</i> woodlands, acacia shrublands, Broombush vegetation, or coastal heathlands.</p> <p>The breeding habitat of the Malleefowl, within its home range, is characterised by light soil and an abundant leaf litter, which is used in the construction of nesting mounds. The Malleefowl sometimes forages in open areas located near more typical habitat i.e. in grasslands, crop fields and around roads. (Department of Sustainability, Environment, Water, Population and Communities, 2012)</p>	<p>Confirmed present</p> <p>There are records of Carnaby's Black-Cockatoo in the region containing the study area and 10km buffer.</p> <p>Confirmed present</p> <p>There are records of Malleefowl in the region containing the study area and 10km buffer.</p>
<i>Leipoa ocellata</i> Malleefowl	V	T		
<i>Falco peregrinus</i> Peregrine Falcon	S		<p>The Peregrine Falcon is found in most habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water, and may even be found nesting on high city buildings. (birdlife Australia, 2012)</p>	<p>May occur</p> <p>There are records of Peregrine Falcon in the region containing the study area and 10km buffer.</p>

Species	Status		Habitat	Likelihood
	EPBC	WCA		
<i>Ardeotis australis</i> Australian Bustard	P4		Australian Bustards are found on dry plains, grasslands and in open woodland. (birdlife Australia, 2012)	<p>May occur</p> <p>There are records of Australian Bustard in the region containing the study area and 10km buffer.</p>

MAMMALS

Species	Status	Habitat	Likelihood

Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*

- E Endangered
- V Vulnerable
- M Migratory

Western Australian conservation status of each taxon under the *Wildlife Conservation Act 1950*

- T Threatened
- S Other specially protected fauna
- P4 Priority 4

The national list of migratory species consists of species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals - (Bonn Convention)

The Japan-Australia Migratory Bird Agreement (JAMBA) also includes a list of endangered species of birds in Japan.

Table 17 – Likelihood of occurrence of migratory species within the study area

Species	Migratory Status	Habitat	Likelihood
<i>Apus pacificus</i> fork-tailed swift	Marine	Summer migrant (October – April). Occurs in low to very high airspace over variety of habitats including rainforest and semi-arid areas. Known to be most active in front of summer storm fronts (Morcombe, 2003)	Likely to occur There are records of Fork-tailed Swift in the region containing the study area and 10km buffer.
<i>Ardea alba</i> great egret, white egret	Marine, Wetlands	Occurs in wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs (Morcombe, 2003)	Unlikely to occur due to lack of suitable habitat within the study area
<i>Ardea ibis</i> cattle egret	Marine, Wetlands	Occurs in moist pastures with tall grass, shallow open wetlands and margins and also mudflats (Morcombe, 2003)	Unlikely to occur due to lack of suitable habitat within the study area
<i>Haliaeetus leucogaster</i> white-bellied sea-eagle	Terrestrial	Occurs in predominantly coastal areas although also occurs far inland on large pools of rivers. Mostly over islands, reefs, headlands, beaches and estuaries. Known to occur on seasonally inundated swamps, lagoons and floodplains (Morcombe, 2003)	Unlikely to occur due to lack of suitable habitat within the study area
<i>Merops ornatus</i> rainbow bee-eater	Terrestrial	Summer migrant (September – April) although in northern Australia they remain and breed. Occurs in open woodlands, semi-arid scrub, grasslands, clearing in heavier forests, farmlands and coastal areas. Avoids heavy forests due to hindrance to feeding (i.e. catching insects) (Morcombe, 2003)	Confirmed Present There are records of Rainbow Bee-eater in the region containing the study area and 10km buffer.
<i>Arenaria interpres</i> Ruddy Turnstone	Marine	Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats. In south-west Australia, it may occur on pebble-strewn shores of saltlakes near the coast. Surveys demonstrate that the Ruddy Turnstone can live away from coastal areas in habitats such river beds, and on inland lakes and adjacent farmland. (Department of Sustainability, Environment, Water, Population and Communities, 2012)	Unlikely to occur due to lack of suitable habitat within the study area

Species	Migratory Status	Habitat	Likelihood
<i>Calidris ruficollis</i> Red-necked Stint	Marine	The Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands. They have occasionally been recorded on dry gibber plains, with little or no perennial vegetation. (Department of Sustainability, Environment, Water, Population and Communities, 2012)	Unlikely to occur due to lack of suitable habitat within the study area
<i>Limosa lapponica</i> Bar-tailed Godwit	Marine	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas. (Department of Sustainability, Environment, Water, Population and Communities, 2012)	Unlikely to occur due to lack of suitable habitat within the study area
<i>Pluvialis squatarola</i> Grey Plover	Marine	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes. On their breeding grounds they inhabit tundra. (Department of Sustainability, Environment, Water, Population and Communities, 2012)	Unlikely to occur due to lack of suitable habitat within the study area

Appendix C Species Observed

Table 18 – Observations of flora species within the study area

Family	Scientific Name	EPBC Conservation Status	WC Act Conservation Status
Anarthriaceae	<i>Hopkinsia anoectocolea</i>		P3
Apiaceae	<i>Actinotus leucocephalus</i>		
Apiaceae	<i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>		
Asparagaceae	<i>Acanthocarpus</i> sp.		
Asparagaceae	<i>Thysanotus teretifolius</i>		
Asparagaceae	<i>Thysanotus thyrsoides</i>		
Asparagaceae	<i>Thysanotus triandrus</i>		
Asteraceae	* <i>Arctotheca calendula</i>		
Asteraceae	* <i>Centaurea melitensis</i>		
Asteraceae	<i>Olearia ?lehmanniana</i>		
Asteraceae	<i>Olearia rudis</i>		
Asteraceae	<i>Olearia</i> sp.		
Asteraceae	<i>Rhodanthe</i> sp.		
Asteraceae	* <i>Sonchus oleraceus</i>		
Boraginaceae	* <i>Echium plantagineum</i>		
Casuarinaceae	<i>Allocasuarina</i> sp.		
Casuarinaceae	<i>Allocasuarina humilis</i>		
Cyperaceae	<i>Mesomelaena pseudostygia</i>		
Cyperaceae	<i>Schoenus griffinianus</i>		P3
Cyperaceae	<i>Schoenus</i> sp. G Broad Sheath (K.L. Wilson 2633)		
Dilleniaceae	<i>Hibbertia hypericoides</i>		
Dilleniaceae	<i>Hibbertia</i> sp.		
Ecdeiocoleaceae	<i>Ecdeiocolea monostachya</i>		
Ericaceae	<i>Astroloma xerophyllum</i>		
Euphorbiaceae	<i>Adriana quadripartita</i>		
Euphorbiaceae	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>		
Fabaceae	<i>Acacia ?saligna</i>		
Fabaceae	<i>Acacia acuminata</i>		
Fabaceae	<i>Acacia blakelyi</i>		
Fabaceae	<i>Acacia rostellifera</i>		
Fabaceae	<i>Acacia</i> sp.		
Fabaceae	<i>Acacia spathulifolia</i>		
Fabaceae	<i>Daviesia pedunculata</i>		
Fabaceae	<i>Daviesia</i> sp.		
Fabaceae	<i>Jacksonia hakeoides</i>		
Fabaceae	<i>Jacksonia</i> sp.		
Goodeniaceae	<i>Dampiera spicigera</i>		

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Family	Scientific Name	EPBC Conservation Status	WC Act Conservation Status
Goodeniaceae	<i>Lechenaultia linarioides</i>		
Goodeniaceae	<i>Lechenaultia</i> sp.		
Goodeniaceae	<i>Scaevola sericophylla</i>		
Goodeniaceae	<i>Velleia</i> sp.		
Gyrostemonaceae	<i>Gyrostemon ramulosus</i>		
Haemodoraceae	<i>Conostylis candicans</i>		
Haemodoraceae	<i>Conostylis</i> spp.		
Hemerocallidaceae	<i>Stawellia dimorphantha</i>	V	P4
Lamiaceae	<i>Hemiandra glabra</i>		
Lamiaceae	<i>Hemigenia barbata</i>		
Lamiaceae	<i>Hemigenia humilis</i>		
Lamiaceae	<i>Hemiphora bartlingii</i>		
Lamiaceae	<i>Hemiphora bartlingii</i>		
Lamiaceae	<i>Quoya loxocarpa</i>		
Malvaceae	<i>Alyogyne hakeifolia</i>		
Malvaceae	<i>Guichenotia quasicalva</i>		P2
Myrtaceae	<i>Baeckea</i> sp.		
Myrtaceae	<i>Beaufortia squarrosa</i>		
Myrtaceae	<i>Calothamnus quadrifidus</i>		
Myrtaceae	<i>Calothamnus sanguineus</i>		
Myrtaceae	<i>Calothamnus</i> sp.		
Myrtaceae	<i>Calytrix depressa</i>		
Myrtaceae	<i>Calytrix sapphirina</i>		
Myrtaceae	<i>Calytrix strigosa</i>		
Myrtaceae	<i>Chamelaucium uncinatum</i>		
Myrtaceae	<i>Eremaea beaufortoides</i>		
Myrtaceae	<i>Eremaea</i> sp.		
Myrtaceae	<i>Eucalyptus camaldulensis</i>		
Myrtaceae	<i>Eucalyptus erythrocorys</i>		
Myrtaceae	<i>Eucalyptus loxophleba</i>		
Myrtaceae	<i>Eucalyptus</i> sp.		
Myrtaceae	<i>Eucalyptus todtiana</i>		
Myrtaceae	<i>Leptospermum erubescens</i>		
Myrtaceae	<i>Leptospermum oligandrum</i>		
Myrtaceae	<i>Leptospermum</i> sp.		
Myrtaceae	<i>Melaleuca ?atroviridis</i>		
Myrtaceae	<i>Melaleuca raphiophylla</i>		
Myrtaceae	<i>Melaleuca</i> spp.		
Myrtaceae	<i>Micromyrtus</i> sp.		
Myrtaceae	<i>Pileanthus filifolius</i>		

Family	Scientific Name	EPBC Conservation Status	WC Act Conservation Status
Myrtaceae	<i>Regelia ciliata</i>		
Myrtaceae	<i>Thryptomene</i> sp.		
Myrtaceae	<i>Verticordia chrysanthella</i>		
Myrtaceae	<i>Verticordia densiflora</i> var. <i>densiflora</i>		
Myrtaceae	<i>Verticordia fragrans</i>		P3
Myrtaceae	<i>Verticordia grandis</i>		
Myrtaceae	<i>Verticordia nobilis</i>		
Myrtaceae	<i>Verticordia ovalifolia</i>		
Myrtaceae	<i>Verticordia pennigera</i>		
Nitrariaceae	<i>Nitraria</i> sp.		
Orchidaceae	<i>Pyrorchis</i> sp.		
Poaceae	<i>Austrostipa</i> sp.		
Poaceae	* <i>Avena barbata</i>		
Poaceae	* <i>Briza minor</i>		
Poaceae	* <i>Bromus hordeaceus</i>		
Poaceae	<i>Neurachne alopecuroidea</i>		
Poaceae	* <i>Pennisetum setaceum</i>		
Poaceae	* <i>Vulpia bromoides</i>		
Primulaceae	* <i>Lysimachia arvensis</i>		
Proteaceae	<i>Banksia attenuata</i>		
Proteaceae	<i>Banksia candolleana</i>		
Proteaceae	<i>Banksia elegans</i>		P4
Proteaceae	<i>Banksia hookeriana</i>		
Proteaceae	<i>Banksia leptophylla</i>		
Proteaceae	<i>Banksia menziesii</i>		
Proteaceae	<i>Banksia prionotes</i>		
Proteaceae	<i>Banksia sessilis</i>		
Proteaceae	<i>Banksia</i> spp.		
Proteaceae	<i>Conospermum incurvum</i>		
Proteaceae	<i>Conospermum</i> spp.		
Proteaceae	<i>Grevillea biternata</i>		
Proteaceae	<i>Grevillea erinacea</i>		P3
Proteaceae	<i>Grevillea exposita</i>		
Proteaceae	<i>Grevillea leucopteris</i>		
Proteaceae	<i>Grevillea</i> spp.		
Proteaceae	<i>Hakea circumalata</i>		
Proteaceae	<i>Hakea lissocarpha</i>		
Proteaceae	<i>Hakea preissii</i>		
Proteaceae	<i>Hakea</i> sp.		
Proteaceae	<i>Hakea trifurcata</i>		

Family	Scientific Name	EPBC Conservation Status	WC Act Conservation Status
Proteaceae	<i>Isopogon</i> sp.		
Proteaceae	<i>Persoonia rudis</i>		P3
Proteaceae	<i>Petrophile brevifolia</i>		
Proteaceae	<i>Petrophile</i> sp.		
Proteaceae	<i>Stirlingia latifolia</i>		
Proteaceae	<i>Stirlingia</i> sp.		
Proteaceae	<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>		
Proteaceae	<i>Xylomelum angustifolium</i>		
Santalaceae	<i>Santalum</i> sp.		
Solanaceae	<i>Anthocercis littorea</i>		
Solanaceae	<i>Anthocercis</i> sp.		
Stylidiaceae	<i>Levenhookia octomaculata</i>		
Stylidiaceae	<i>Stylidium brunonianum</i>		
Stylidiaceae	<i>Stylidium cygnorum</i>		
Stylidiaceae	<i>Stylidium dichotomum</i>		
Stylidiaceae	<i>Stylidium elongatum</i>		
Stylidiaceae	<i>Stylidium kalbarriense</i>		
Stylidiaceae	<i>Stylidium</i> spp.		
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>		
Zamiaceae	<i>Macrozamia fraseri</i>		

EPBC – Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*

V Vulnerable

WC Act – Western Australian conservation status of each taxon under the *Wildlife Conservation Act 1950*

P2 Priority 2

P3 Priority 3

P4 Priority 4

* Non-native exotic species

Table 19 – Opportunistic observations of fauna species within the study area

Common Name	Scientific Name	Type	Detection Method
Australasian Pipit	<i>Anthus novaeseelandiae</i>	Bird	Visual, Aural
Australian Magpie	<i>Cracticus tibicen</i>	Bird	Visual, Aural
Australian Raven	<i>Corvus coronoides</i>	Bird	Visual, Aural
Australian Ringneck	<i>Barnardius zonarius</i>	Bird	Visual, Aural
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Bird	Visual, Aural
Black-faced Woodswallow	<i>Artamus cinereus</i>	Bird	Visual, Aural
Black-shouldered Kite	<i>Elanus axillaris</i>	Bird	Visual
Brown Falcon	<i>Falco berigora</i>	Bird	Visual
Brown Honeyeater	<i>Lichmera indistincta</i>	Bird	Visual, Aural
Brown Songlark	<i>Cincloramphus cruralis</i>	Bird	Visual, Aural
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	Bird	Visual, Aural
Brush Bronzewing	<i>Phaps elegans</i>	Bird	Visual
Budgerigar	<i>Melopsittacus undulatus</i>	Bird	Visual, Aural
***Carnaby's Black-Cockatoo	<i>Calyptorhynchus latirostris</i>	Bird	Visual, Aural
Crested Pigeon	<i>Ocyphaps lophotes</i>	Bird	Visual, Aural
Emu	<i>Dromaius novaehollandiae</i>	Bird	Visual, Aural
Galah	<i>Eolophus roseicapillus</i>	Bird	Visual, Aural
Golden Whistler	<i>Pachycephala pectoralis</i>	Bird	Visual, Aural
Grey Currawong	<i>Strepera versicolor</i>	Bird	Visual
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	Bird	Visual, Aural
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Bird	Visual, Aural
Little Corella	<i>Cacatua sanguinea</i>	Bird	Visual, Aural
Magpie-lark	<i>Grallina cyanoleuca</i>	Bird	Visual, Aural
***Malleefowl	<i>Leipoa ocellata</i>	Bird	Old nest
Nankeen Kestrel	<i>Falco cenchroides</i>	Bird	Visual
Painted Button-quail	<i>Tumix varius</i>	Bird	Visual, Aural
Pallid Cuckoo	<i>Cacomantis pallidus</i>	Bird	Visual
Pied Honeyeater	<i>Certhionyx variegatus</i>	Bird	Visual, Aural
**Rainbow Bee-eater	<i>Merops ornatus</i>	Bird	Visual, Aural
Red Wattlebird	<i>Anthochaera carunculata</i>	Bird	Visual, Aural
Red-capped Robin	<i>Petroica goodenovii</i>	Bird	Visual, Aural
Rufous Whistler	<i>Pachycephala rufiventris</i>	Bird	Visual, Aural
Sacred Kingfisher	<i>Todiramphus sanctus</i>	Bird	Visual
Scarlet Robin	<i>Petroica multicolor</i>	Bird	Visual, Aural
Silvereye	<i>Zosterops lateralis</i>	Bird	Visual, Aural
Singing Honeyeater	<i>Lichenostomus virescens</i>	Bird	Visual, Aural
Splendid Fairy-wren	<i>Malurus splendens</i>	Bird	Aural
Striated Pardalote	<i>Pardalotus striatus</i>	Bird	Aural
Tawny-crowned Honeyeater	<i>Glyciphila melanops</i>	Bird	Visual, Aural

Arrowsmith Level 1 Botanical Survey and Threatened Fauna Assessment Report

Common Name	Scientific Name	Type	Detection Method
Tree Martin	<i>Petrochelidon nigricans</i>	Bird	Visual
Variegated Fairy-wren	<i>Malurus lamberti</i>	Bird	Aural
Wedge-tailed Eagle	<i>Aquila audax</i>	Bird	Visual
Whistling Kite	<i>Haliastur sphenurus</i>	Bird	Visual, Aural
White-browed Scrubwren	<i>Sericornis frontalis</i>	Bird	Visual, Aural
White-cheeked Honeyeater	<i>Phylidonyris niger</i>	Bird	Visual, Aural
White-winged Triller	<i>Lalage sueurii</i>	Bird	Visual, Aural
Willie Wagtail	<i>Rhipidura leucophrys</i>	Bird	Visual, Aural
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	Bird	Visual, Aural
Zebra Finch	<i>Taeniopygia guttata</i>	Bird	Visual, Aural
*Dog	<i>Canis lupus familiaris</i>	Mammal	Skeleton
*Goat	<i>Capra hircus</i>	Mammal	Visual
*Pig	<i>Sus scrofa</i>	Mammal	Scat
*Rabbit	<i>Oryctolagus cuniculus</i>	Mammal	Visual, Warrens, Scat
*Fox	<i>Vulpes vulpes</i>	Mammal	Visual
*Sheep	<i>Ovis aries</i>	Mammal	Visual
Western Grey Kangaroo	<i>Macropus fuliginosus</i>	Mammal	Visual, Scat, Tracks
Bearded Dragon	<i>Pogona Barbata</i>	Reptile	Visual - dead
Dwarf bearded dragon	<i>Pogona minor</i>	Reptile	Visual
Spotted Military Dragon	<i>Ctenophorus maculatus</i>	Reptile	Visual
Thorny Devil	<i>Moloch horridus</i>	Reptile	Visual

* Introduced species

** Listed migratory species (EPBC Act)

*** Listed threatened species (EPBC Act)

Table 20 – Priority flora observations

Waypoint ID	Population size	Easting (m)	Northing (m)
<i>Banksia elegans</i>			
AMA48	>50	319374.56	6725494.5
AMA49	15	319374.1	6725496
AMA50	16	319370.2	6725538.5
AMA51	2	319374.35	6725584.9
AMA56	1	319371.76	6725727.3
AMA59	2	321379.17	6718072.1
AMA76	8	321363.63	6718950.1
AMA78	20+	321376.02	6718999.8
AMA79	20+	321378.81	6719142.8
AMA81	12	321373.63	6719214
AMA88	10	321375.59	6720071.3
AMA89	1	321365.37	6720208.3
AMA91	7	321378.99	6720324.3
<i>Grevillea erinacea</i>			
AM11-07	1	318183.83	6721545.1
AM11-08	1	318192.04	6721570.3
AM15-01	1	316569.75	6720580.2
<i>Guichenotia quasicalva</i>			
AMA92	2	321373.01	6720654.8
AMA93	3	321378.01	6720678
JC107	1	322155.56	6721409.1
JC199	20	319770.64	6721424.2
JC205	200	319779.08	6720591.6
JC206	50	319791.91	6720588.5
JC207	25	319791.93	6720569
JC253	20	318963.89	6722120
<i>Hopkinsia anoectocolea</i>			
AM15-08	>100	316580.53	6724234.8
AM15-09	4	316566.41	6724437.9
AM15-10	>20	316567.7	6724538.9
AM15-12	>100	316583.97	6724614.8
AM15-13	>50	316569.53	6724734.1
AM15-14	>20	316572.77	6724828.7
AM5-15	3	320572.35	6720578.1
AM5-16	2	320572.69	6720592.9
AM5-17	3	320581.91	6720609.9
AM5-18	5	320583.12	6720658
AM5-19	3	320574.01	6720684.4
JC108	5	322124.32	6720911.7
JC203	25	319788.17	6720887.4

Arrowsmith Level 1 Botanical Survey and Threatened Fauna Assessment Report

Waypoint ID	Population size	Easting (m)	Northing (m)
JC286	20	317362.95	6724365.7
JC287	100	317362.36	6724354.2
JC288	150	317362.39	6724340.7
<i>Persoonia rudis</i>			
JC155	1	319765.76	6725469.4
JC168	1	319774.04	6723758.2
JC39	2	322149.11	6725112
JC63	1	322187.51	6723776.2
JC64	5	322190.26	6723737.3
JC68	1	322210.52	6723607.9
<i>Schoenus griffinianus</i>			
AMA9	7	321370.56	6726107.3
JC_18	50	320957.29	6725973.6
JC_3	50	320585.83	6725933.5
JC_6	5	320568.13	6725986.1
JC37	10	322156.04	6725157.8
<i>Stawellia dimorphantha</i>			
AM21-01	1	314252.7	6720542.3
AM21-06	2	314164.19	6724009.5
AM21-07	2	314150.52	6724031.2
AM23-03	3	313392.01	6724507.9
AM23-05	4	313403.51	6724315.7
AM23-09	7	313413.46	6723875.4
AM6	>50	321199.3	6726149.9
JC236	1	318969.68	6724157.9
JC321	1	315770.19	6720094.7
JC366	1	318182.45	6717194.5
<i>Verticordia fragrans</i>			
JC186	1	319779.17	6722310.1

Appendix D Terms and Conditions

Attachment 1 - Standard Terms and Conditions

1. Definitions and Interpretations

Consultant	O2 Ecology Pty Ltd (ABN 98 153 475 382)
Client	As stipulated in Attachment 2.
Proposal	Letter or report outlining the understanding of the project, proposed scope and methodology and fees associated with the project, and these standard terms and conditions. The proposal constitutes an offer for services.
Agreement	On acceptance of the proposal by the client, the client will be regarded as have entered into a contractual agreement with the consultant.
Project	As defined in the proposal by the scope, methodology and fees.
Variations	Changes to proposed scope, fees or timing to a project after commissioning and before completion.

1.1. Reference to:

- a) The singular includes the plural and vice versa
- b) "including" and similar expressions are not words of limitations
- c) Reference to you, yours, their or other variations refer to the client.
- d) Reference to we, ours or tother variations refer to the Consultant
- e) Reference to days are calendar days unless otherwise specified.
- f) Headings are for convenience only and do not form part of this agreement or its interpretation
- g) All fees listed exclude GST except in those instances where GST is explicitly included in the fee.

2. Role of Consultant

- 2.1. The consultant shall comply with all instructions given by the client in respect to this agreement (including instruction which have the effect of modifying or terminating this agreement).
- 2.2. The client will not be responsible for fees or charges incurred when the consultant has acted in contrary to clause 2.1.
- 2.3. The consultant is engaged as an independent contractor and not as an agent, employee, or as any other type of relationship.
- 2.4. The consultant will nominate a project manager as the primary contact for the project. The project manager will be responsible for the timely, cost effective provision of deliverables.

3. Role of Client

- 3.1. Confirm that the consultants understanding of works and proposed scope address the clients' requirements by reviewing the proposal and standard terms and conditions and providing appropriate authority to commence works.
- 3.2. The client shall make available to the Consultant information, documents, maps and other particulars relating to the Client's requirements for the services in a timely manner.
- 3.3. The client shall make appropriate arrangements to enable the Consultant to gain access to properties as necessary to enable the Consultant to perform the services.
- 3.4. The client shall provide advice to the Consultant if changes to the scope or timing of the project are requested.

4. Commissioning

- 4.1. Acceptance of the proposal may be made by any one of the following ways:
 - a) The client shall fax, email or post a completed copy of Annexure 2 (project commissioning form) to the Consultant
 - b) Providing written or email instructions after receiving the proposal
 - c) Contacting us (verbally or otherwise) and advising of your acceptance
- 4.2. Without derogating from the above, we prefer that you accept in the way set out in 4.1a to ensure all appropriate contract and account details are accurately captured, and a full written record can be maintained.
- 4.3. This proposal is valid for 14 days from the issue date and then subject to confirmation.

5. Payment for Services

- 5.1. The consultant may require payment of the proposed fee at commissioning, or full payment on acceptance of watermarked draft deliverables (prior to release of final deliverables).
- 5.2. The client shall pay to the consultant fees as stipulated in the Proposal. Fees will be progressively invoiced on a monthly basis, after completion of identified milestones or following project completion whichever is sooner, strictly on 14 day terms
- 5.3. Disbursements (including, but not limited to laboratory fees, equipment hire, travel costs and sub consultant fees) will attract a surcharge of 15%. Expected disbursements may be invoiced one billing period in advance.
- 5.4. Moneys not received within the agreed payment terms shall incur a fee to cover finance costs and additional administrative costs associated with this debt. This fee shall be equal to 3% of the outstanding money owed, and will be levied initially on the first day after payment was due , and monthly thereafter until the clients account is fully settled.
- 5.5. The client will be liable for third party or legal costs be incurred by the Consultant in recovering outstanding monies.
- 5.6. If the client disputes the whole or any portion of the amount claim in an account, the Client shall pay the portion of the amount stated that is not in dispute, and shall notify the Consultant in writing of the reasons for disputing the outstanding amount within 5 days of receipt of invoice, else invoice is deemed accepted. Any claim shall then be dealt with as per Section 7 of the Standard Conditions.

6. Variations

- 6.1. The client may request a variation to the services after acceptance of the proposal. The consultant may accept or reject this request.
- 6.2. If the consultant accepts a request for variation, notice of proposed changes to scope and fee will be provided to the client for consideration and acceptance as per Section 4.
- 6.3. The consultant may require a variation to the services and/or fee to complete the project in the event changes are required due to circumstances outside the Consultants immediate control. A written notice of proposed changes to scope and fee will be provided to the client for consideration and acceptance as per Section 4.

7. Dispute Resolutions

- 7.1. In the unlikely event that a dispute between the Client and Consultant, the parties agree that they will proceed in the following manner;
 - a) In the first instance the Client and the Consultant's (or representatives) shall attempt to resolve the dispute by negotiation.
 - b) If, in the opinion of either party, the offending party has not carried out its obligations to correct the dispute in seven (7) days, the offended party shall, by notice in writing to the offending party, provide details of the specific obligations that have not been carried out.

- c) If, after seven (7) days from the date of such notice, the offending party fails to remedy such default the matter shall be referred to the Brisbane Dispute Resolution Branch.
 - d) The cost of arbitration proceedings pursuant to this Agreement shall be borne by the parties as the arbitrator may direct.
- 7.2. Condition 7.1 shall not affect the consultant's rights to deal with delinquent payments as per condition 5 of the standard terms and conditions.

8. Termination of Agreement

- 8.1. Agreement is taken to be completed after draft deliverables have been reviewed provided and accepted by the client.
- 8.2. The consultant may terminate this agreement immediately and without penalty for any just cause, or if the client:
- a) doesn't pay invoices within the nominated terms
 - b) isn't able to agree on a variation to fees required under Section 6.3 of the standard terms and conditions
 - c) fails to provide us instruction or information either requested in the proposal, or arising throughout the project in a reasonable time
 - d) fails to accept advice provided by the consultant
 - e) asks us to act unethically.
- 8.3. The client may terminate or suspend the agreement, however the client will be liable for all professional fees, fees for other items, expenses and disbursements incurred by the consultant up to the termination or suspension date, together with a cancellation fee equal to 15% of the uninvoiced project value.

9. Intellectual Property

- 9.1. The Consultant shall retain the copyright and all intellectual property rights in all documents and material it produces. Subject to payment of the Fee, the Consultant shall grant the Client a licence to use those document and materials for the purposes of the project.
- 9.2. If the Client is in breach of any obligation to make a payment to the Consultant, the Consultant may revoke the licence referred to in clause 9.1, and the Client shall then cause to be returned to the Consultant all documents referred to in clause 9.1 and all copies thereof.

10. Limits to Liability

- 10.1 The liability of the consultant to the client arising out of the performance or non-performance of the services, whether under the law of contract, tort or otherwise shall be limited to the estimated fees payable to consultant described in the attached proposal. Should a fee not be nominated in the proposal, this limit shall be set at \$50,000.
- 10.2 The consultant shall be deemed to have been discharged from all liability in respect of the Services, whether under the law of contract, tort or otherwise, on the expiration of one year from the completion of the Services, and the Client (and persons claiming through or under the Client) shall not be entitled to commence any action or claim whatsoever against the consultant (or any employee of the consultant) in respect of the Services after that date.
- 10.3 The consultant does not give any warranty nor accept any liability in relation to the performance or non-performance of the Services except to the extent, if any, required by law or specifically provided for in this Agreement. If apart from this Clause any warranty would be implied whether by law, custom or otherwise, that warranty is to the full extent permitted by law hereby excluded.
- 10.4 Nothing herein, contained shall be read or applied so as to purport to exclude, restrict or modify or have the effect of excluding, restricting or modifying the application in

relation to the supply of any goods or services pursuant to this Agreement of all or any of the provisions of Part V of the Trade Practices Act 1974 (as amended) or any relevant State Act or Territorial Ordinance which by law cannot be excluded, restricted or modified.

11. Severance and Acknowledgements

- 11.1. In the event that any part of this agreement is found to be void or unenforceable for any reason, the remaining parts shall remain in force.
- 11.2. In commissioning the consultant, you acknowledge that you have read and understood this proposal (including standard terms and conditions), and that you accept the payment terms and relevant fees associated with late payment.

12. General

- 12.1. The Client agrees to allow O2 Ecology to use its company logo for marketing purposes, and the use of its company name and a brief project summary on the O2 Ecology website (confidential project details will not be disclosed), unless directed otherwise.

Appendix 3

Aboriginal Heritage Inquiry System

search result – EP 413



Search Criteria

0 Registered Aboriginal Sites in Petroleum Title - EP 413 R2

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register of Aboriginal Sites established under and maintained under the Aboriginal Heritage Act 1972 (AHA).

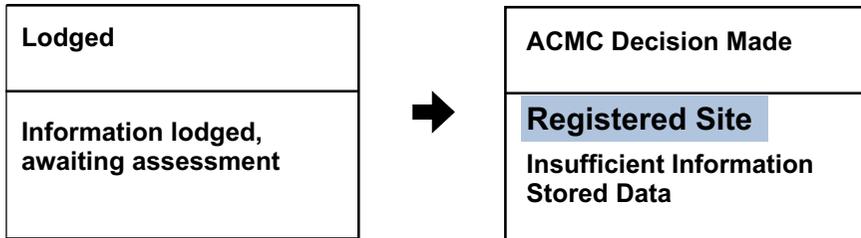
Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

Reliable The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.

Unreliable The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information recorded.

Status



Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of the sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting/Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels.



List of Registered Aboriginal Sites with Map

No Results



Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

-  Registered Sites
-  Aboriginal Community Occupied
-  Aboriginal Community Unoccupied
-  Town
-  Search Area

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Cadastre, Local Government Authority, Native Title boundary, Roads data copyright © Western Australian Land Information Authority trading as Landgate (2013).

Geothermal Application, Geothermal Title, Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (DMP) (2013.9)

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