

**Level 2 Flora & Vegetation Survey
Lake Wells Project
Prepared For
Australian Potash Limited**



**June 2017
FINAL**

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Glossary

Acronym	Description
ANCA	Australian Nature Conservation Agency.
AP	Australian Potash Limited
BAM Act	Biosecurity and Agriculture Management Act 2007, WA Government.
BC	Botanica Consulting.
BC Act	Biodiversity Conservation Act (2016). WA Government.
BoM	Bureau of Meteorology.
CALM	Department of Conservation and Land Management (now DPaW), WA Government.
DAFWA	Department of Agriculture and Food, WA Government.
DEC	Department of Environment and Conservation (now DPaW), WA Government.
DEH	Department of Environment and Heritage Australian Government.
DEP	Department of Environment Protection (now DER), WA Government.
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DotEE), Australian Government
DER	Department of Environment Regulation (formerly DEC, DoE), WA Government.
DMP	Department of Mines and Petroleum (formerly DoIR), WA Government.
DoE	Department of Environment (now DER/DPaW), WA Government.
DoIR	Department of Industry and Resources (now DMP), WA Government.
DotEE	Department of the Environment and Energy (formerly DSEWPaC, DEWHA, and DEH), Australian Government.
DoW	Department of Water, WA Government.
DPaW	Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotE, formerly DEH, DEWHA), Australian Government.
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
Km	Kilometre (1,000 metres).
LWP Project	Lake Wells Potash Project
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority, WA Government.
PEC	Priority Ecological Community.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WC Act	Wildlife Conservation Act 1950, WA Government.

Executive Summary

Botanica Consulting (BC) was commissioned by Australian Potash Limited (AP) to undertake a Level 2 flora and vegetation survey of the Lake Wells Potash (LWP) Project (referred to as the 'survey area'), which is located within the Great Victoria Desert, approximately 160km north north-east of Laverton and approximately 78km north of the Cosmo Newbery Aboriginal Community. The survey was initially conducted in spring from the 10th to 17th September 2016, covering an area of 37,510 ha (of which approximately 3,645 ha was covered by Lake Wells). During this survey, 81 quadrats (50m X 50m) were established. These quadrats were revisited in autumn from the 26th to the 29th April 2017. Prior to the autumn survey, the survey area was increased to a total area of 53,680 ha, with an additional 19 quadrats (50m X 50m) established in the extended survey area. A total of 100 quadrats were established within the final survey area.

Seventeen vegetation types were identified within the survey area. These vegetation types were located within nine different landform types and comprised of five major vegetation groups, which were represented by a total of 45 Families, 124 Genera and 278 Taxa (including 60 annual taxa).

Species composition assessments indicate there was minimal heterogeneity in species composition across the survey area, with majority of vegetation types intermixed into floristic groups despite differences in both dominant stratum taxa and landform; however, two distinct supergroups were identified. The first supergroup comprised of a mix of twelve floristic groups, from multiple different vegetation types identified in the field including quadrats from all the different landforms and major vegetation groups (excluding Samphire shrubland; CD-CSSSF1). Within this supergroup, the Eucalypt Woodlands were separated from the Acacia Forests and Woodlands, Chenopod Shrublands and Casuarina Forests and Woodlands. The second super group comprised of five floristic groups, including quadrats from the Gypsum Dunefield and Closed Depression (Samphire Shrubland) vegetation types. Within this group, the Mallee Woodlands and Shrublands & Casuarina Forests and Woodlands were separated from the Samphire shrubland (CD-CSSSF1). Species composition of the Salt Lake vegetation (CD-CSSSF1) varied between the quadrats, however this variation appears to be due to the low species diversity of the Samphire vegetation rather than variation in spatial distribution across the lake (i.e. quadrats were grouped together regardless of location across the lake/ survey area). The Chaos 2 richness estimator provided an estimated species richness of 188 species in 100 sample sites (quadrats). Species richness recorded for the 100 quadrats surveyed was 244 species (including annuals) which indicates survey intensity was adequate.

No Threatened Flora taxa listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or listed under the *Wildlife Conservation (WC) Act 1950*¹ were recorded within the survey area. Two Priority Flora taxa as listed by the Department of Parks and Wildlife (DPaW) were identified within the survey area; *Lepidium xyloides* (P1) and *Melaleuca apostiba* (P3). No Threatened Ecological Communities (TEC) pursuant to Commonwealth or State legislation were identified within the survey area. The survey area does not contain any world or national heritage places and does not occur within a Bush Forever site. There are no wetlands of international importance (Ramsar Wetlands), national importance (Australian Nature Conservation Agency (ANCA) Wetlands) or conservation category wetlands within the survey area. No Priority Ecological Communities (PEC) as listed by DPaW were recorded within the survey area.

The survey area is not located within an Environmentally Sensitive Area (ESA) or Schedule 1 Area as listed under the *Environmental Protection (EP) Act 1986*. The survey area is not located within a listed or proposed conservation area managed by DPaW.

¹ *Biodiversity Conservation Act 2016* received assent on 21 September 2016 with Parts of the Act coming into effect on 3 December 2016. Once fully enacted with enabling subsidiary regulations, it will replace the *Wildlife Conservation Act 1950*.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (ranging from 'pristine' to 'completely degraded'), six vegetation types were rated as 'good' and the remaining eleven vegetation types had a vegetation condition rating of 'very good'. Five introduced species were identified within the survey area:

1. *Bidens bipinnata* (Spanish needles)
2. *Citrullus lanatus* (Pie Melon)
3. *Cucumis myriocarpus* (Prickly Paddy Melon)
4. *Sonchus oleraceus* (Common Sowthistle)
5. *Tribulus terrestris* (Caltrop)

According to the Department of Agriculture and Food Western Australia (DAFWA) none of these species are listed as a Declared Plant under Section 22 of the *Biosecurity and Agriculture Management (BAM) Act 2007*.

1 **Introduction**

1.1 **Project Description**

Botanica Consulting (BC) was commissioned by Australian Potash Limited (AP) to undertake a Level 2 flora and vegetation survey of the Lake Wells Potash (LWP) Project (referred to as the 'survey area'), which is located within the Great Victoria Desert, approximately 160km north north-east of Laverton approximately 78km north of the Cosmo Newbery Aboriginal Community. The survey covered a total area of 55,900 ha, of which approximately 3,645 ha was covered by Lake Wells. A total of 100 quadrats (50m X 50m) were established within the survey area, and surveyed over multiple seasons/ years in accordance with DPaW and EPA Technical Guidelines for Terrestrial Flora and Vegetation surveys.

AP proposes to develop and operate a facility to extract and purify natural brines to produce potassium sulphate and potassium chloride at Lake Wells. The implementation of the proposed LWP Project will require land clearing, groundwater abstraction, mineral processing, storage of waste salt and a variety of support activities (construction or upgrade of roads, operation of an accommodation village and airstrip, etc).

1.2 **Objectives**

The survey was conducted in accordance with *Guidance for the Assessment of Environmental Factors (No. 51) Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) and *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (DPaW & EPA, 2016). The objectives of the assessment were to:

- gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- identify significant flora, vegetation/ecological communities and assess the potential sensitivity to impact;
- conduct a field survey to verify / ground truth the desktop assessment findings through targeted and detailed survey;
- undertake floristic community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- undertake vegetation condition mapping;
- assess the project area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description;
- assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral of the project to the Commonwealth DotEE;
- determine the State legislative context of environmental aspects required for the assessment; and
- provide a basis for assessing the potential impacts on flora and vegetation of implementing the proposed LWP Project.

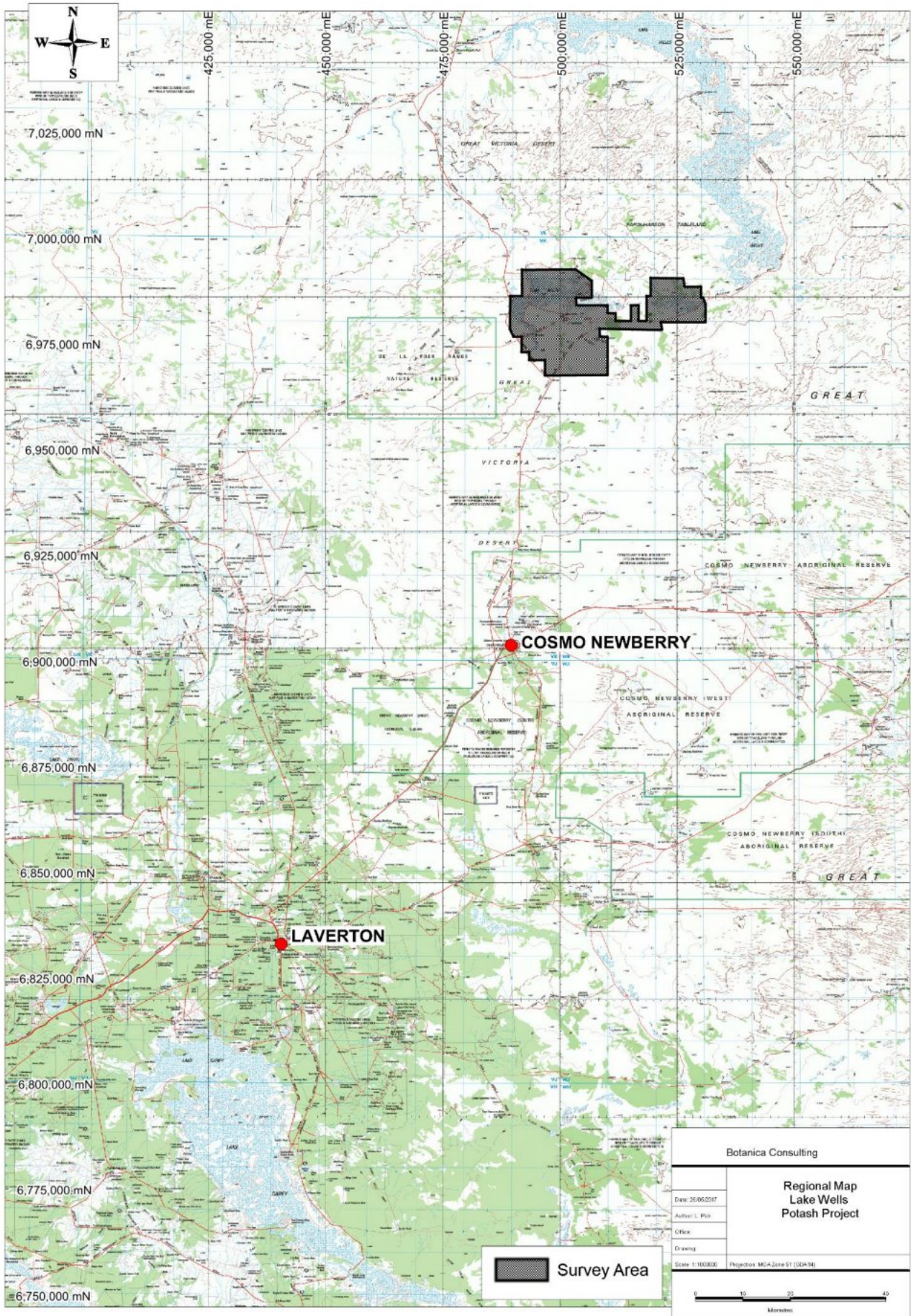


Figure 1: Regional map of the Lake Wells Potash Project survey area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area lies within the Austin Botanical District and Helms Botanical District of WA. The Austin Botanical District consists of predominantly of Mulga low woodland on plains and scrub on hills (Beard, 1990). The Helms Botanical District is described as Mulga low woodland on hardpan soils between dunes. Where this is not prominent, tree steppes of *Eucalyptus gongylocarpa*, *E. youngiana* and *Triodia basedowii* occur (Beard, 1990).

Based on the Interim Biogeographic Regionalisation of Australia (IBRA), Version 7 (DotEE, 2012), the survey area is located within the Great Victoria Desert Bioregion of WA (Figure 2). The Great Victoria Desert Bioregion is further divided into four subregions; Shield, Central, Maralinga and Kintore, with the survey area located within the Shield (GVD1) subregion (Figure 2).

The Great Victoria Desert Bioregion is an active sand-ridge desert of deep Quaternary aeolian sands with a tree steppe of *Eucalyptus gongylocarpa*, Mulga and *E. youngiana* over hummock grassland, dominated by *Triodia basedowii*. The climate is arid, with summer and winter rain averaging between 150 and 190mm annually. Landforms consist of red sand plains with patches of aeolian dunefields, salt lakes on major valley floors with lake-derived dunes, and silcrete-capped (breakaway) mesas and plateaus (McKenzie, J.E. May and S. McKenna, 2002).

Landforms of the Shield Subregion (GVD1) consist of salt lakes and major valley floors with lake derived dunes, sandplains with patches of seif dunes running east west and areas of moderate relief with out-cropping and silcrete-capped mesas and plateaus (breakaways). The subregion contains a major palaeochannel of Ponton Creek. Spinifex (*Triodia* spp.) and mallee (*Eucalyptus kingsmillii*, *E. youngiana*) over hummock grassland dominated by *Triodia basedowii* occur on the aeolian sandplain. Scattered marble gum (*E. gongylocarpa*) and native pine (*Callitris*) occur on the deeper sands of the sand plains. Mulga and acacia woodlands occur mainly on the colluvial and residual soils. Salt bush (*Atriplex*), Bluebush (*Maireana*), and samphire (*Tecticornia*) occur on the margins of salt lakes and in saline drainage areas.

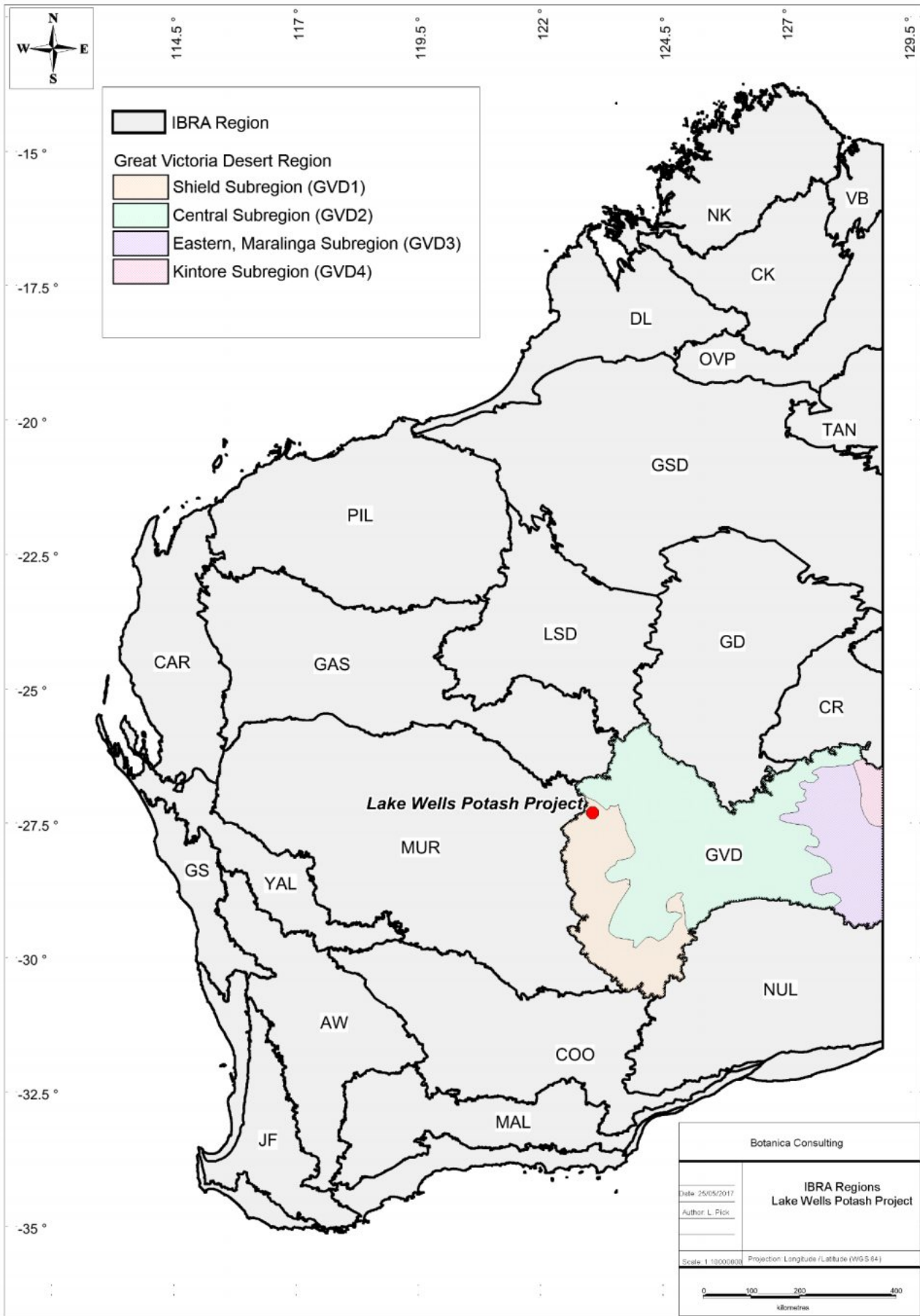


Figure 2: Map of Interim Biogeographic Regionalisation of Australia (IBRA)

2.2 Soils and Landscape Systems

The Great Victoria Desert bioregion forms the southern part of the anti-clockwise whorl of dune fields of Australia. The dominating landforms are dunes and swales. There are local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky prominences (Commonwealth Government, 2008b). Playa lakes are a minor, but locally significant landform in the desert, occurring in topographically low-lying regions. Many represent the dried remnants of former drainage channels (Shephard, 1995). The Great Victoria Desert (GVD) is an active sand-ridge desert of deep Quaternary (less than 65 million years ago) Aeolian sands overlying Permian (251 – 298 million years ago) and Mesozoic (65 - 251 million years ago) units of the Officer Basin (Commonwealth Government, 2008b). The GVD is underlain on its eastern, western and northern margins by an ancient crystalline basement comprising rocks at least 1000 million years old (Shephard, 1995).

Based on geographic information provided by DAFWA (2014), the survey area is located within the North-western Great Victoria Desert Zone 122 of the Gunbarrel Province (12) and the Leemans Sandplain Zone 274 of the Murchison Province (27).

The North-western Great Victoria Desert Zone is characterised by sandplains and dunes (with some undulating plains and uplands) on sedimentary rocks of the Gunbarrel Basin. Soils comprised sandy earths and red deep sands with some red loamy earths and red-brown hardpan shallow loams. Vegetation is predominantly Mulga shrublands and spinifex grasslands with mallee. This zone is located in the southern arid interior between Lake Carnegie, Lake Rason and Warburton (Tille, 2006).

The Leemans Sandplain Zone is characterised by sandplains (with some gravel plains, mesas and salt lakes) on granitic rocks of the Yilgarn Craton (Eastern Goldfields Superterrane). Soils consist of red sandy earths with red loamy earths and some red deep sands, red-brown hardpan shallow loams and Calcareous loamy earths. Vegetation is predominantly spinifex grasslands with marble gum, mallee and mulga shrublands (and some halophytic shrublands). The zone is located in the south-western arid interior between Lake Wells and Minigwal, to the east of Laverton (Tille, 2006).

These zones are further divided into soil landscape systems within the soil landscape systems of the survey area shown in Table 1 and Figure 3 (ASRIS, 2014).

Table 1: Soil Landscape Systems within the Lake Wells Potash Project survey area

Zone	Landscape System/ Mapping Unit	Description
North-western Great Victoria Desert Zone (122)	Heppingstone System	Sand dunes and sand plains with spinifex grasslands and scattered eucalypts and native pines.
Leemans Sandplain Zone (274)	AB49	Plains with a variable proportion of longitudinal sand dunes and scattered residuals of hard sedimentary rocks and laterites
	AB50	Plains with scattered dunes and small breakaways of unit BY7
	Bullimore System	Gently undulating sandplain with occasional linear dunes and stripped surfaces supporting spinifex grasslands with mallees and acacia shrubs.
	Carnegie System	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.
	Darlot System	Salt lakes, fringing saline alluvial plains, regularly arranged sandy banks and numerous claypans and swamps, supporting halophytic shrublands and spinifex and wanderrie grasslands.

Zone	Landscape System/ Mapping Unit	Description
	Desdemona System	Plains with deep sandy or loamy soils supporting mulga tall shrublands and wanderrie grasses.
	Fa7	Green stone hills and ranges with some slate and basalt
	Fz31	Undulating pediments characterized by silcrete-capped cuestas, and hilly ridges on tillite and shale; much rock outcrop; stony pavements are common
	Mileura System	Saline and non-saline calcreted river plains with flood plains and calcrete platforms supporting variable tall shrublands, mixed halophytic shrublands and shrubby grasslands.
	Nubev System	Gently undulating stony plains, minor limonitic low rises and drainage floors supporting mulga and halophytic shrublands.

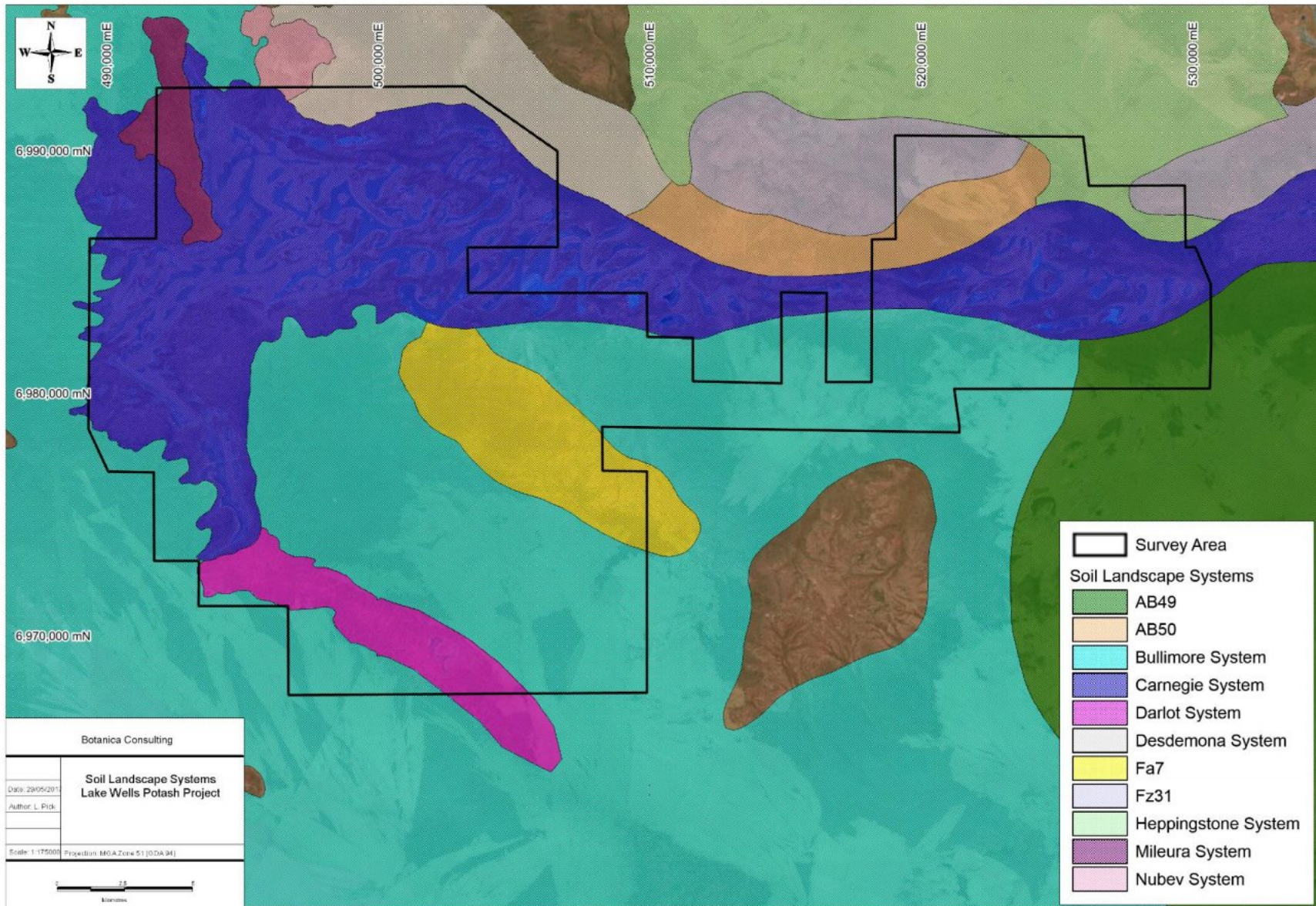


Figure 3: Map of Soil Landscape Systems within the Lake Wells Potash Project survey area

2.3 Remnant Vegetation

The DAFWA GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation associations Great Victoria Desert 39, 125, 676, 1239 and Wiluna 107 (Figure 4). The extent of these vegetation associations as specified in the *2015 Statewide Vegetation Statistics* (DPaW, 2015) is provided in Table 2.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered” (EPA, 2000). All of the vegetation types present in the areas intersected by the LWP Project are estimated to remain at approximately 100% of their estimated pre-European extent. The development of the LWP Project will not significantly reduce the extent of pre-European vegetation associations.

Table 2: Remaining Beard Vegetation Associations within Western Australia (DPaW, 2015)

Vegetation association	Pre-European Extent (Ha)	Current Extent (Ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Great Victoria Desert 39	151,986.18	151,986.18	100.00	0.00	Shrublands; mulga scrub
Great Victoria Desert 125**	54,842.71	54,842.71	100.00	0.00	Bare areas; salt lakes
Great Victoria Desert 676	40,329.39	40,329.39	100.00	0.00	Succulent steppe; samphire
Great Victoria Desert 1239***	1,393,810.03	1,393,810.03	100.00	2.46	Hummock grasslands, open medium tree & mallee steppe; marble gum & mallee (<i>E. youngiana</i>) over hard spinifex <i>Triodia basedowii</i> on sandplain
Wiluna 107*	552.17	552.17	100.00	7.06	Hummock grasslands, shrub steppe; mulga and <i>Eucalyptus kingsmillii</i> over hard spinifex

*Low Reservation Priority according to the International Union for Conservation of Nature (IUCN)

**Medium Reservation Priority according the IUCN

***High Reservation Priority according the IUCN

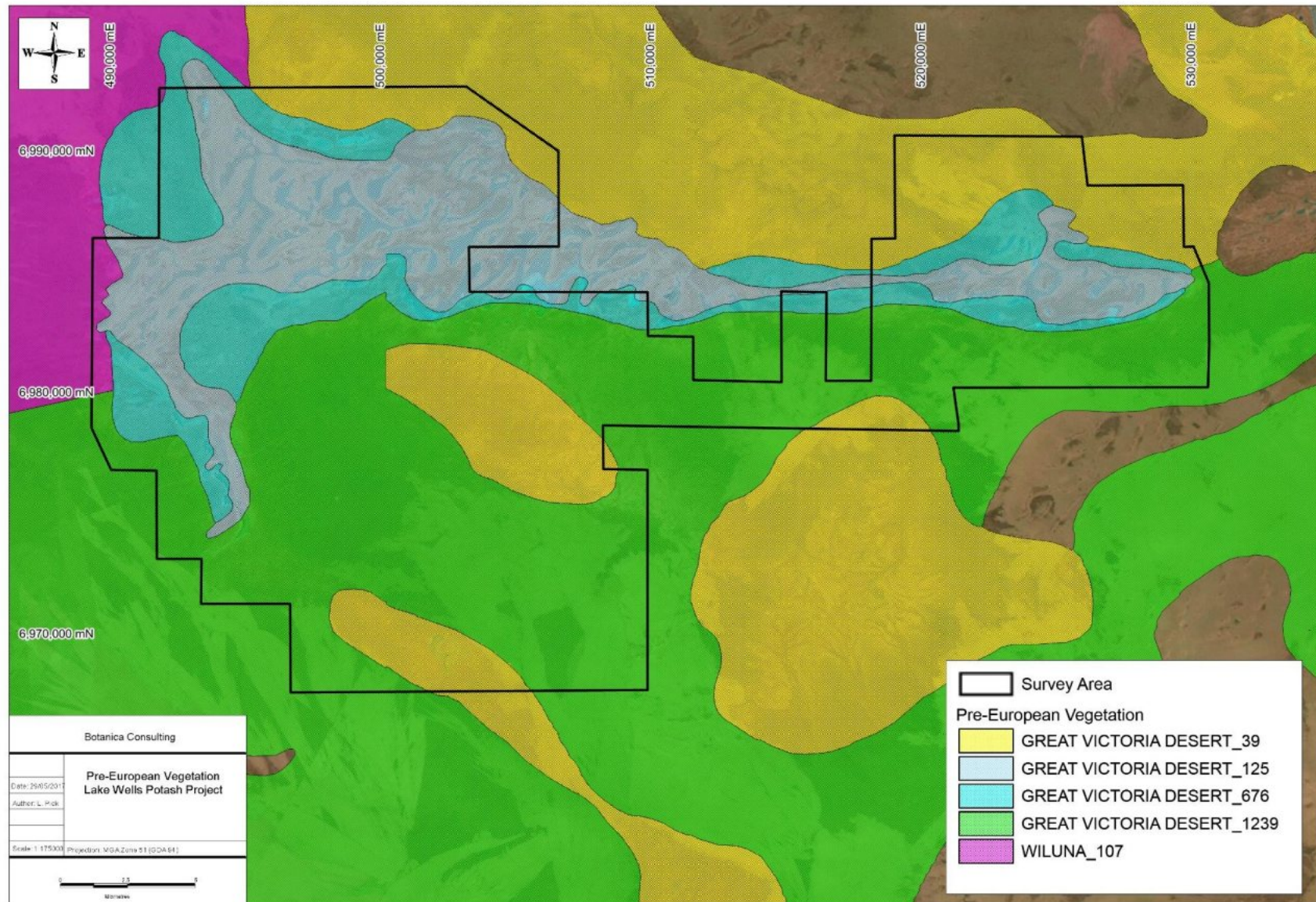


Figure 4: Pre-European Vegetation Associations within the Lake Wells Potash Project survey area

2.4 Climate

The climate of the Shield subregion is characterised as arid, with summer and winter rain approximately 190mm per annum (Barton & Cowan, 2001). Rainfall data for the Laverton Aero weather station (#12035) obtained from the Bureau of Meteorology (BoM) located approximately 143 km south-west of the LWP Project is provided in Figure 5 (BoM, 2017a). Annual rainfall (for 2016 (Figure 6) was above average (302.1mm) recording a total of 338.6mm. Rainfall in 2017 was highest in January and March. From January to April 2017, the area recorded 422.8mm of rain rainfall, exceeding the annual average for the area (120.7mm above annual average).

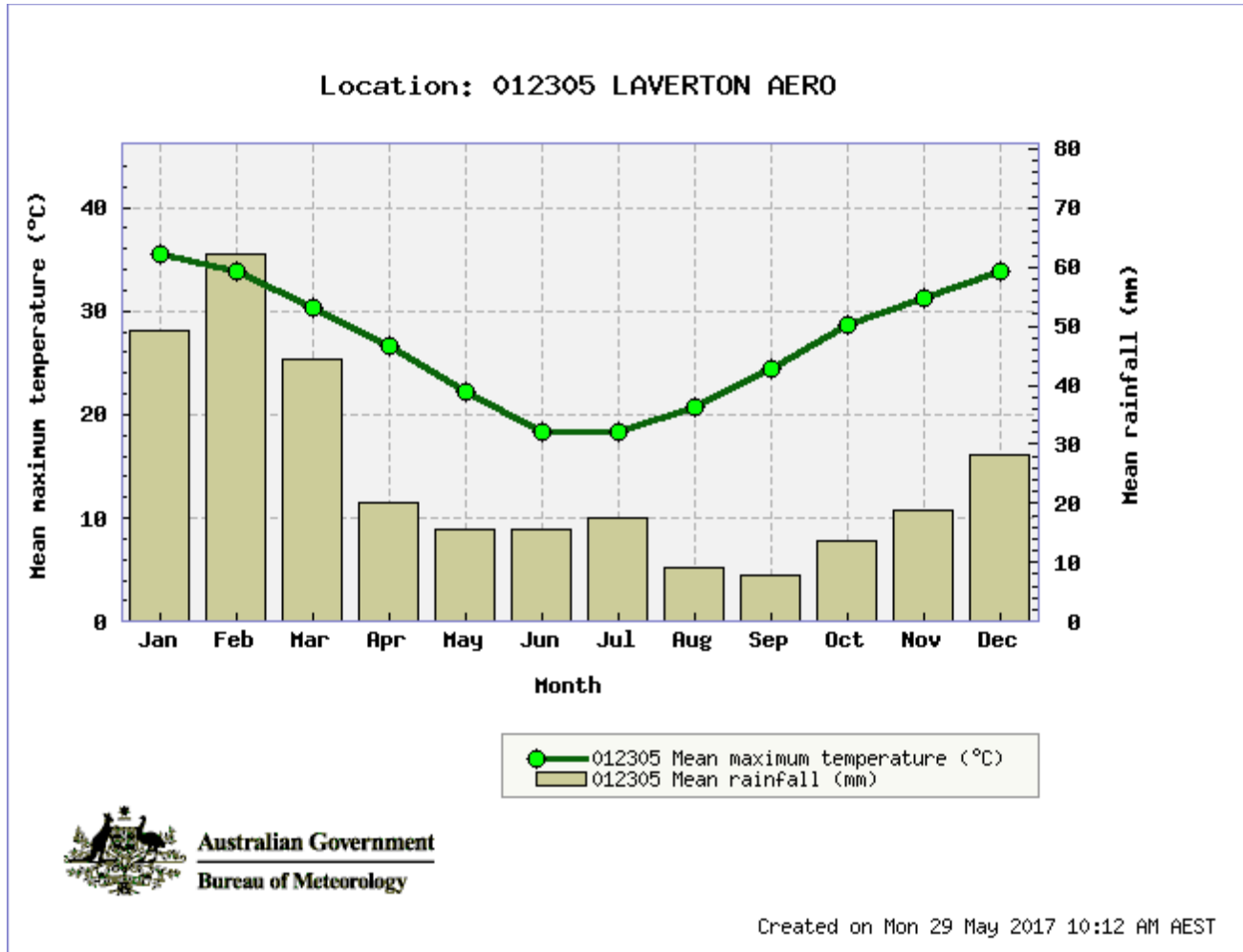


Figure 5: Mean monthly rainfall and maximum temperature (June 1994 to April 2017) for the Laverton Aero weather station (#12035) (BoM, 2017a)

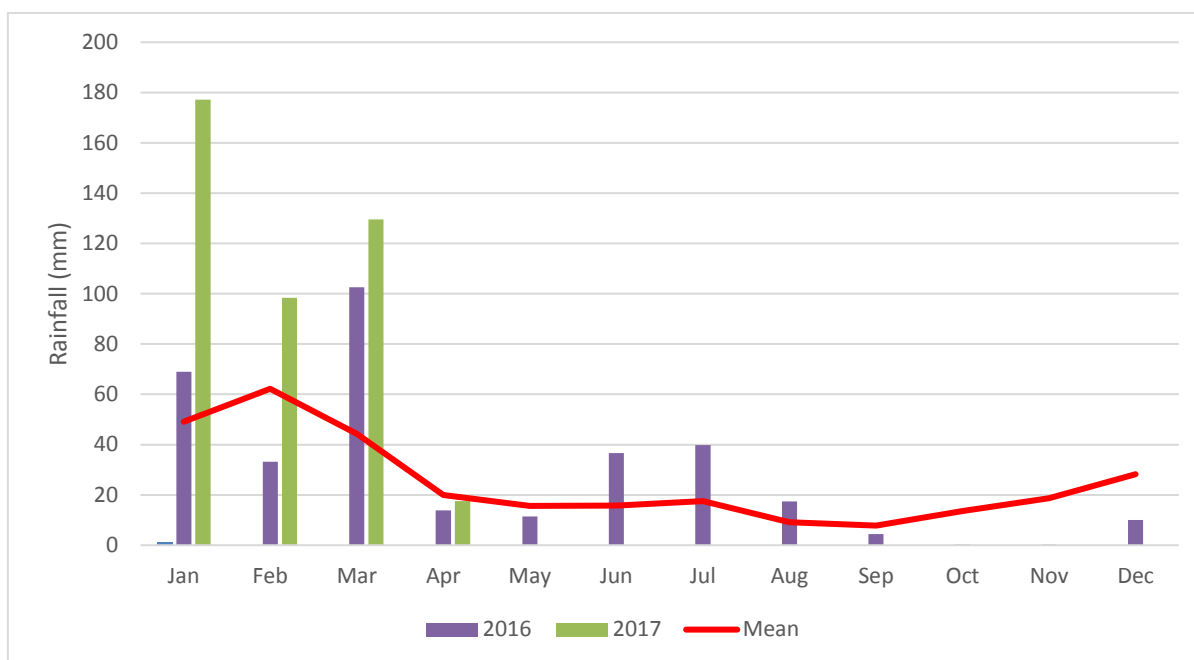


Figure 6: Monthly rainfall and mean monthly rainfall (January 2016 to April 2017) for the Laverton Aero weather station (#12035) (BoM, 2017a)

2.5 Hydrology

The survey area encompasses the south-western region of Lake Wells as shown in Figure 7 which covers a total area of 49,480 ha (of which approximately 3,645 ha is located within the survey area). Lake Wells is an ephemeral salt lake and is therefore dry for most of the year except for short periods after rainfall. The lake does however have a very shallow water table positioned just below the surface and as a consequence the underlying sedimentary units are permanently saturated with salt brine.

According to the Department of Water (DoW) groundwater salinity database (DoW, 2017), groundwater salinities in the survey area ranges from TDS 1000-3000 mg/L (southern region of the survey area) to TDS >35,000 mg/L associated with Lake Wells. The groundwater flow system is an intermediate flow system² in Cainozoic sediments.

With respect to the lake bed's subsurface geology, historic and recent drilling has revealed a variable regolith horizon. It consists of surficial or near surface evaporite and sand/silt, silcrete +/- laterite, common lake clays with some well sorted sand units and puggy lacustrine clays with minor sand/silt. Archaean basement rocks including transitional porphyry, granite, ultramafic and amphibolite types.

According to the Geoscience Australia database (2001) there are no drainage lines within the survey area (Figure 7). The survey area overlies one subsurface paleochannel; the Wells paleochannel. A map showing the hydrology of the LWP Project survey area is provided in Figure 7.

² Intermediate flow systems have a greater storage capacity and permeability than local systems and take longer to 'fill' in response to increased recharge.

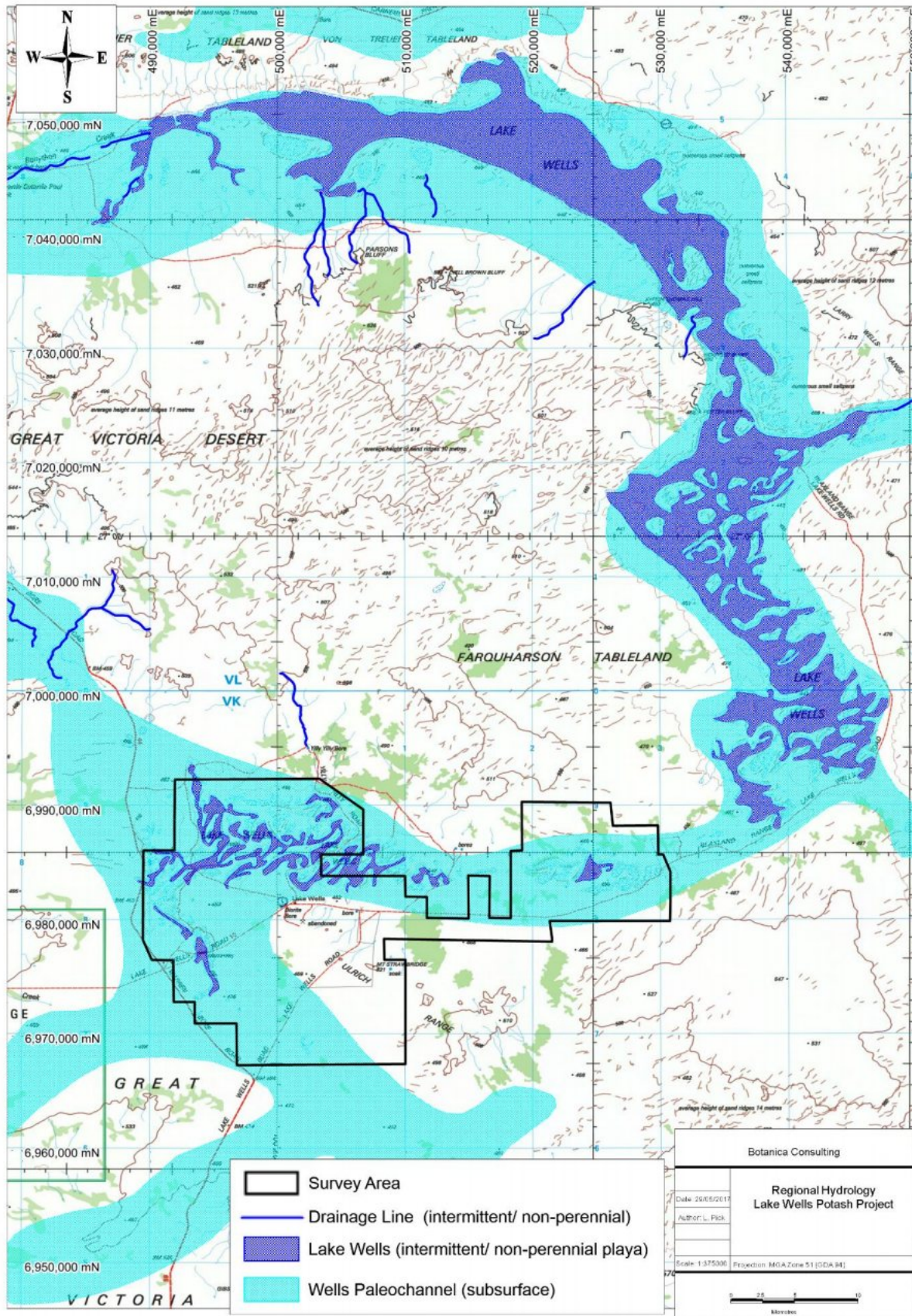


Figure 7: Hydrology of the Lake Wells Potash Project survey area (data obtained from Geoscience Australia, 2001)

2.6 Land Use

The dominant land uses of the Shield subregion include; Aboriginal reserves (12.3%), Conservation Reserves (7%), grazing-native pastures (24.8%), UCL and Crown Reserves (55.7%) and other-lake and major watercourse (0.1%) (Cowan, 2001). The survey area is located within the Lake Wells pastoral lease which operates as an active cattle station.

3 Survey Methodology

3.1 Desktop Assessment

Searches of the following databases were undertaken to aid in the compilation of a list of plant taxa within the survey area:

- DPaW Priority/ Threatened Flora Database Search (DPaW, 2016a)
- DPaW Priority/ Threatened Ecological Communities Database Search (DPaW, 2016b)
- DPaW NatureMap Database (DPaW, 2016c);
- DotEE Protected Matters search tool (DotEE, 2016a).

The NatureMap and Protected Matters searches were conducted for an area encompassing a 40km radius of the centre coordinates; 123° 12' 00" E, 27° 20' 10" S.

It should be noted that these lists are based on observations from a broader area than the survey area (40 km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only. Local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

Prior to the field survey, a combined search of the DPaW Flora of Conservation Significance databases (DPaW, 2016a) was undertaken within a 60km radius of the survey area. Significant flora species identified through the database search were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise survey participants with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Threatened/ Priority Flora were also obtained from Florabase.

The conservation significance of flora taxa was assessed using data from the following sources:

- EPBC Act. Administered by the Australian Government (DotEE);
- WC Act. Administered by the WA Government (DPaW)³;
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and

³ *Biodiversity Conservation Act 2016* received assent on 21 September 2016 with Parts of the Act coming into effect on 3 December 2016. Once fully enacted with enabling subsidiary regulations, it will replace the *Wildlife Conservation Act 1950*.

- DPaW Priority Flora list. A non-legislative list maintained by DPaW for management purposes (DPaW).

Table 3 represents the definitions of Flora of Conservation Significance ratings under the WC Act and EPBC Act.

Table 3: Definitions of Conservation Significant Flora

Code	Category
State categories of threatened and priority species	
T	Threatened Flora “flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F (2) of the Wildlife Conservation Act.”
P1	Priority One – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.”
P2	Priority Two – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”
P3	Priority Three – Poorly Known Taxa “Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but needs further survey.”
P4	Priority Four – Rare Taxa “Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.”
P5	Priority Five-Conservation Dependent Taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Code	Category
Conservation dependent	<p>Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied:</p> <p>(i) the species is a species of fish;</p> <p>(ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;</p> <p>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;</p> <p>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</p>

Conservation significant flora identified during the database searches were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

- **Unlikely:** Area is outside of the currently documented distribution for the species and /or no suitable habitat (type, quality and extent) was identified as being present during the field/desktop assessment.
- **Possible:** Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop assessment, supported in some cases by recent records being documented from within or near the area.
- **Known to Occur:** The species in question was positively identified as being present during the field survey.

A search of the DPaW PEC and TEC database was also conducted within a 60km radius of the survey area (DPaW, 2012b). Table 4 represents the definitions of Threatened and Priority Ecological Communities.

Table 4: Definition of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PTD	<p>Presumed Totally Destroyed</p> <p>An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies:</p> <p>records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;</p> <p>all occurrences recorded within the last 50 years have since been destroyed.</p>
CE	<p>Critically Endangered</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria:</p>

Category Code	Category
	<p>The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the immediate future.</p>
E	<p>Endangered</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria:</p> <p>The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short-term future, or is unlikely to be substantially rehabilitated in the short-term future due to modification;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the short-term future.</p>
V	<p>Vulnerable</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:</p> <p>The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;</p> <p>The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution;</p> <p>The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.</p>
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	<p>Critically Endangered</p> <p>If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).</p>
E	<p>Endangered</p> <p>If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).</p>
V	<p>Vulnerable</p> <p>If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future (indicative timeframe being the next 50 years).</p>

Category Code	Category
Priority Ecological Communities (PEC)	
P1	<p>Poorly-known ecological communities</p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.</p>
P2	<p>Poorly-known ecological communities</p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.</p>
P3	<p>Poorly known ecological communities</p> <p>Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p>
P5	<p>Conservation Dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

3.2 Field Assessment

The flora survey was initially conducted in spring from the 10th to 17th September 2016, covering an area of 37,510 ha (of which approximately 3,645 ha was covered by Lake Wells). 81 quadrats (50m X 50m) were established during the initial survey. These quadrats were revisited in autumn from the 26th to the 29th April 2017. Prior to the autumn survey, the survey area was increased to a total area of 55,900 ha, with an additional 19 quadrats (50m X 50m) established in the extended survey area in autumn 2017. A total of 100 quadrats were established within the final survey area.

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum;
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and WAHERB. Vegetation types were classified in accordance with the NVIS Vegetation Type (Level V) classification. Presence/absence data of taxa from sample sites were used to compile the representative floristic groups. The survey area was traversed by three people via 4WD, all-terrain vehicle and on foot (Figure 8).

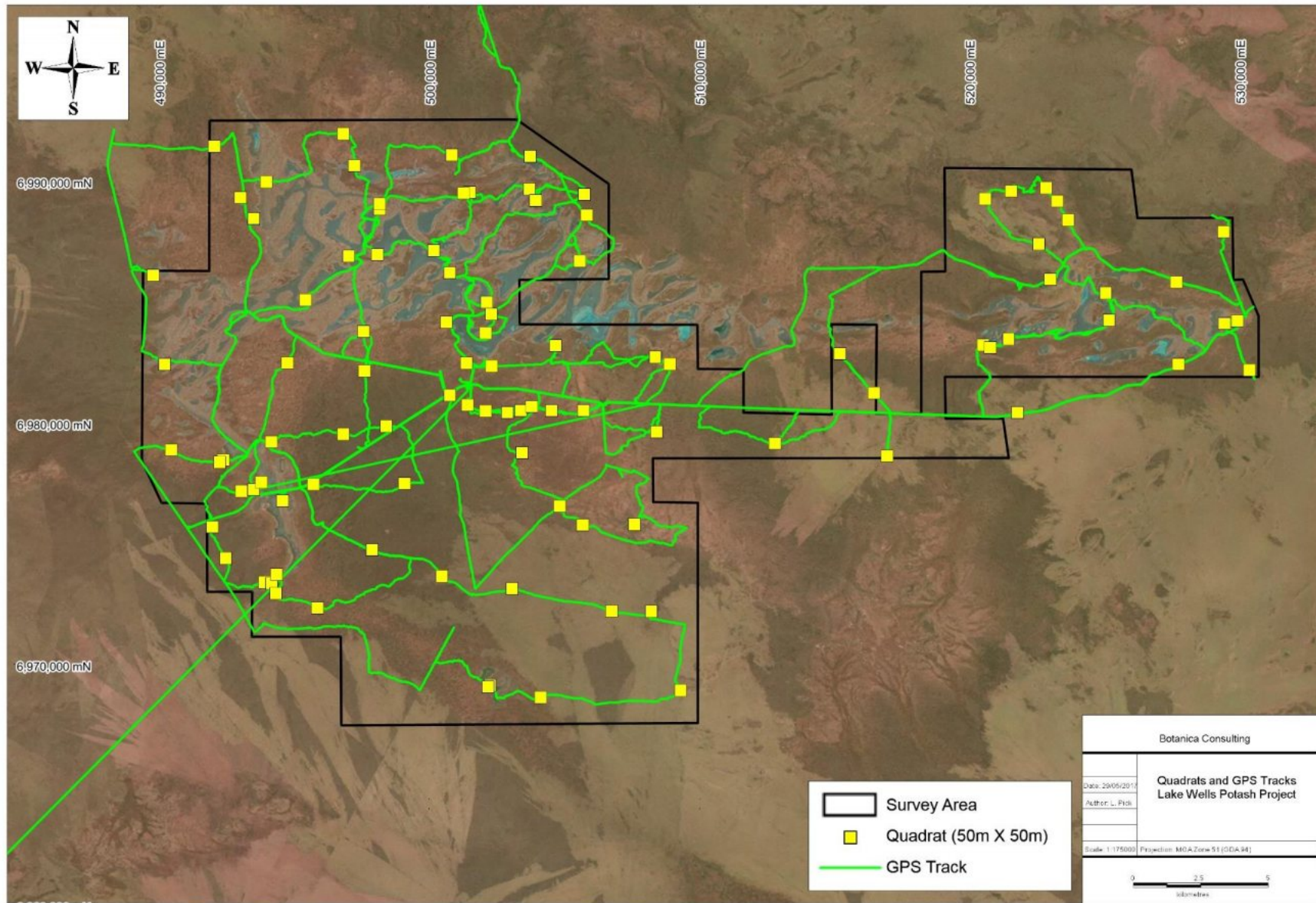


Figure 8: Quadrat locations, survey area boundary and GPS tracks traversed throughout the Lake Wells Potash Project survey area

3.2.1 Sampling Quadrats

One hundred 50m x 50m quadrats were established within the survey area (Figure 8). The objective was to have at least three quadrats per vegetation type to capture the floristic variations within the survey area. The quadrats were established by inserting metal pickets in each corner, and measuring the length of the resultant boundaries to verify the quadrats were 50m x 50m (square quadrats).

Following their establishment and boundary verification, the location of each quadrat was recorded by GPS (Appendix 5) photographed (Appendix 7). All vascular plants within the quadrat were recorded (Appendix 6). This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using BC's own reference herbarium and relevant taxonomical keys or by a taxonomic consultant. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix 6). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with current DPaW/EPA Guidelines (2016).

3.2.2 Personnel involved

Jim Williams	- Environmental Consultant/ Director (Diploma of Horticulture)
Lauren Pick	- Environmental Consultant (BSc Zoology & Conservation Biology)
Aidan Williams	- Environmental Technician (Undergraduate Environmental Science)
Mike Hislop	- WA Herbarium Taxonomic Consultant
Kelly Shepherd	- WA Herbarium Taxonomic Consultant (<i>Tecticornia</i> specialist)

3.2.3 Scientific licences

Table 5: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL011451	21-05-2016
	SL011826	21-05-2017
Lauren Pick	SL011452	21-05-2016
	SL011825	21-05-2017

3.3 Data Analysis Tools

Once the survey was completed the data obtained was analysed to generate a vegetation map (Appendix 2). The statistical program PATN was used to assess species composition of the quadrats (Appendix 8).

3.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/ absence of species. Annual taxa were removed from the data prior to analysis (total of 56 annual taxa). Species reconciliation eliminated those sterile taxa that could not be fully identified from the analysis (two taxa), and reconciled subsp. and/or variant taxa. Singleton taxa were included in the analysis due to the low species diversity of some vegetation types (removal of both annual and singleton taxa would have resulted in certain quadrats containing no taxa for the analysis).

The analysis produced a quantitative estimate of the relationship between species composition of each quadrat. The classifications were based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Arithmetic Mean (UPGMA) method (with a beta value of -0.1) which standardises the data enabling the analysis to be completed. Semi-strong hybrid (SSH) ordination of the quadrat is then undertaken to show spatial relationships between groups and to elucidate possible environmental correlates with the classification.

The analysis also produced a stress value which is a measure of the 'strength' of the analysis (i.e. how well the quadrats are grouped together into the appropriate floristic groups). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis appropriately grouped quadrats. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e. other factors influencing differences in floristic groups other than species composition e.g. fire, clearing disturbance etc.).

3.3.2 EstimateS

EstimateS software was used to estimate species richness present using the Chao2 richness estimator. For any number of samples, the estimator uses the existing pattern of species accumulation to estimate the true number of species at a site. The estimators tend to under-estimate species number when sample size is small, hence the estimated number of true species can be seen to increase with sample size. This software was also used to compute Coleman rarefaction curves estimates which were used to calculate species accumulation curves.

3.4 Flora survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 6.

Table 6: Limitations and constraints associated with the flora and vegetation survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD, all-terrain vehicle and on foot. Numerous station tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. Coordinating Botanist: Jim Williams Field Staff: Jim Williams, Lauren Pick & Aidan Williams Data Interpretation: Jim Williams, Andrea Williams, Lauren Pick
Timing of survey, weather & season	Not a constraint	Initial survey work was conducted in Spring (September 2016) following above average autumn and winter rainfall and during optimal flowering period for most taxa. The second season survey work was conducted in Autumn (April 2017) following high summer rainfall. Rainfall data has shown that annual rainfall recorded in 2016 exceeded average annual rainfall and rainfall from January to April 2017 exceeds mean annual rainfall.
Area disturbance	Minor constraint	The survey area has been subject to disturbance from pastoral land use and fire.

Variable	Potential Impact on Survey	Details
Survey Effort/ Extent	Not a constraint	Survey intensity was high with a Level 2 quadrat based survey conducted over two survey periods and different seasons. Prior to the quadrats being established a reconnaissance of the survey area was conducted in order to identify vegetation communities and any Flora of Conservation Significance.
Availability of contextual information at a regional and local scale	Not a constraint	Threatened flora database searches provided by the DPaW were used to identify any potential locations of Threatened/Priority Flora species. BoM, DoW, DAFWA, DPaW and DotEE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Environmental assessments within the local region have been limited however BC was able to obtain information about the area from previous flora assessments conducted within the Great Victoria Desert region and reconnaissance surveys conducted by BC which provided context on the local environment.
Data Analysis	Minor constraint	BC staff conducting the PATN statistical analyses are not statistical analysts and have basic statistics training. These analyses are used to provide basic information on the relationships between vegetation communities delineated in the field.
Completeness	Not a constraint	In the opinion of BC, the survey area was covered sufficiently in order to identify vegetation assemblages. Survey work was conducted in multiple seasons (Autumn and Spring) across multiple years (2016 and 2017). Many of the plants during the survey were in flower and many annual species were present. It is estimated that approximately 95% of the flora within the survey area were able to be fully identified. The vegetation types for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities outside the study area is not known, however vegetation types identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS Major Vegetation Groups (DotEE, 2017b).

4 Results

4.1 Desktop Assessment

4.1.1 Literature Review

Flora and vegetation surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and could not be referenced. The most significant of those available have been used as the primary reference material for the current vegetation assessment (Table 7).

Table 7: Previous Flora and Vegetation Surveys within the Lake Wells Potash Project and surrounding area

Survey/ Author/ Year	Vegetation/Landforms	Flora of Conservation Significance
<p>An inventory and condition survey of the north-eastern Goldfields Western Australia. (Department of Agriculture and Food WA, 2004)</p>	<p>Perennial grasses were common throughout the survey area, divided into two major groups; Wanderrie bunch grasses and Spinifex hummock grasses. <i>Eragrostis eriopoda</i> (woolly butt) being the most widespread and abundant of the Wanderrie grasses with <i>Triodia basedowii</i> (hard spinifex) being the most abundant of the hummock grasses. <i>Triodia basedowii</i> often occurs as vast expanses in the east of the survey area. Tall shrubs are the most dominant stratum on most of the hardpan plains and adjacent uplands. The most widely distributed and common tall shrubs are from the genera <i>Acacia</i> and <i>Eremophila</i>. <i>Acacia</i> tall shrublands on hardpan plains are generally dominated by a single species; <i>Acacia aneura</i> (mulga). Other common <i>Acacias</i> which are occasionally dominant are; <i>A. craspedocarpa</i>, <i>A. linophylla</i>, <i>A. ramulosa</i> and <i>A. tetragonophylla</i>. On stony plains, <i>Eremophila macmillaniana</i>, <i>E. fraseri</i> and <i>E. platycalyx</i> are common or dominant tall shrubs.</p> <p>There are three common groups of mallee (multi-stemmed eucalypts). The first group is found in spinifex sandplains and is most widely represented by <i>Eucalyptus youngiana</i> and <i>E. kingsmillii</i>. The second group of mallee is found on sandy soils over calcareous pans in the south of the survey area. The most common species are <i>E. trichopoda</i> and <i>E. concinna</i>. The third group, which includes <i>E. salubris</i> var. <i>salubris</i>, is found low in the landscape on heavier textured soils in association with <i>Atriplex vesicaria</i>.</p> <p>The most common trees in the survey area are <i>Acacias</i>, <i>Eucalypts</i> and <i>Casuarina cristata</i>. <i>Acacia</i> woodland occurs in broad plains with deep sandy loams or loamy sands over hardpan, most extensively in the south of the survey area. Similar land surfaces further north are dominated more frequently by wanderrie grasses and the tall shrub form of <i>A. aneura</i>. In the north and east of the survey area, <i>Eucalyptus gongylocarpa</i> is common in extensive spinifex hummock grasslands on sandplains and on the sides of sand ridges.</p>	<p>N/A</p>
<p>The Biological survey of the Eastern Goldfields of Western Australia Part 7: Sandstone-Sir Samuel. Laverton-Leonora study area. (Hall, N.J., Newbey, K.R., McKenzie, N.L., Keighery, G.J., Rolfe, J.K & Youngson, W. K., 1993)</p>	<p>The Sandstone-Sir Samuel and Laverton-Leonora Study Areas are adjacent, and have a similar climate, geomorphology and biota. Ten landform units are recognized in these Study Areas. The most extensive are Sandplains and Broad Valleys. Salt Lake Features, Calcareous Plains bordering salt lakes, and Undulating Plains are prominent in both Study Areas. Small areas of Dunefields, Breakaways and Granite Exposures are scattered throughout the Study Areas while Hills and Drainage Lines occur largely within Undulating Plains. The main vegetation groups are low woodlands of <i>Acacia aneura</i> (Mulga). <i>Eucalyptus</i> species with an understorey of hummock grasses (<i>Triodia</i>) are dominant on deep sands. Tall and low shrublands occur in limited areas, generally in association with salt lakes and dunes.</p>	<p>N/A</p>

Survey/ Author/ Year	Vegetation/Landforms	Flora of Conservation Significance
	<p>The known vascular flora comprises 7 species of ferns and 777 taxa of flowering plants, including 303 taxa recorded from Wanjarri Nature Reserve. No species of Threatened Flora were recorded within the Study Areas.</p>	
<p>Tropicana Gold Project Public Environmental Review. (Tropicana Joint Venture (TJV)-Anglo Gold Ashanti Australia and Independence Group NL). 2009)</p>	<p>Sixteen major vegetation communities were identified within the 131,367ha operational area;</p> <ol style="list-style-type: none"> 1. Mixed Eucalypt woodland over mixed open shrubs and <i>Triodia basedowii</i>; 2. Isolated <i>Acacia</i> spp. over open low shrubs and moderately dense tussock grasslands; 3. Minor clay pan: Scattered <i>Acacia nyssophylla</i>/<i>Grevillea sarissa</i> over open herbs and grasses; 4. Dunes: Scattered <i>Eucalyptus gongylocarpa</i> over mixed shrubs and <i>Triodia desertorum</i> or <i>T. basedowii</i>; 5. <i>Acacia aneura</i> woodland over grasses ± <i>Triodia basedowii</i>; 6. Open to moderately dense <i>A. aneura</i> over <i>Aluta maisonneuvei</i> subsp. <i>articulata</i>/<i>Acacia ramulosa</i> var. <i>ramulosa</i> over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> over <i>Triodia basedowii</i>; 7. <i>E. gongylocarpa</i>/<i>E. youngiana</i>/<i>E. concinna</i> over open mixed shrubland over <i>Triodia desertorum</i>; 8. Open to moderately dense <i>Casuarina pauper</i> woodland over open mixed shrubs and scattered soft grasses and/or <i>Triodia scariosa</i>; 9. Narrow drainage channel: Sparse <i>Acacia aneura</i> over sparse to open shrubs and moderately dense tussock grasses; 10. Rock breakaways and associated slopes: Open <i>Acacia quadrimarginea</i>/<i>Dodonaea rigida</i> over sparse mixed shrubs over mixed soft grasses; 11. <i>E. gongylocarpa</i> over open shrubland over open <i>Dodonaea viscosa</i> subsp. <i>angustissima</i>/<i>Eremophila platythamnos</i> subsp. <i>platythamnos</i> shrubland over <i>Triodia desertorum</i> or <i>T. basedowii</i>; 12. White to grey brown clay pans: Dwarf halophytic shrublands of variable composition over sparse to dense herbs and grasses; 13. Pale orange to orange clay pans: Low open to sparse scrub dominated by <i>Frankenia cinerea</i>/<i>Atriplex vesicaria</i> over sparse cover of <i>Eragrostis pergracilis</i>/<i>Aristida contorta</i>; 14. Shallow depressions and areas fringing some clay pans: Moderately dense <i>Melaleuca interioris</i> shrubland over sparse chenopods and soft grasses; 15. Plains and gentle hill slopes at margins of saline complex: Sparse to open <i>Casuarina pauper</i> ± mallee Eucalypts over <i>Dodonaea viscosa</i> subsp. <i>angustissima</i>/<i>Senna artemisioides</i> subsp. <i>petiolaris</i> over Chenopod species and soft grasses; and 16. Open mallee <i>E. concinna</i> over sparse to open low shrubs over open <i>Triodia scariosa</i>. 	<p>Priority Flora taxa as listed by the DPaW were identified within the area:</p> <ol style="list-style-type: none"> 1. <i>Baeckea</i> sp. Great Victoria Desert (A.S. Weston 14813) (No longer Priority listed); 2. <i>Baeckea</i> sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963) P3; 3. <i>Dampiera eriantha</i> P1; 4. <i>Dicrasyllis nicholasii</i> P4; 5. <i>Malleostemon</i> sp. Officer Basin (D. Pearson 350) P2; 6. <i>Olearia arida</i> P4; 7. <i>Grevillea secunda</i> P4; 8. <i>Acacia eremophila</i> numerous-nerved variant (A.S. George 11924) P3; 9. <i>Acacia eremophila</i> var. <i>variabilis</i> P3; 10. <i>Dicrasyllis cundeeleensis</i> P4; 11. <i>Microcorys macedieana</i> (No longer Priority listed); 12. <i>Micromyrtus stenocalyx</i> (No longer Priority listed); 13. <i>Daviesia purpurascens</i> (No longer Priority listed); and 14. <i>Lepidobolus deserti</i> (No longer Priority listed).
<p>Level 1 Flora and Vegetation Survey,</p>	<p>One hundred and four vegetation communities were identified within the Sunrise Dam to Tropicana survey area. These communities comprised of six landform types. These</p>	<p>Seven Priority Flora taxa, as listed by the DPaW were identified within</p>

Survey/ Author/ Year	Vegetation/Landforms	Flora of Conservation Significance
Sunrise Dam Gold Mine to Tropicana Gold Mine Gas Pipeline (BC 2014a)	<p>vegetation communities were represented by a total of 43 Families, 114 Genera and 281 Taxa.</p> <ol style="list-style-type: none"> 1. Breakaway: Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands 2. Clay-Loam Plains: Acacia Forests and Woodlands, Acacia Shrublands, Mallee Open Woodlands and Shrublands, Acacia Open Woodlands, Casuarina Forests and Woodlands, Chenopod shrublands, samphire shrublands and forblands, Eucalypt Woodlands, Mallee Woodlands and Shrublands 3. Closed Depression: Acacia Forests and Woodlands, Acacia Shrublands, Other Shrublands 4. Dunes: Eucalypt Woodlands, Mallee Woodlands and Shrublands, Other Shrublands 5. Interdune Swales and Sandplain: Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Eucalypt Open Woodlands, Heathlands, Regrowth, modified native vegetation, 6. Rocky Hillslopes: Acacia Forests and Woodlands, Casuarina Forests and Woodlands 	<p>the survey area:</p> <ol style="list-style-type: none"> 1. <i>Acacia eremophila</i> numerous-nerved variant (A.S. George 11924) (P3); 2. <i>Caesia talingka</i> (P2); 3. <i>Dicrastylis cundeeleensis</i> (P4); 4. <i>Grevillea secunda</i> (P4); 5. <i>Labichea eremaea</i> (P3); 6. <i>Melaleuca apostiba</i> (P3); and 7. <i>Olearia arida</i> (P4).
Level 1 Flora and Vegetation Survey, Miningwal Borefields. (BC 2014b)	<p>Twenty vegetation communities were identified within the survey area. These communities comprised of five landform types and five NVIS broad vegetation groups. These vegetation communities were represented by a total of 35 Families, 91 Genera and 168 Taxa (including sub-species and variants).</p> <ol style="list-style-type: none"> 1. Clay-Loam Plains: Acacia Forest and Woodlands, Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands 2. Dunes: Eucalypt Woodlands 3. Interdune Swales and Sandplain: Eucalypt Woodland, Mallee Woodland and Shrubland 4. Rocky Hillslope: Acacia Forest and Woodlands <p>Closed Depression: Mallee Woodlands and Shrublands</p>	<p>Two Priority Flora taxa, as listed by the DPaW and one plant of conservation significance were identified within the survey area:</p> <ol style="list-style-type: none"> 1. <i>Conospermum toddii</i> (P4); 2. <i>Olearia arida</i> (P4); and 3. <i>Lawrencia</i> aff. <i>cinerea</i> (Species of conservation significance)
Vascular Flora of the Peterswald Hill area, Great Victoria Desert (N Gibson, EM Sandiford and M Langley 2015)	<p>Four major physiographic units were recognised; rocky uplands, sand dunes and sand plains, lateritic plain overlain in part by aeolian sand or valley fill and depressions representing relictual drainage systems.</p> <p>A total of 454 collections were made of 334 taxa representing 87.7% of taxa encountered. Of the 381 taxa recorded in the current survey 70 (18.4%) were new records for the Great Victoria Desert based on FloraBase records. Five taxa were collected that could not be assigned to currently described species, two of these appear to have been collected for the first time (<i>Sclerolaena</i> sp. (NG & EMS 7530), <i>Sida</i> sp. (NG & EMS 7618)). A number of significant range extensions were recorded the largest was over 500 km (<i>Aenictophyton anomalum</i>). Given the access limitations and the diversity recorded in other areas where detailed floristic studies have been undertaken in the Great Victoria Desert the results of this survey should be considered preliminary.</p>	

Survey/ Author/ Year	Vegetation/Landforms	Flora of Conservation Significance
<p>Level 1 Flora & Vegetation Survey Lake Wells. (BC 2015a)</p>	<p>Eleven vegetation communities were identified within the survey area. These communities comprised of eight landform types and five NVIS broad vegetation groups. These vegetation communities were represented by a total of 22 Families, 40 Genera and 87 Taxa (including sub-species and variants).</p> <ol style="list-style-type: none"> 1. Closed Depression: Chenopod Shrublands, Samphire Shrublands and Forblands 2. Clay-Loam Plains: Acacia Forest and Woodlands, Mallee Woodlands and Shrublands 3. Drainage Depression: Acacia Forest and Woodlands 4. Rocky Hillslope: Acacia Forest and Woodlands 5. Quartz/ Rocky Plain: Acacia Forest and Woodlands 6. Dune: Acacia Forest and Woodlands, Casuarina Forest and Woodlands 7. Sand-Loam Plain: Acacia Forest and Woodlands 8. Sandplain: Eucalypt Woodlands, Mallee Woodlands and Shrublands 	<p>Seven Priority Flora taxa, as listed by the DPaW were identified within the survey area:</p> <ol style="list-style-type: none"> 1. <i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662) (P1); 2. <i>Eleocharis papillosa</i> (P3); 3. <i>Elatine macrocalyx</i> (P3); 4. <i>Frankenia glomerata</i> (P3) 5. <i>Goodenia lyrata</i> (P3) 6. <i>Melaleuca apostiba</i> (P3); and 7. <i>Eremophila shonae</i> subsp. <i>diffusa</i> (P3)
<p>Level 2 Flora & Vegetation Survey Gruyere Project (BC, 2015b)</p>	<p>Thirty-two broad vegetation communities were identified within the survey area. These communities were represented by a total 44 Families, 104 Genera and 240 Taxa (including sub-species and variants).</p> <ol style="list-style-type: none"> 1. Breakaway: Acacia Shrublands 2. Clay-Loam Plains: Acacia Forest and Woodlands, Acacia Shrublands, Mallee Woodlands and Shrublands 3. Drainage Depression: Acacia Open Woodlands, Acacia Forest and Woodlands 4. Quartz/ Rocky Plain: Acacia Open Woodlands, Acacia Forest and Woodlands 5. Rocky Hillslope: Acacia Forests and Woodlands 6. Sand Dune: Eucalypt Woodlands, Mallee Woodlands and Shrublands 7. Sandplain: Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands 	<p>No flora of conservation significance</p>

4.1.2 Flora of Conservation Significance

The results of the combined search of the DPaW's Flora of Conservation Significance databases and DotEE protected matters search recorded a total of 37 Priority Flora taxa within the local region. These taxa were assessed and ranked for their likelihood of occurrence within the survey area (Table 8).

Table 8: Likelihood of occurrence for Flora of Conservation Significance within the survey area

Taxon	Conservation Code	Description (WAHERB, 2017)	Likelihood of Occurrence
<i>Eremophila anomala</i>	P1	Shrub. Fl. white, Aug to Sep. Basalt outcrop.	Unlikely
<i>Eucalyptus semota</i>	P1	(Mallee) or tree, 2-9 m high, bark rough & peeling on trunk, smooth above. Clay. Quartz outcrops.	Unlikely
<i>Hibiscus</i> sp. Carnarvon (S. van Leeuwen 5110)	P1	No description available.	Possible
<i>Hibiscus</i> sp. Wonganoo Station (K. Boladeras 125)	P1	No description available.	Possible
<i>Minuria</i> sp. Little Sandy Desert (S. van Leeuwen 4919)	P1	No description available.	Possible
<i>Ptilotus tetrandrus</i>	P1	Annual, herb, 0.15-0.3 m high. Fl. Oct. Loamy sand.	Possible
<i>Samolus</i> sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	P1	No description available.	Possible
<i>Tecticornia bibenda</i>	P1	Erect or spreading shrub, 0.5-1.2 m high. Fl. Aug to Oct. Red-brown saline sand with some clay over calcrete and gypsum. Near the edges of gypsiferous playas and salt lakes on flat to gently undulating terrain.	Possible
<i>Tecticornia mellarium</i>	P1	Erect, perennial shrub, 0.2-0.4 m high. Well-drained red gypseous sand, clay. Gypseous dunes, margins of playa lakes, on clay pans.	Possible
<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	P1	No description available.	Possible
<i>Tecticornia</i> sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830)	P1	No description available.	Possible
<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd et al. KS 867)	P1	No description available.	Possible
<i>Calytrix warburtonensis</i>	P2	Shrub, 0.3-0.6 m high. Fl. white, Mar or Sep to Oct. Rocky hills, breakaways.	Unlikely
<i>Eremophila undulata</i>	P2	Small shrub, to 0.5 m high, 1 m wide. Fl. green-brown/yellow-green, Jul to Sep. Red-brown clay loam, sand.	Possible

Taxon	Conservation Code	Description (WAHERB, 2017)	Likelihood of Occurrence
<i>Acacia eremophila</i> var. Numerous-nerved variant (A.S. George 11924)	P3	Dense, spreading shrub, 1-2 m high. Fl. yellow, Sep. Sandy soils. Flats.	Possible
<i>Bossiaea eremaea</i>	P3	Divaricately-branched, spreading shrub, to 1.2 m high. Fl. red-yellow-purple-brown, Jul to Sep. Deep red sand.	Possible
<i>Calytrix praecipua</i>	P3	Shrub, 0.3-0.7 m high. Fl. pink-white, Jun to Jul or Sep to Nov. Skeletal sandy soils over granite or laterite. Breakaways, outcrops.	Unlikely
<i>Comesperma pallidum</i>	P3	Erect shrub, 0.7-2 m high. Fl. yellow/cream & purple, May to Aug. Red sand. Sandplains & dunes.	Possible
<i>Daviesia arthropoda</i>	P3	Spiny, bushy shrub, to 1 m high. Fl. yellow-brown. Dunes.	Possible
<i>Eremophila campanulata</i>	P3	Low shrub, ca 0.3 m high, 0.4 m wide. Fl. purple-red, Sep. Stony red/brown clay.	Possible
<i>Eremophila gracillima</i>	P3	Low flat shrub, ca 0.3 m high, 1.2 m wide. Fl. blue, Sep. Stony flats.	Possible
<i>Eremophila shonae</i> subsp. <i>diffusa</i>	P3	Erect, open, straggly shrub, ca 0.4 m high. Fl. purple, Aug to Oct. Stony yellow or red sandy soils.	Possible
<i>Fimbristylis sieberiana</i>	P3	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25-0.6 m high. Fl. brown, May to Jun. Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	Unlikely
<i>Gonocarpus pycnostachyus</i>	P3	Erect annual, herb, 0.1-0.15 m high. Fl. green-red. Sand or clay soils. Wet depressions, granite rocks.	Unlikely
<i>Goodenia modesta</i>	P3	Herb, to 0.5 m high. Fl. yellow, probably Jan to Dec. Red loam, sand.	Possible
<i>Gunniopsis propinqua</i>	P3	Prostrate annual or perennial, herb, 0.03-0.1 m high. Fl. white/pink, Aug to Sep. Stony sandy loam. Lateritic outcrops, winter-wet sites.	Unlikely
<i>Homalocalyx echinulatus</i>	P3	Shrub, 0.45-1 m high. Fl. pink, Jun to Sep. Laterite. Breakaways, sandstone hills.	Unlikely
<i>Melaleuca apostiba</i>	P3	Spreading shrub, to 2 m high, with grey fissured bark and dull green leaves. Fl. red, Jun.	Possible
<i>Phyllanthus baeckeoides</i>	P3	Shrub, 0.5-1.5 m high. Fl. white-yellow/green-yellow, Jul to Sep. Red lateritic & sandy clay soils. Granite outcrops.	Unlikely
<i>Stackhousia clementii</i>	P3	Dense broom-like perennial, herb, to 0.45 m high. Fl. green/yellow/brown. Skeletal soils. Sandstone hills.	Unlikely
<i>Thryptomene nealensis</i>	P3	Shrub, ca 0.3 m high. Fl. pink, Oct. Lateritic breakaways	Unlikely

Taxon	Conservation Code	Description (WAHERB, 2017)	Likelihood of Occurrence
<i>Comesperma viscidulum</i>	P4	Shrub, to ca 0.7 m high.	Possible
<i>Eremophila pungens</i>	P4	Erect, viscid shrub, 0.5-1.5 m high. Fl. purple-violet, Jun to Aug. Sandy loam, clayey sand over laterite. Plains, ridges, breakaways.	Unlikely
<i>Frankenia glomerata</i>	P4	Prostrate shrub. Fl. pink-white, Nov. White sand.	Unlikely
<i>Grevillea inconspicua</i>	P4	Intricately branched, spreading shrub, 0.6-2 m high. Fl. white/pink-white, Jun to Aug. Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Possible
<i>Hemigenia exilis</i>	P4	Erect, multi-stemmed shrub, 0.5-2 m high. Fl. blue-purple/white, Apr or Sep to Nov. Laterite. Breakaways, slopes.	Unlikely
<i>Olearia arida</i>	P4	Erect shrub, to 0.4 m high. Fl. white, Jul to Sep. Red or yellow sand. Undulating low rises.	Possible

4.1.3 Field Assessment

4.2 Flora of conservation significance

Flora of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No Threatened Flora taxa pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area. Two Priority Flora taxa were identified within the survey area; *Lepidium xyloides* (P1) and *Melaleuca apostiba* (P3). A map showing the locations of these taxa identified within the survey area is provided in Figure 9.

4.2.1 *Lepidium xyloides* (P3)

This taxon is described as an erect shrub, which grows between 0.4-1.5 m high, with stems becoming spinescent (Plate 1). It produces white/cream flowers in August or November. It occurs on gravelly loam or clayey sand soils (WAHERB, 2017). The specimen of this plant was identified by taxonomic specialist Mike Hislop of the WAHERB. One location of this taxon was recorded by BC within the survey area, within an estimated 500+ plants recorded at this location. There are currently only six DPaW listed locations of this taxon recorded on the DPaW database all of which occur within the Western Murchison subregion. The record of this taxon within the survey area is a range extension for this taxon. GPS locations of this taxon recorded within the survey area is provided in Appendix 4.



Plate 1: *Lepidium xyloides* (P1)

4.2.2 *Melaleuca apostiba* (P3)

This taxon is described as a spreading shrub, which grows to 2 m high, with grey fissured bark and dull green leaves (Plate 2). It produces red flowers in June (WAHERB, 2017). The specimen of this plant was identified by taxonomic specialist Mike Hislop of the WAHERB. Three locations of this taxon were recorded by BC within the survey area, and an additional location of this taxon was recorded approximately 650m north of the survey area (located approximately 1km east of a DPaW known location). An estimated 610+ plants were recorded within the survey area. GPS locations of this taxon recorded within the survey area is provided in Appendix 4.



Plate 2: *Melaleuca apostiba* (P3)

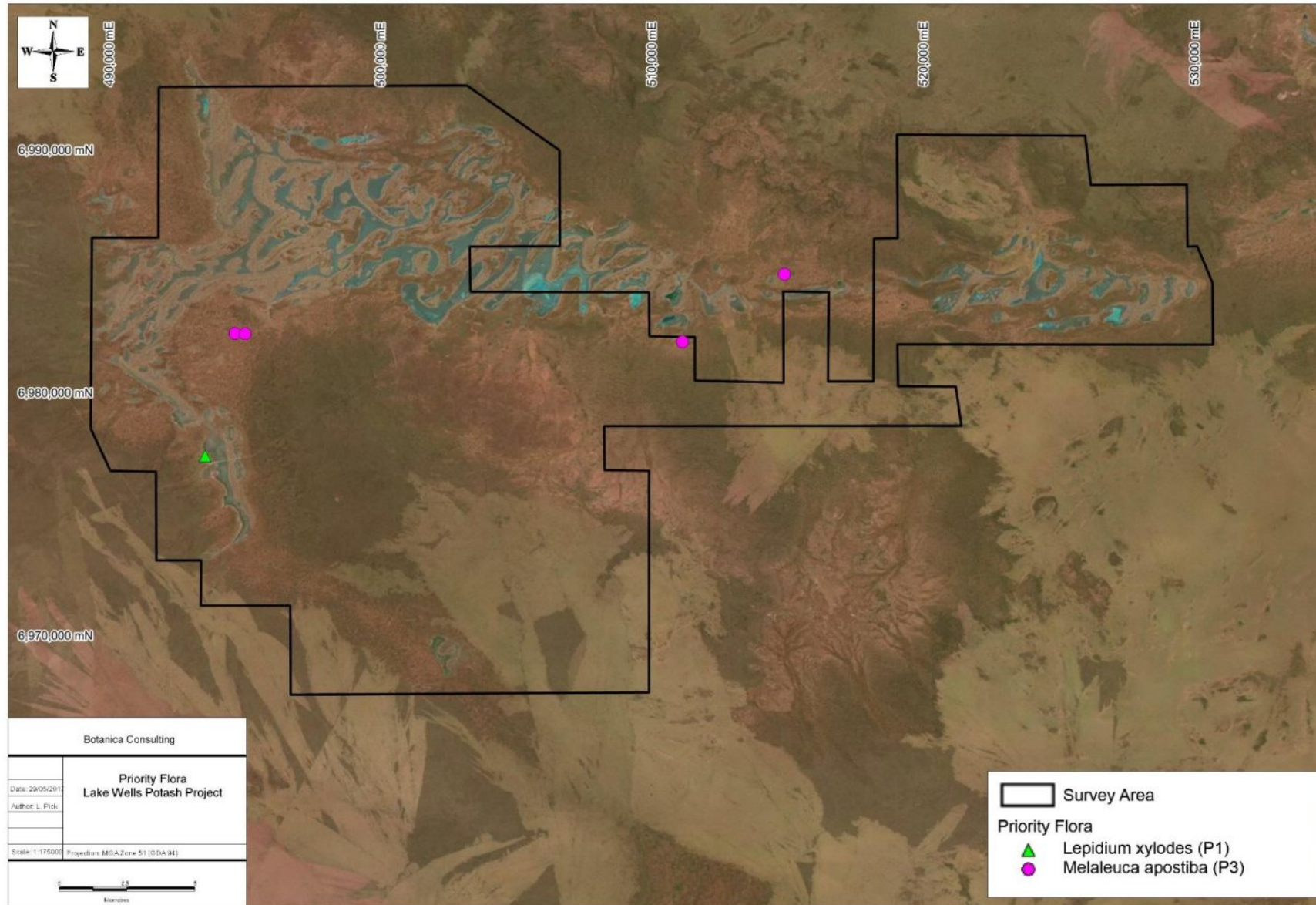


Figure 9: Flora of Conservation Significance identified within the Lake Wells Potash Project survey area

4.3 Vegetation Communities

Seventeen vegetation types were identified within the survey area. These vegetation types were located within nine different landform types and comprised of five major vegetation groups, which were represented by a total of 45 Families, 124 Genera and 278 Taxa (including 60 annual taxa) (Appendix 3). A map showing the vegetation types present in the survey area is located in Appendix 2 and a summary of vegetation types is presented in Table 9.

Table 9: Summary of vegetation types within the Lake Wells Potash Project survey area

Landform	NVIS Vegetation Group	Vegetation Code	Vegetation Type	Area (ha)	Area (%)
Closed Depression	Chenopod Shrublands, Samphire Shrublands and Forblands (MVG 22)	CD-CSSSF1	Low samphire shrubland of <i>Tecticornia indica</i> subsp. <i>bidens</i> / <i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa	4938	8.8
		CD-CSSSF2	Mid heathland of <i>Cratystylis subspinescens</i> over low open chenopod shrubland of <i>Atriplex vesicaria</i> and open forbland of <i>Frankenia</i> spp. on playa edge	3921	7.0
		CD-CSSSF3	Mid open shrubland of <i>Eremophila paisleyi</i> / <i>Lawrencia squamata</i> / <i>Lygium australis</i> over low open chenopod shrubland of <i>Atriplex</i> spp. and open forbland of <i>Frankenia</i> spp. on playa edge	2492	4.5
Clay-Loam Plain	Acacia Forests and Woodlands (MVG 6)	CLP-AFW1	Low open forest of <i>Acacia incurvaneura</i> over mid shrubland of <i>Eremophila margarethae</i> and low open tussock grassland of <i>Eriachne mucronata</i> / <i>Eragrostis eriopoda</i> on clay loam plain	6113	10.9
	Acacia Forests and Woodlands (MVG 6)	CLP-AFW2	Low woodland of <i>Acacia caesaneura</i> over mid open shrubland of <i>A. burkittii</i> and mid chenopod shrubland of <i>Maireana pyramidata</i> / low open hummock grassland of <i>Triodia desertorum</i> on clay loam plain	2072	3.7
Drainage Depression	Acacia Forests and Woodlands (MVG 6)	DD-AFW1	Low open forest of <i>Acacia caesaneura</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open tussock grassland of <i>Eragrostis eriopoda</i> in drainage depression	1538	2.8
Gypsum Dunefield	Casuarina Forests and Woodlands (MVG 8)	D-CFW1	Low open forest of <i>Casuarina pauper</i> over tall open shrubland of <i>Acacia burkittii</i> and low sparse chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	2930	5.2
	Mallee Woodlands and Shrublands (MVG 14)	D-MWS1	Mid open mallee forest of <i>Eucalyptus gypsophila</i> over mid open shrubland of <i>Senna artemisioides</i> / <i>Eremophila</i> spp. and low open chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	1381	2.5
Quartz/ Rocky Plain	Acacia Forests and Woodlands (MVG 6)	QRP-AFW1	Low open woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over mid open shrubland of <i>A. burkittii</i> / <i>Eremophila fraseri</i> and low open shrubland of <i>Ptilotus obovatus</i> / sparse tussock grassland of <i>Eragrostis eriopoda</i> on quartz/rocky plain	1730	3.1
	Casuarina Forests and Woodlands (MVG 8)	QRP-CFW1	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Eremophila paisleyi</i> subsp. <i>paisleyi</i> / <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on quartz/rocky plain	1320	2.4
Rocky Hillslope	Acacia Forests and Woodlands (MVG 6)	RH-AFW1	Low open forest of <i>Acacia quadrimarginea</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> / <i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and low open shrubland of <i>Ptilotus obovatus</i> on rocky hillslope	736	1.3
		RH-AFW2	Low woodland of <i>Acacia incurvaneura</i> over mid open shrubland of <i>Eremophila jucunda</i> and tussock grassland of <i>Eragrostis eriopoda</i> / <i>Eriachne mucronata</i> on rocky hillslope	788	1.4
Sand Dunefield	Acacia Forests and Woodlands (MVG 6)	SD-AFW1	Low woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over tall open shrubland of <i>Eremophila</i> spp./ <i>Senna</i> spp./ <i>Melaleuca interioris</i> and low open hummock grassland of <i>Triodia basedowii</i> / low open tussock grassland of <i>Eragrostis eriopoda</i> in dunefield	3205	5.7

Landform	NVIS Vegetation Group	Vegetation Code	Vegetation Type	Area (ha)	Area (%)
	Mallee Woodlands and Shrublands (MVG 14)	SD-MWS1	Mid mallee woodland of <i>Eucalyptus concinna</i> over low open shrubland of <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> / <i>Dodonaea viscosa</i> and low closed hummock grassland of <i>Triodia desertorum</i> in dunefield	1665	3.0
Sand-Loam Plain	Acacia Forests and Woodlands/ Mallee Woodlands and Shrublands (MVG 6/ 14)	SLP-AFW/MWS1	Low open forest of <i>Acacia caesaneura</i> / mid mallee woodland of <i>Eucalyptus lucasii</i> over mid open shrubland of <i>Eremophila latrobei</i> subsp. <i>glabra</i> and low hummock grassland of <i>Triodia desertorum</i> on sand-loam plain	4256	7.6
Sandplain	Eucalypt Woodlands (MVG 5)	SP-EW1	Low woodland of <i>Eucalyptus gongylocarpa</i> over mid open shrubland of <i>Eremophila platythamnus</i> subsp. <i>exotrachys</i> and low hummock grassland of <i>Triodia desertorum</i> on sandplain	5235	9.4
	Mallee Woodlands and Shrublands (MVG 14)	SP-MWS1	Mid mallee shrubland of <i>Eucalyptus</i> spp. over mid open shrubland of <i>Acacia</i> spp. and low closed hummock grassland of <i>Triodia basedowii</i> on sandplain	11580	20.7
Total				55,900	100

Closed Depression: Chenopod Shrublands, Samphire Shrublands and Forblands

4.3.1 Low samphire shrubland of *Tecticornia indica* subsp. *bidens*/ *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa (CD-CSSSF1)

The total flora recorded within this vegetation type was represented by a total of 11 Families, 13 Genera and 21 Taxa (Plate 3). No Threatened Flora taxa or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 10. According to the NVIS, this community is best represented by the MVG22- Chenopod Shrublands, Samphire Shrublands and Forblands (DotEE, 2017b).

Table 10: Vegetation assemblage for Low samphire shrubland of *Tecticornia indica* subsp. *bidens*/ *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa

Life Form/Height Class	Canopy Cover	Dominant Taxa
Samphire Shrub <0.5m	30-70%	<i>Tecticornia indica</i> subsp. <i>bidens</i> <i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS522)



Plate 3: Low samphire shrubland of *Tecticornia indica* subsp. *bidens*/ *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa

4.3.2 Mid heathland of *Cratystylis subspinescens* over low open chenopod shrubland of *Atriplex vesicaria* and open forbland of *Frankenia* spp. on playa edge (CD-CSSSF2)

The total flora recorded within this vegetation type was represented by a total of 16 Families, 25 Genera and 35 Taxa (Plate 4). No Threatened Flora taxa or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 11. According to the NVIS, this community is best represented by the MVG22- Chenopod Shrublands, Samphire Shrublands and Forblands (DotEE, 2017b).

Table 11: Vegetation assemblage for Mid heathland of *Cratystylis subspinescens* over low open chenopod shrubland of *Atriplex vesicaria* and open forbland of *Frankenia* spp. on playa edge

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub 1-2m	30-70%	<i>Tecticornia indica</i> subsp. <i>bidens</i> <i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS522)
Chenopod Shrub <1m	30-70%	<i>Atriplex vesicaria</i>
Forb <0.5m	10-30%	<i>Frankenia cinerea</i> <i>Frankenia pauciflora</i>



Plate 4: Mid heathland of *Cratystylis subspinescens* over low open chenopod shrubland of *Atriplex vesicaria* and open forbland of *Frankenia* spp. on playa edge

4.3.3 Mid open shrubland of *Eremophila paisleyi*/ *Lawrencia squamata*/ *Lycium australis* over low open chenopod shrubland of *Atriplex* spp. and open forbland of *Frankenia* spp. on playa edge (CD-CSSSF3)

The total flora recorded within this vegetation type was represented by a total of 16 Families, 24 Genera and 35 Taxa (Plate 5). No Threatened Flora taxa were identified within this community. One Priority Flora taxon was identified within this vegetation community; *Melaleuca apostiba* (P3). Dominant taxa from the vegetation assemblage are shown in Table 12. According to the NVIS, this community is best represented by the MVG22- Chenopod Shrublands, Samphire Shrublands and Forblands (DotEE, 2017b).

Table 12: Vegetation assemblage for Mid open shrubland of *Eremophila paisleyi*/ *Lawrencia squamata*/ *Lycium australis* over low open chenopod shrubland of *Atriplex* spp. and open forbland of *Frankenia* spp. on playa edge

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub 1-2m	10-30%	<i>Eremophila paisleyi</i> <i>Lawrencia squamata</i> <i>Lycium australis</i>
Chenopod Shrub <1m	30-70%	<i>Atriplex bunburyana</i> <i>Atriplex vesicaria</i>
Forb <0.5m	10-30%	<i>Frankenia cinerea</i> <i>Frankenia pauciflora</i>



Plate 5: Mid open shrubland of *Eremophila paisleyi*/ *Lawrencia squamata*/ *Lycium australis* over low open chenopod shrubland of *Atriplex* spp. and open forbland of *Frankenia* spp. on playa edge

Clay-Loam Plain: Acacia Forests and Woodlands

4.3.4 Low open forest of *Acacia incurvaneura* over mid shrubland of *Eremophila margarethae* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on clay loam plain (CLP-AFW1)

The total flora recorded within this vegetation type was represented by a total of 13 Families, 22 Genera and 34 Taxa (Plate 6). No Threatened Flora taxa or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 13. According to the NVIS, this community is best represented by the MVG6- Acacia Forests and Woodlands (DotEE, 2017b).

Table 13: Vegetation assemblage for Low open forest of *Acacia incurvaneura* over mid shrubland of *Eremophila margarethae* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on clay loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Acacia incurvaneura</i>
Shrub 1-2m	30-70%	<i>Eremophila margarethae</i>
Tussock Grass <0.5m	30-70%	<i>Eriachne mucronata</i> <i>Eragrostis eriopoda</i>



Plate 6: Low open forest of *Acacia incurvaneura* over mid shrubland of *Eremophila margarethae* and low open tussock grassland of *Eriachne mucronata/ Eragrostis eriopoda* on clay loam plain

4.3.5 Low woodland of *Acacia caesaneura* over mid open shrubland of *A. burkittii* and mid chenopod shrubland of *Maireana pyramidata* low open tussock grassland of *Eragrostis eriopoda* on clay loam plain (CLP-AFW2)

The total flora recorded within this vegetation type was represented by a total of 19 Families, 32 Genera and 60 Taxa (Plate 17). No Threatened Flora or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 14. According to the NVIS, this community is best represented by the MVG6- Acacia Forests and Woodlands (DotEE, 2017b).

Table 14: Vegetation assemblage for Low woodland of *Acacia caesaneura* over mid open shrubland of *A. burkittii* and mid chenopod shrubland of *Maireana pyramidata* low open tussock grassland of *Eragrostis eriopoda* on clay loam plain

Life Form/Height Class	Canopy Cover	Dominant species present
Tree <10m	10-30%	<i>Acacia caesaneura</i>
Shrub 1-2m	10-30%	<i>Acacia burkittii</i>
Chenopod Shrub 1-2m	30-70%	<i>Maireana pyramidata</i>
Tussock Grass <1m	10-30%	<i>Eragrostis eriopoda</i>



Plate 7: Low woodland of *Acacia caesaneura* over mid open shrubland of *A. burkittii* and mid chenopod shrubland of *Maireana pyramidata* low open tussock grassland of *Eragrostis eriopoda* on clay loam plain

Drainage Depression: Acacia Forests and Woodlands

4.3.6 Low open forest of *Acacia caesaneura* over mid open shrubland of *Senna artemisioides* subsp. *filifolia* and low open tussock grassland of *Eragrostis eriopoda* in drainage depression (DD-AFW1)

The total flora recorded within this vegetation type was represented by a total of 20 Families, 33 Genera and 47 Taxa (Plate 8). No Threatened Flora taxa or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 15. According to the NVIS, this community is best represented by the MVG6- Acacia Forests and Woodlands (DotEE, 2017b).

Table 15: Vegetation assemblage for Low open forest of *Acacia caesaneura* over mid open shrubland of *Senna artemisioides* subsp. *filifolia* and low open tussock grassland of *Eragrostis eriopoda* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Acacia caesaneura</i>
Shrub 1-2m	10-30%	<i>Senna artemisioides</i> subsp. <i>filifolia</i>
Tussock Grass <0.5m	10-30%	<i>Eragrostis eriopoda</i>



Plate 8: Low open forest of *Acacia caesaneura* over mid open shrubland of *Senna artemisioides* subsp. *filifolia* and low open tussock grassland of *Eragrostis eriopoda* in drainage depression

Gypsum Dunefield: Casuarina Forests and Woodlands

4.3.7 Low open forest of *Casuarina pauper* over tall open shrubland of *Acacia burkittii* and low sparse chenopod shrubland of *Atriplex vesicaria* on gypsum dune (D-CFW1)

The total flora recorded within this vegetation type was represented by a total of 14 Families, 25 Genera and 34 Taxa (Plate 9). No Threatened Flora or Priority Flora taxon were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 16. According to the NVIS, this community is best represented by the MVG8- Casuarina Forests and Woodlands (DotEE, 2017b).

Table 16: Vegetation assemblage for Low open forest of *Casuarina pauper* over tall open shrubland of *Acacia burkittii* and low sparse chenopod shrubland of *Atriplex vesicaria* on gypsum dune

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Casuarina pauper</i>
Shrub >2m	10-30%	<i>Acacia burkittii</i>
Chenopod Shrub <1m	5-10%	<i>Atriplex vesicaria</i>



Plate 9: Low open forest of *Casuarina pauper* over tall open shrubland of *Acacia burkittii* and low sparse chenopod shrubland of *Atriplex vesicaria* on gypsum dune

Gypsum Dunefield: Mallee Woodland and Shrublands

4.3.8 Mid open mallee forest of *Eucalyptus gypsophila* over mid open shrubland of *Senna artemisioides*/*Eremophila* spp. and low open chenopod shrubland of *Atriplex vesicaria* on gypsum dune (D-MWS1)

The total flora recorded within this vegetation type was represented by a total of 18 Families, 29 Genera and 40 Taxa (Plate 10). No Threatened Flora were identified within this community. One Priority Flora taxon was identified within this community; *Lepidium xylodes* (P1). Dominant taxa from the vegetation assemblage are shown in Table 17. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 17: Vegetation assemblage for Mid open mallee forest of *Eucalyptus gypsophila* over mid open shrubland of *Senna artemisioides*/*Eremophila* spp. and low open chenopod shrubland of *Atriplex vesicaria* on gypsum dune

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree Mallee 3-10m	30-70%	<i>Eucalyptus gypsophila</i>
Shrub 1-2m	10-30%	<i>Eremophila caperata</i> <i>Eremophila paisleyi</i> subsp. <i>paisleyi</i> <i>Senna artemisioides</i> subsp. <i>filifolia</i>
Chenopod Shrub <1m	10-30%	<i>Atriplex vesicaria</i>



Plate 10: Mid open mallee forest of *Eucalyptus gypsophila* over mid open shrubland of *Senna artemisioides*/*Eremophila* spp. and low open chenopod shrubland of *Atriplex vesicaria* on gypsum dune

Quartz/ Rocky Plain: Acacia Forests and Woodlands

4.3.9 Low open woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid open shrubland of *A. burkittii*/ *Eremophila fraseri* and low open shrubland of *Ptilotus obovatus*/ sparse tussock grassland of *Eragrostis eriopoda* on quartz/rocky plain (QRP-AFW1)

The total flora recorded within this vegetation type was represented by a total of 14 Families, 22 Genera and 41 Taxa (Plate 11). No Threatened Flora or Priority Flora taxon were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 18. According to the NVIS, this community is best represented by the MVG6-Acacia Forests and Woodlands (DotEE, 2017b).

Table 18: Vegetation assemblage for Low open woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid open shrubland of *A. burkittii*/ *Eremophila fraseri* and low open shrubland of *Ptilotus obovatus*/ sparse tussock grassland of *Eragrostis eriopoda* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	5-10%	<i>Acacia caesaneura</i> <i>Acacia incurvaneura</i>
Shrub 1-2m	10-30%	<i>Acacia burkittii</i> <i>Eremophila fraseri</i>
Shrub <1m	10-30%	<i>Ptilotus obovatus</i>
Tussock Grass <1m	5-10%	<i>Eragrostis eriopoda</i>



Plate 11: Low open woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid open shrubland of *A. burkittii*/ *Eremophila fraseri* and low open shrubland of *Ptilotus obovatus*/ sparse tussock grassland of *Eragrostis eriopoda* on quartz/rocky plain

Quartz/ Rocky Plain: Casuarina Forests and Woodlands

4.3.10 Low woodland of *Casuarina pauper* over mid shrubland of *Eremophila paisleyi* subsp. *paisleyi*/ *Senna artemisioides* subsp. *filifolia* and low open shrubland of *Ptilotus obovatus* on quartz/rocky plain (QRP-CFW1)

The total flora recorded within this vegetation type was represented by a total of 13 Families, 23 Genera and 42 Taxa (Plate 12). No Threatened Flora or Priority Flora taxon were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 19. According to the NVIS, this community is best represented by the MVG8-Casuarina Forests and Woodlands (DotEE, 2017b).

Table 19: Vegetation assemblage for Low woodland of *Casuarina pauper* over mid shrubland of *Eremophila paisleyi* subsp. *paisleyi*/ *Senna artemisioides* subsp. *filifolia* and low open shrubland of *Ptilotus obovatus* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	10-30%	<i>Casuarina pauper</i>
Shrub 1-2m	30-70%	<i>Eremophila paisleyi</i> subsp. <i>paisleyi</i> <i>Senna artemisioides</i> subsp. <i>filifolia</i>
Shrub <1m	10-30%	<i>Ptilotus obovatus</i>



Plate 12: Low woodland of *Casuarina pauper* over mid shrubland of *Eremophila paisleyi* subsp. *paisleyi*/ *Senna artemisioides* subsp. *filifolia* and low open shrubland of *Ptilotus obovatus* on quartz/rocky plain

Rocky Hillslope: Acacia Forests and Woodlands

4.3.11 Low open forest of *Acacia quadrimarginea* over mid open shrubland of *Senna artemisioides* subsp. *filifolia*/ *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on rocky hillslope (RH-AFW1)

The total flora recorded within this vegetation type was represented by a total of 22 Families, 33 Genera and 51 Taxa (Plate 13). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 20. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotEE, 2017b).

Table 20: Vegetation assemblage for Low open forest of *Acacia quadrimarginea* over mid open shrubland of *Senna artemisioides* subsp. *filifolia*/ *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on rocky hillslope

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Acacia quadrimarginea</i>
Shrub 1-2m	10-30%	<i>Senna artemisioides</i> subsp. <i>filifolia</i> <i>Senna</i> sp. Meekatharra (E. Bailey 1-26)
Shrub <1m	2-10%	<i>Ptilotus obovatus</i>



Plate 13: Low open forest of *Acacia quadrimarginea* over mid open shrubland of *Senna artemisioides* subsp. *filifolia*/ *Senna* sp. Meekatharra (E. Bailey 1-26) and low open shrubland of *Ptilotus obovatus* on rocky hillslope

4.3.12 Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila jucunda* and tussock grassland of *Eragrostis eriopoda*/ *Eriachne mucronata* on rocky hillslope (RH-AFW2)

The total flora recorded within this vegetation type was represented by a total of 19 Families, 24 Genera and 35 Taxa (Plate 14). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 21. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotEE, 2017b).

Table 21: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila jucunda* and tussock grassland of *Eragrostis eriopoda*/ *Eriachne mucronata* on rocky hillslope

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	10-30%	<i>Acacia incurvaneura</i>
Shrub 1-2m	10-30%	<i>Eremophila jucunda</i>
Tussock Grass <1m	30-70%	<i>Eragrostis eriopoda</i> <i>Eriachne mucronata</i>



Plate 14: Low woodland of *Acacia incurvaneura* over mid open shrubland of *Eremophila jucunda* and tussock grassland of *Eragrostis eriopoda*/ *Eriachne mucronata* on rocky hillslope

Sand Dunefield: Acacia Forests and Woodlands

4.3.13 Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over tall open shrubland of *Eremophila* spp./ *Senna* spp./ *Melaleuca interioris* and low open hummock grassland of *Triodia basedowii* low open tussock grassland of *Eragrostis eriopoda* in dunefield (SD-AFW1)

The total flora recorded within this vegetation type was represented by a total of 20 Families, 39 Genera and 61 Taxa (Plate 15). No Threatened Flora or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 22. According to the NVIS, this community is best represented by the MVG6- Acacia Forests and Woodlands (DotEE, 2017b).

Table 22: Vegetation assemblage for Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over tall open shrubland of *Eremophila* spp./ *Senna* spp./ *Melaleuca interioris* and low open hummock grassland of *Triodia basedowii* low open tussock grassland of *Eragrostis eriopoda* in dunefield

Life Form/Height Class	Canopy Cover	Dominant species present
Tree <10m	10-30%	<i>Acacia caesaneura</i> <i>Acacia incurvaneura</i>
Shrub 1-2m	10-30%	<i>Eremophila latrobei</i> subsp. <i>glabra</i> <i>Eremophila miniata</i> <i>Melaleuca interioris</i> <i>Senna artemisioides</i> subsp. <i>filifolia</i>
Tussock Grass <1m	10-30%	<i>Eragrostis eriopoda</i>
Hummock Grass <0.5m	10-30%	<i>Triodia basedowii</i>



Plate 15: Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over tall open shrubland of *Eremophila* spp./ *Senna* spp./ *Melaleuca interioris* and low open hummock grassland of *Triodia basedowii* low open tussock grassland of *Eragrostis eriopoda* in dunefield

Sand Dunefield: Mallee Woodlands and Shrublands

4.3.14 Mid mallee woodland of *Eucalyptus concinna* over low open shrubland of *Aluta maisonneuvei* subsp. *auriculata*/*Dodonaea viscosa* and low closed hummock grassland of *Triodia desertorum* in dunefield (SD-MWS1)

The total flora recorded within this vegetation type was represented by a total of 29 Families, 46 Genera and 68 Taxa (Plate 16). No Threatened Flora or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 23. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 23: Vegetation assemblage for Mid mallee woodland of *Eucalyptus concinna* over low open shrubland of *Aluta maisonneuvei* subsp. *auriculata*/*Dodonaea viscosa* and low closed hummock grassland of *Triodia desertorum* in dunefield

Life Form/Height Class	Canopy Cover	Dominant species present
Tree Mallee 3-10m	10-30%	<i>Eucalyptus concinna</i>
Shrub <1m	10-30%	<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> <i>Dodonaea viscosa</i>
Hummock Grass <0.5m	70-100%	<i>Triodia desertorum</i>



Plate 16: Mid mallee woodland of *Eucalyptus concinna* over low open shrubland of *Aluta maisonneuvei* subsp. *auriculata*/*Dodonaea viscosa* and low closed hummock grassland of *Triodia desertorum* in dunefield

Sand-Loam Plain: Acacia Forests and Woodlands/ Mallee Woodlands and Shrublands

4.3.15 Low open forest of *Acacia caesaneural* mid mallee woodland of *Eucalyptus lucasii* over mid open shrubland of *Eremophila latrobei* subsp. *glabra* and low hummock grassland of *Triodia desertorum* on sand-loam plain (SLP-AFW/MWS1)

The total flora recorded within this vegetation type was represented by a total of 13 Families, 22 Genera and 34 Taxa (Plate 17). No Threatened Flora taxa or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 24. According to the NVIS, this community is best represented by the MVG6- Acacia Forests and Woodlands/ MVG14- Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 24: Vegetation assemblage for Low open forest of *Acacia caesaneural* mid mallee woodland of *Eucalyptus lucasii* over mid open shrubland of *Eremophila latrobei* subsp. *glabra* and low hummock grassland of *Triodia desertorum* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Acacia caesaneural</i>
Tree Mallee 3-10m	30-70%	<i>Eucalyptus lucasii</i>
Shrub 1-2m	10-30%	<i>Eremophila latrobei</i> subsp. <i>glabra</i>
Hummock Grass <0.5m	70-100%	<i>Triodia desertorum</i>



Plate 17: Low open forest of *Acacia caesaneural* mid mallee woodland of *Eucalyptus lucasii* over mid open shrubland of *Eremophila latrobei* subsp. *glabra* and low hummock grassland of *Triodia desertorum* on sand-loam plain

Sandplain: Eucalypt Woodlands

4.3.16 Low woodland of *Eucalyptus gongylocarpa* over mid open shrubland of *Eremophila platythamnos* subsp. *exotrachys* and low hummock grassland of *Triodia desertorum* on sandplain (SP-EW1)

The total flora recorded within this vegetation type was represented by a total of 27 Families, 66 Genera and 117 Taxa (Plate 18). No Threatened Flora or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 25. According to the NVIS, this community is best represented by the MVG5- Eucalypt Woodlands (DotEE, 2017b).

Table 25: Vegetation assemblage for Low woodland of *Eucalyptus gongylocarpa* over mid open shrubland of *Eremophila platythamnos* subsp. *exotrachys* and low hummock grassland of *Triodia desertorum* on sandplain

Life Form/Height Class	Canopy Cover	Dominant species present
Tree <10m	10-30%	<i>Eucalyptus gongylocarpa</i>
Shrub 1-2m	10-30%	<i>Eremophila platythamnos</i> subsp. <i>exotrachys</i>
Hummock Grass <0.5m	30-70%	<i>Triodia desertorum</i>



Plate 18: Low woodland of *Eucalyptus gongylocarpa* over mid open shrubland of *Eremophila platythamnos* subsp. *exotrachys* and low hummock grassland of *Triodia desertorum* on sandplain

Sandplain: Mallee Woodlands and Shrublands

4.3.17 Mid mallee shrubland of *Eucalyptus* spp. over mid open shrubland of *Acacia* spp. and low closed hummock grassland of *Triodia basedowii* on sandplain (SP-MWS1)

The total flora recorded within this vegetation type was represented by a total of 23 Families, 44 Genera and 69 Taxa (Plate 19). No Threatened Flora or Priority Flora taxa were identified within this community. Dominant taxa from the vegetation assemblage are shown in Table 26. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 26: Vegetation assemblage for Mid mallee shrubland of *Eucalyptus* spp. over mid open shrubland of *Acacia* spp. and low closed hummock grassland of *Triodia basedowii* on sandplain

Life Form/Height Class	Canopy Cover	Dominant species present
Mallee shrub 3-10m	30-70%	<i>Eucalyptus eremicola</i> <i>Eucalyptus lucasii</i> <i>Eucalyptus trivalva</i> <i>Eucalyptus youngiana</i>
Shrub 1-2m	10-30%	<i>Acacia abrupta</i> <i>Acacia aptaneura</i> <i>Acacia desertorum</i> <i>Acacia ramulosa</i> var. <i>ramulosa</i>
Hummock Grass <0.5m	70-100%	<i>Triodia basedowii</i>



Plate 19: Mid mallee shrubland of *Eucalyptus* spp. over mid open shrubland of *Acacia* spp. and low closed hummock grassland of *Triodia basedowii* on sandplain

4.4 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 8), six vegetation types were rated as 'good' and the remaining eleven vegetation types had a vegetation condition rating of 'very good' (Table 27). A map of the vegetation condition within the survey area is provided in Figure 10.

'Good' condition depicts that vegetation has been impacted by more obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing (donkeys and camels) or slightly aggressive weeds.

'Very Good' condition depicts that vegetation has some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.

Table 27: Vegetation Condition Rating for Vegetation Types of the Lake Wells Potash Project survey area

Landform	NVIS Vegetation Group	Code	Vegetation Types	Condition Rating
Closed Depression	Chenopod Shrublands, Samphire Shrublands and Forblands (MVG 22)	CD-CSSSF1	Low samphire shrubland of <i>Tecticornia indica</i> subsp. <i>bidens</i> / <i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa	Good
		CD-CSSSF2	Mid heathland of <i>Cratystylis subspinescens</i> over low open chenopod shrubland of <i>Atriplex vesicaria</i> and open forbland of <i>Frankenia</i> spp. on playa edge	Very Good
		CD-CSSSF3	Mid open shrubland of <i>Eremophila paisleyi</i> / <i>Lawrenzia squamata</i> / <i>Lycium australis</i> over low open chenopod shrubland of <i>Atriplex</i> spp. and open forbland of <i>Frankenia</i> spp. on playa edge	Good
Clay-Loam Plain	Acacia Forests and Woodlands (MVG 6)	CLP-AFW1	Low open forest of <i>Acacia incurvaneura</i> over mid shrubland of <i>Eremophila margarethae</i> and low open tussock grassland of <i>Eriachne mucronata</i> / <i>Eragrostis eriopoda</i> on clay loam plain	Good
	Acacia Forests and Woodlands (MVG 6)	CLP-AFW2	Low woodland of <i>Acacia caesaneura</i> over mid open shrubland of <i>A. burkittii</i> and mid chenopod shrubland of <i>Maireana pyramidata</i> /low open hummock grassland of <i>Triodia desertorum</i> on clay loam plain	Good
Drainage Depression	Acacia Forests and Woodlands (MVG 6)	DD-AFW1	Low open forest of <i>Acacia caesaneura</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open tussock grassland of <i>Eragrostis eriopoda</i> in drainage depression	Good
Gypsum Dunefield	Casuarina Forests and Woodlands (MVG 8)	D-CFW1	Low open forest of <i>Casuarina pauper</i> over tall open shrubland of <i>Acacia burkittii</i> and low sparse chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	Very Good
	Mallee Woodlands and Shrublands (MVG 14)	D-MWS1	Mid open mallee forest of <i>Eucalyptus gypsophila</i> over mid open shrubland of <i>Senna artemisioides</i> / <i>Eremophila</i> spp. And low open chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	Very Good
Quartz/ Rocky Plain	Acacia Forests and Woodlands (MVG 6)	QRP-AFW1	Low open woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over mid open shrubland of <i>A. burkittii</i> / <i>Eremophila fraseri</i> and low open shrubland of <i>Ptilotus obovatus</i> / sparse tussock grassland of <i>Eragrostis eriopoda</i> on quartz/rocky plain	Very Good

Landform	NVIS Vegetation Group	Code	Vegetation Types	Condition Rating
	Casuarina Forests and Woodlands (MVG 8)	QRP-CFW1	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Eremophila paisleyi</i> subsp. <i>paisleyi</i> / <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on quartz/rocky plain	Very Good
Rocky Hillslope	Acacia Forests and Woodlands (MVG 6)	RH-AFW1	Low open forest of <i>Acacia quadrimarginea</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> / <i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and low open shrubland of <i>Ptilotus obovatus</i> on rocky hillslope	Very Good
		RH-AFW2	Low woodland of <i>Acacia incurvaneura</i> over mid open shrubland of <i>Eremophila jucunda</i> and tussock grassland of <i>Eragrostis eriopoda</i> / <i>Eriachne mucronata</i> on rocky hillslope	Very Good
Sand Dunefield	Acacia Forests and Woodlands (MVG 6)	SD-AFW1	Low woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over tall open shrubland of <i>Eremophila</i> spp./ <i>Senna</i> spp./ <i>Melaleuca interioris</i> and low open hummock grassland of <i>Triodia basedowii</i> / low open tussock grassland of <i>Eragrostis eriopoda</i> in dunefield	Very Good
	Mallee Woodlands and Shrublands (MVG 14)	SD-MWS1	Mid mallee woodland of <i>Eucalyptus concinna</i> over low open shrubland of <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> / <i>Dodonaea viscosa</i> and low closed hummock grassland of <i>Triodia desertorum</i> in dunefield	Very Good
Sand-Loam Plain	Acacia Forests and Woodlands/ Mallee Woodlands and Shrublands (MVG 6/ 14)	SLP-AFW/MWS1	Low open forest of <i>Acacia caesaneura</i> / mid mallee woodland of <i>Eucalyptus lucasii</i> over mid open shrubland of <i>Eremophila latrobei</i> subsp. <i>glabra</i> and low hummock grassland of <i>Triodia desertorum</i> on sand-loam plain	Good
Sandplain	Eucalypt Woodlands (MVG 5)	SP-EW1	Low woodland of <i>Eucalyptus gongylocarpa</i> over mid open shrubland of <i>Eremophila platythamnus</i> subsp. <i>exotrachys</i> and low hummock grassland of <i>Triodia desertorum</i> on sandplain	Very Good
	Mallee Woodlands and Shrublands (MVG 14)	SP-MWS1	Mid mallee shrubland of <i>Eucalyptus</i> spp. over mid open shrubland of <i>Acacia</i> spp. and low closed hummock grassland of <i>Triodia basedowii</i> on sandplain	Very Good

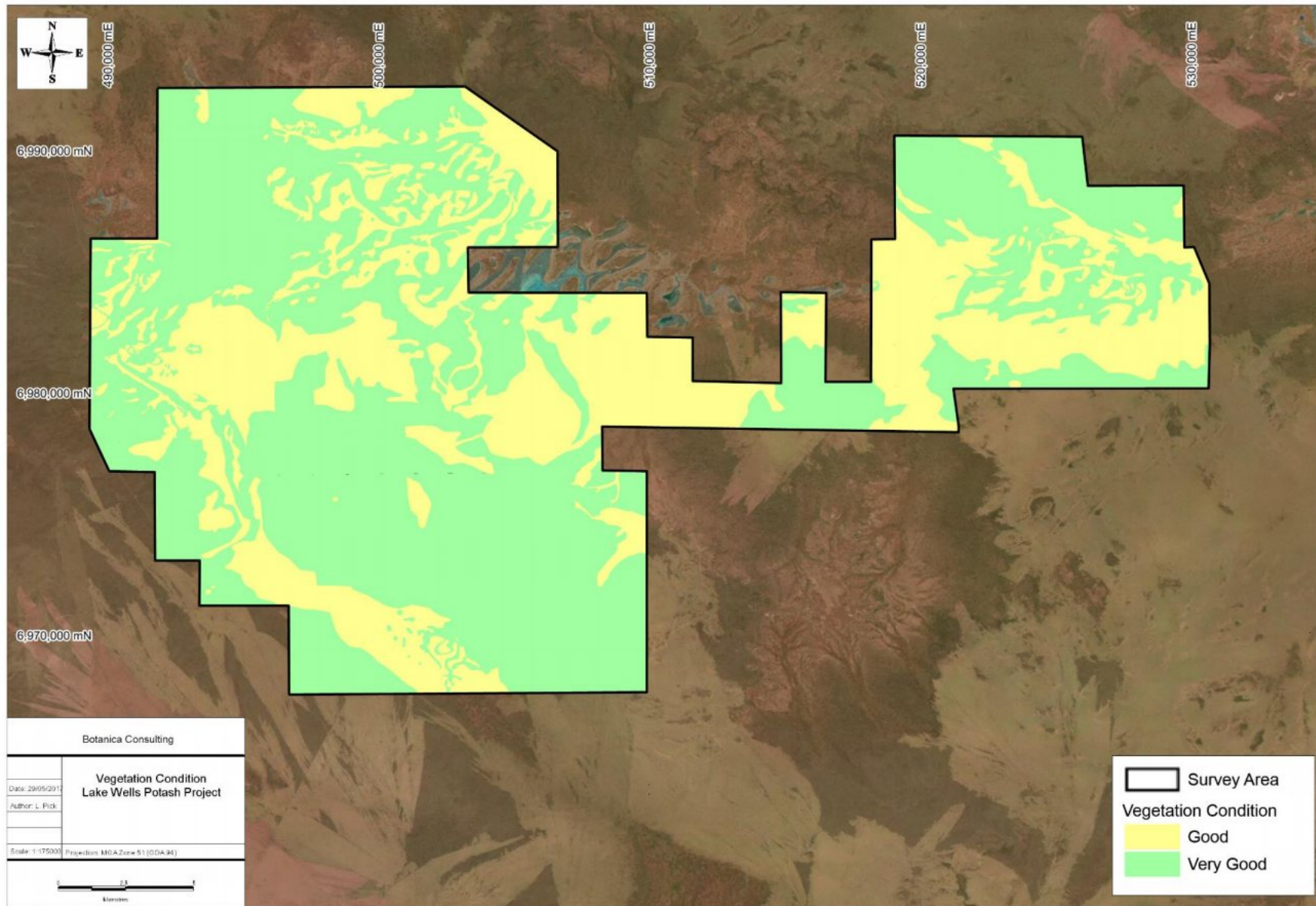


Figure 10: Vegetation Condition Rating of the Lake Wells Potash Project survey area

4.5 Introduced Plant Species

Five introduced species were identified within the survey area:

1. *Bidens bipinnata* (Spanish needles)
2. *Citrullus lanatus* (Pie Melon)
3. *Cucumis myriocarpus* (Prickly Paddy Melon)
4. *Sonchus oleraceus* (Common Sowthistle)
5. *Tribulus terrestris* (Caltrop)

According to the DAFWA none of these species are listed as a Declared Plant under Section 22 of the *BAM Act 2007*.

4.5.1 *Bidens bipinnata* (Spanish needles)

This species is described as an erect annual, herb, which grows between 0.1-0.9(-1.5) m high. It produces yellow flowers from March to September (Plate 20). It occurs on alluvium, clay, loam over sandstone and limestone, along rivers & creeks, coastal areas and rocky hillsides (WAHERB, 2017). *Cenchrus ciliaris* was identified within one vegetation type; DD-AFW1.



Plate 20: *Bidens bipinnata* (Spanish needles)

4.5.2 *Citrullus lanatus* (Pie Melon)

This taxon is described as a trailing annual, herb or climber. It produces yellow flowers from January to December (Plate 21). It occurs on sandy gravelly soil, loam and clay soils of plains, river banks, centers of dry lakes, drainage areas and disturbed areas (WAHERB, 2017). This taxon was identified in three vegetation types:

1. DD-AFW1;
2. CLP-AFW2; and
3. SP-MWS1



Plate 21: *Citrullus lanatus* (Pie Melon)

4.5.3 *Cucumis myriocarpus* (Prickly Paddy Melon)

This species is described as a prostrate, annual herb. It produces yellow flower from January to February, or April to May (Plate 22). It is found in disturbed areas (WAHERB, 2017). This taxon was identified in one vegetation type; CD-CSSSF1.



Plate 22: *Cucumis myriocarpus* (Prickly Paddy Melon)

4.5.4 *Sonchus oleraceus* (Common Sowthistle)

This species is described as an erect annual, herbaceous plant which grows up to 1.5 m high (Plate 23). It produces yellow flowers from January to December and occurs on a variety of soils. It is commonly a weed of waste places and disturbed ground (WAHERB, 2017). This taxon was identified within one vegetation type; CD-CSSSF1.



Plate 23: *Sonchus oleraceus* (Common Sowthistle)

4.5.5 *Tribulus terrestris* (Caltrop)

This species is described as a prostrate annual, herbaceous plant which produces yellow flowers from January to December (Plate 24). It often occurs on sandy soils in waste places (WAHERB, 2017). This taxon was identified within one vegetation type; DD-AFW1.



Plate 24: *Tribulus terrestris* (Caltrop)

4.6 Floristic Composition of the Lake Wells Potash Project Quadrats

This analysis was used to determine the similarities or differences between vegetation types. Appendix 8 provides the dendrogram and ordination graph for all generated from the PATN statistical analysis. A list of the 100 quadrats and their respective vegetation communities are provided in Table 28 below. The PATN analysis produced a stress value of 0.2263.

Table 28: Vegetation types with corresponding quadrats

Landform	NVIS Vegetation Group	Code	Vegetation Community	Quadrats
Closed Depression	Chenopod Shrublands, Samphire Shrublands and Forblands (MVG 22)	CD-CSSSF1	Low samphire shrubland of <i>Tecticornia indica</i> subsp. <i>bidens</i> / <i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS522) in playa	Q10, Q14, Q24, Q33, Q37, Q49, Q56, Q59, Q79, Q96
		CD-CSSSF2	Mid heathland of <i>Cratystylis subspinescens</i> over low open chenopod shrubland of <i>Atriplex vesicaria</i> and open forbland of <i>Frankenia</i> spp. on playa edge	Q15, Q27, Q51
		CD-CSSSF3	Mid open shrubland of <i>Eremophila paisleyi</i> / <i>Lawrenzia squamata</i> / <i>Lycium australis</i> over low open chenopod shrubland of <i>Atriplex</i> spp. and open forbland of <i>Frankenia</i> spp. on playa edge	Q8, Q46, Q61
Clay-Loam Plain	Acacia Forests and Woodlands (MVG 6)	CLP-AFW1	Low open forest of <i>Acacia incurvaneura</i> over mid shrubland of <i>Eremophila margarethae</i> and low open tussock grassland of <i>Eriachne mucronata</i> / <i>Eragrostis eriopoda</i> on clay loam plain	Q22, Q25, Q28, Q48, Q53, Q84, Q92

Landform	NVIS Vegetation Group	Code	Vegetation Community	Quadrats
	Acacia Forests and Woodlands (MVG 6)	CLP-AFW2	Low woodland of <i>Acacia caesaneura</i> over mid open shrubland of <i>A. burkittii</i> and mid chenopod shrubland of <i>Maireana pyramidata</i> / low open hummock grassland of <i>Triodia desertorum</i> on clay loam plain	Q18, Q26, Q72, Q77
Drainage Depression	Acacia Forests and Woodlands (MVG 6)	DD-AFW1	Low open forest of <i>Acacia caesaneura</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open tussock grassland of <i>Eragrostis eriopoda</i> in drainage depression	Q65, Q68, Q70
Gypsum Dunefield	Casuarina Forests and Woodlands (MVG 8)	D-CFW1	Low open forest of <i>Casuarina pauper</i> over tall open shrubland of <i>Acacia burkittii</i> and low sparse chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	Q3, Q6, Q19, Q35, Q50, Q58, Q95
	Mallee Woodlands and Shrublands (MVG 14)	D-MWS1	Mid open mallee forest of <i>Eucalyptus gypsophila</i> over mid open shrubland of <i>Senna artemisioides</i> / <i>Eremophila</i> spp. and low open chenopod shrubland of <i>Atriplex vesicaria</i> on gypsum dune	Q1, Q7, Q9, Q16, Q31, Q42
Quartz/ Rocky Plain	Acacia Forests and Woodlands (MVG 6)	QRP-AFW1	Low open woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over mid open shrubland of <i>A. burkittii</i> / <i>Eremophila fraseri</i> and low open shrubland of <i>Ptilotus obovatus</i> / sparse tussock grassland of <i>Eragrostis eriopoda</i> on quartz/rocky plain	Q4, Q45, Q67, Q69, Q83
	Casuarina Forests and Woodlands (MVG 8)	QRP-CFW1	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Eremophila paisleyi</i> subsp. <i>paisleyi</i> / <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on quartz/rocky plain	Q2, Q11, Q75, Q81, Q94
Rocky Hillslope	Acacia Forests and Woodlands (MVG 6)	RH-AFW1	Low open forest of <i>Acacia quadrimarginea</i> over mid open shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> / <i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and low open shrubland of <i>Ptilotus obovatus</i> on rocky hillslope	Q29, Q64, Q66, Q85, Q98, Q100
		RH-AFW2	Low woodland of <i>Acacia incurvaneura</i> over mid open shrubland of <i>Eremophila jucunda</i> and tussock grassland of <i>Eragrostis eriopoda</i> / <i>Eriachne mucronata</i> on rocky hillslope	Q82, Q86, Q97, Q99
Sand Dunefield	Acacia Forests and Woodlands (MVG 6)	SD-AFW1	Low woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over tall open shrubland of <i>Eremophila</i> spp./ <i>Senna</i> spp./ <i>Melaleuca interioris</i> and low open hummock grassland of <i>Triodia basedowii</i> / low open tussock grassland of <i>Eragrostis eriopoda</i> in dunefield	Q5, Q30, Q32, Q38, Q41, Q57, Q73, Q76, Q80
	Mallee Woodlands and Shrublands (MVG 14)	SD-MWS1	Mid mallee woodland of <i>Eucalyptus concinna</i> over low open shrubland of <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> / <i>Dodonaea viscosa</i> and low closed hummock grassland of <i>Triodia desertorum</i> in dunefield	Q34, Q36, Q60, Q74, Q78, Q88, Q93
Sand-Loam Plain	Acacia Forests and Woodlands/ Mallee Woodlands and Shrublands (MVG 6/ 14)	SLP-AFW/MWS1	Low open forest of <i>Acacia caesaneura</i> / mid mallee woodland of <i>Eucalyptus lucasii</i> over mid open shrubland of <i>Eremophila latrobei</i> subsp. <i>glabra</i> and low hummock grassland of <i>Triodia desertorum</i> on sand-loam plain	Q43, Q47, Q63, Q71
Sandplain	Eucalypt Woodlands (MVG 5)	SP-EW1	Low woodland of <i>Eucalyptus gongylocarpa</i> over mid open shrubland of <i>Eremophila platythamnos</i> subsp. <i>exotrachys</i> and low hummock grassland of <i>Triodia desertorum</i> on sandplain	Q13, Q44, Q52, Q62, Q87, Q90
	Mallee Woodlands and Shrublands (MVG 14)	SP-MWS1	Mid mallee shrubland of <i>Eucalyptus</i> spp. over mid open shrubland of <i>Acacia</i> spp. and low closed hummock grassland of <i>Triodia basedowii</i> on sandplain	Q12, Q17, Q20, Q21, Q23, Q39, Q40, Q54, Q55, Q89, Q91

Two 'supergroups' were identified in the PATN analysis:

1. Mixed group of all landforms (Acacia Forests and Woodlands, Eucalypt Woodlands, Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrubland);
2. Gypsum Dunefield (Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands) and Closed Depression (Samphire Shrubland).

The 'Mixed' super group was divided into twelve floristic groups, comprising of quadrats from each of the different landform types and major vegetation groups (excluding Samphire Shrubland). The first group comprised of all QRP-CFW1 quadrats and one of the D-MWS1 quadrats (Q1) and SD-MWS1 quadrats (Q60). All these quadrats included *Casuarina pauper* in the upper storey and comprised a similar composition of mid-storey species (most notably *Senna artemisioides* and *Scaevola spinescens*). The two remaining D-MWS1 quadrats (Q9 and Q16) in this super group were grouped together separately (Group 3). These quadrats were located within the same vegetation patch in the south-western region of the survey area (isolated from other gypsum dunes).

The second group comprised of two CLP-AFW2 quadrats and two CD-CSSSF3 quadrats. These quadrats comprised a similar understorey composition, most notably *Atriplex bunburyana*, *Maireana pyramidata* and *Solanum lasiophyllum*.

The fourth group included all three CD-CSSSF2 quadrats and the remaining CD-CSSSF3 quadrat (Q46). These two communities have a similar species composition (Chenopod species) yet were distinguished in the field as a result of differences in dominant upper storey.

Group 5 and 6 were large intermixed groups including a mix of Acacia Forests and Woodlands/ Mallee Woodlands and Shrublands quadrats from the Clay-Loam Plain, Drainage Depression, Quartz-Rocky Plain, Sand Dunes and Sandplain communities. The composition of both upper storey (*Acacia caesaneura* and *Acacia incurvaneura*) and mid-storey species (*Eremophila* spp.) between these communities was very similar, with delineation made in the field based on dominant stratum species and landform.

Group 7 included a single quadrat from the SP-MWS1 community (Q23). This group was however closely related to Group 8 (as shown on the dendrogram in Appendix 8). This quadrat had a low species diversity compared to nearby quadrats from this community (i.e. Q20 and Q21). Group 8 included two quadrats from SD-MWS1 and the remaining quadrat from SD-AFW1.

Group 9 comprised of all the Rocky Hillslopes quadrats (RH-AFW1 & RH-AFW2) and majority of QRP-AFW1 quadrats. This group was also intermixed with single quadrats from the DD-AFW1, CLP-AFW1 and SLP-AFW/MWS1 vegetation types. Despite differences in landform, dominant taxa and spatial distribution, these vegetation types consisted of a similar species composition in the upper/mid-storey species, most notably sharing the following common species; *Acacia incurvaneura* and *Eremophila latrobei*.

Groups 10 to 12 were closely related to one another (as shown in the dendrogram) including a mixture of quadrats from the Sandplain (SP-EW1 and SP-MWS1) and Sand Dunefield communities (SD-MWS1).

The 'Gypsum Dunefield and Closed Depression (Samphire Shrubland)' super group was divided into five floristic groups; the first group (Group 13) included all seven D-CFW1 quadrats and the remaining

three D-MWS1 quadrats. Groups 14 to 17 comprised only of quadrats from the CD-CSSSF1 community. As shown in the dendrogram (Appendix 8), these groups were closely related. Despite a similar overall vegetation structure (i.e. Samphire shrubland) evident in the field, species composition differed slightly for these quadrats, based on the presence/ absence of certain *Tecticornia* taxa. Quadrats of Group 14 were grouped together based on presence of a single *Tecticornia* taxon; *Tecticornia* sp. Dennys Crossing (K. A. Shepherd & J. English KS522). This taxon was also present in two other quadrats (Q79 and Q96) of Group 17, however quadrats within this group also included *Tecticornia pruinosa* and *T. undulata*. Group 15 quadrats also included a single *Tecticornia* taxon; *Tecticornia peltata*, which was not recorded within the other CD-CSSSF1 quadrats. Group 16, which included a single quadrat (Q56) also comprised of a single *Tecticornia* taxon; *Tecticornia laevigata*, which was not recorded in the other CD-CSSSF1 quadrats.

Based on the results of the PATN analysis, there was minimal heterogeneity in species composition across the survey area, with majority of vegetation types intermixed into floristic groups despite differences in both dominant stratum taxa and landform (i.e. no unique floristic communities identified); however, two distinct super groups were identified. The first supergroup comprised of a mix of vegetation types identified in the field including quadrats from all the landforms and major vegetation groups (excluding Samphire shrubland; CD-CSSSF1). Within this supergroup, the Eucalypt Woodlands were separated from the Acacia Forests and Woodlands, Chenopod Shrublands and Casuarina Forests and Woodlands.

The second group comprised quadrats from the Gypsum Dunefield and Closed Depression (Samphire Shrubland) communities. Within this group, the Mallee Woodlands and Shrublands & Casuarina Forests and Woodlands were separated from the Samphire Shrubland (CD-CSSSF1). Species composition of the Salt Lake vegetation (CD-CSSSF1) varied between the quadrats, however this variation appears to be due to the low species diversity of the Samphire vegetation rather than variation in spatial distribution across the lake (i.e. species composition of quadrats was similar, irrespective of the quadrat location on the playa).

4.6.1 Species Richness and accumulation estimates

The Chaos 2 richness estimator provided an estimated species richness of 188 species in 100 sample sites (quadrats). Species richness recorded for the 100 quadrats surveyed was 244 species (including annuals and singletons) which indicates survey intensity was adequate.

A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.97) suggests that the data “fits” the species accumulation curve shown in Figure 11. The rate of species accumulation for the first 15 quadrats ranged from nine to three species per quadrat. The rate of species accumulation between 15-25 quadrats was two species per quadrat. Species accumulation reduced to ≤ 1 species per quadrat as quadrat number increased above 50. BC has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

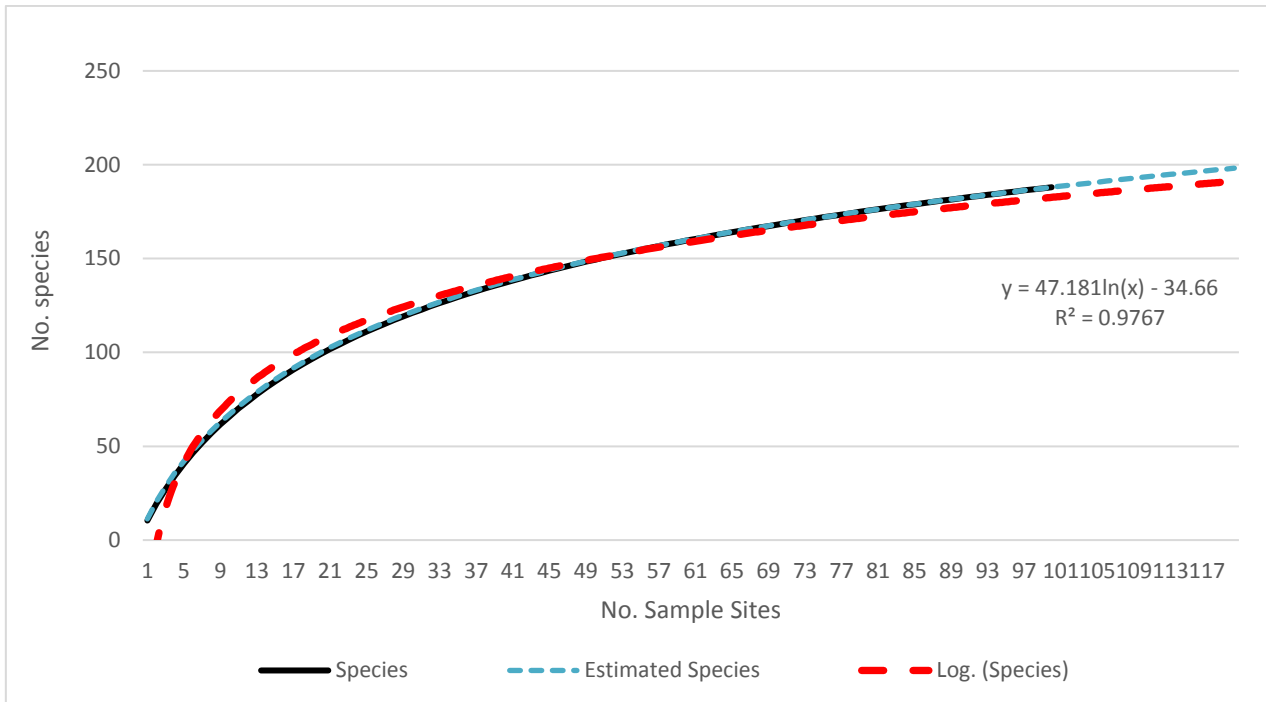


Figure 11: Species accumulation curve

4.7 Vegetation of Conservation Significance

4.7.1 Matters of National Environmental Significance

None of the following matters of national environmental significance as defined by the Commonwealth EPBC Act were identified within the survey area:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

4.7.2 Matters of State Environmental Significance

There are no wetlands of national importance (ANCA Wetlands) or conservation category wetlands within the survey area. The survey area does not contain any TEC or Threatened Flora listed under the WC Act or *Environmental Protection (EP) Act 1986*. No PEC as listed by the DPaW were recorded within the survey area. The survey area is not located within an ESA or Schedule 1 Area as listed under the EP Act. The survey area is not located within a listed or proposed conservation area managed by DPaW. Two Priority Flora taxa were recorded within the survey area; *Lepidium xylodes* (P1) and *Melaleuca apostiba* (P3).

A map showing areas of conservation significance in relation to the survey area is provided in Appendix 1.

5 Summary

Seventeen vegetation types were identified within the survey area. These vegetation types were located within nine different landform types and comprised of five major vegetation groups, which were represented by a total of 45 Families, 124 Genera and 278 Taxa (including 60 annual taxa).

Species composition assessments indicate there were no unique floristic communities within the survey area with majority of vegetation types intermixed into floristic groups despite differences in both dominant stratum taxa and landform; however, two distinct super groups were identified. The first group comprised of a mix of vegetation communities identified in the field including quadrats from all the landforms and major vegetation groups (excluding Samphire shrubland; CD-CSSSF1). Within this super group, the Eucalypt Woodlands were separated from the Acacia Forests and Woodlands, Chenopod Shrublands and Casuarina Forests and Woodlands. The second group comprised quadrats from the Gypsum Dunefield and Closed Depression (Samphire Shrubland) communities. Within this group, the Mallee Woodlands and Shrublands & Casuarina Forests and Woodlands were separated from the Samphire shrubland (CD-CSSSF1). Species composition of the Salt Lake vegetation (CD-CSSSF1) varied between the quadrats, however this variation appears to be due to the low species diversity of the Samphire vegetation rather than variation in spatial distribution across the lake (i.e. quadrats were grouped together regardless of location across the lake/ survey area).

The Chaos 2 richness estimator provided an estimated species richness of 188 species in 100 sample sites (quadrats). Species richness recorded for the 100 quadrats surveyed was 244 species (including annuals) which indicates survey intensity was adequate.

No Threatened Flora taxa listed under State or Commonwealth legislation were recorded within the survey area. Two Priority Flora taxa as listed by DPaW were identified within the survey area; *Lepidium xylodes* (P1) and *Melaleuca apostiba* (P3). *Lepidium xylodes* (P1) was identified within the Low open forest of *Casuarina pauper* over tall open shrubland of *Acacia burkittii* and low sparse chenopod shrubland of *Atriplex vesicaria* on gypsum dune (D-CFW1) vegetation type and *Melaleuca apostiba* (P3) was identified within the Mid open shrubland of *Eremophila paisleyi*/ *Lawrencia squamata*/ *Lycium australis* over low open chenopod shrubland of *Atriplex* spp. and open forbland of *Frankenia* spp. on playa edge (CD-CSSSF3) vegetation type.

No TEC or PEC pursuant to State or Commonwealth legislation were identified within the survey area. The survey area does not contain any world or national heritage places, wetlands of international or national importance. The survey area is not located within any DPaW managed lands or ESA.

Vegetation condition in the survey area ranged from 'good' to 'very good'. Five introduced species was identified within the survey area, none of which are listed as a Declared Plant under the BAM Act.

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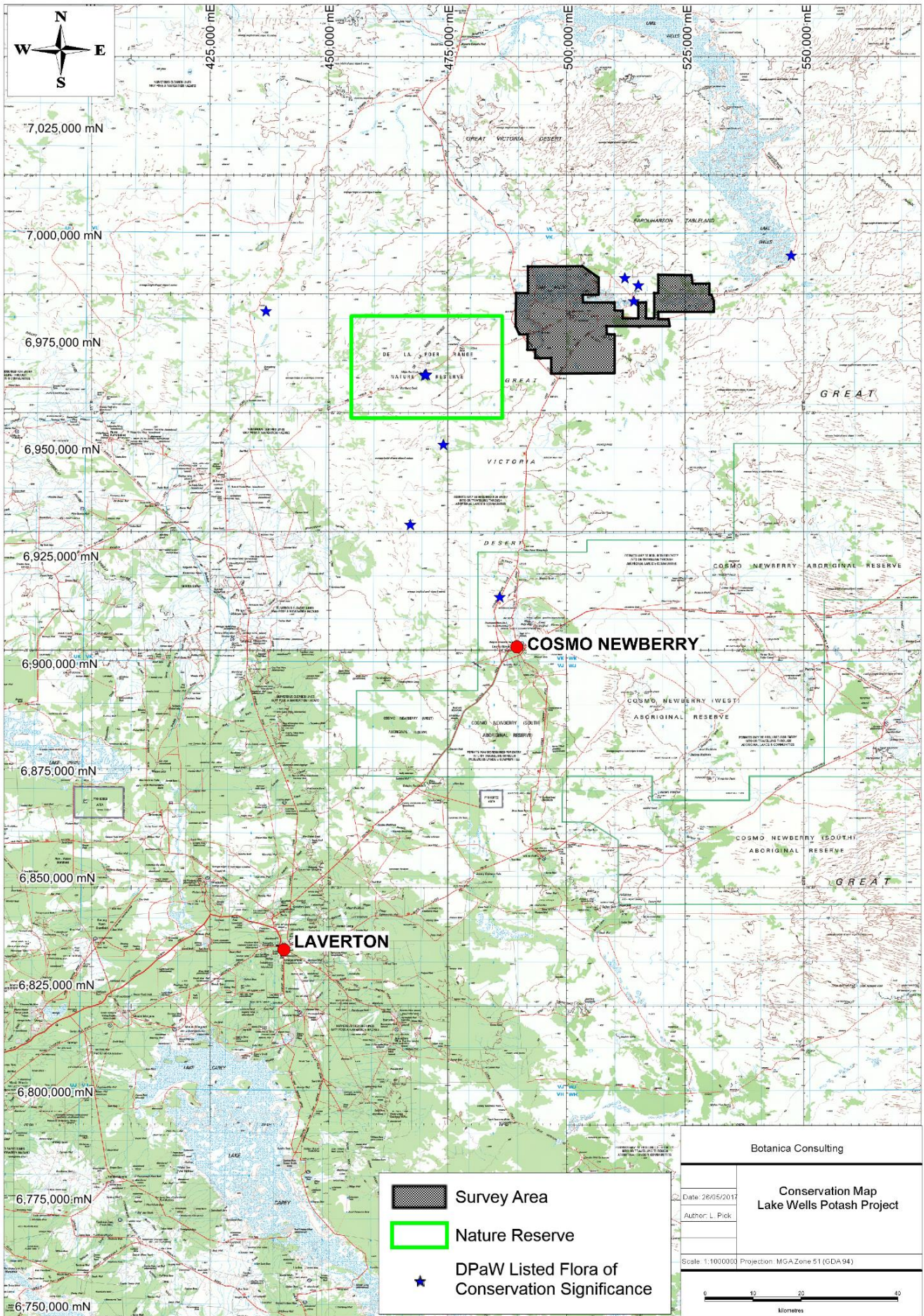
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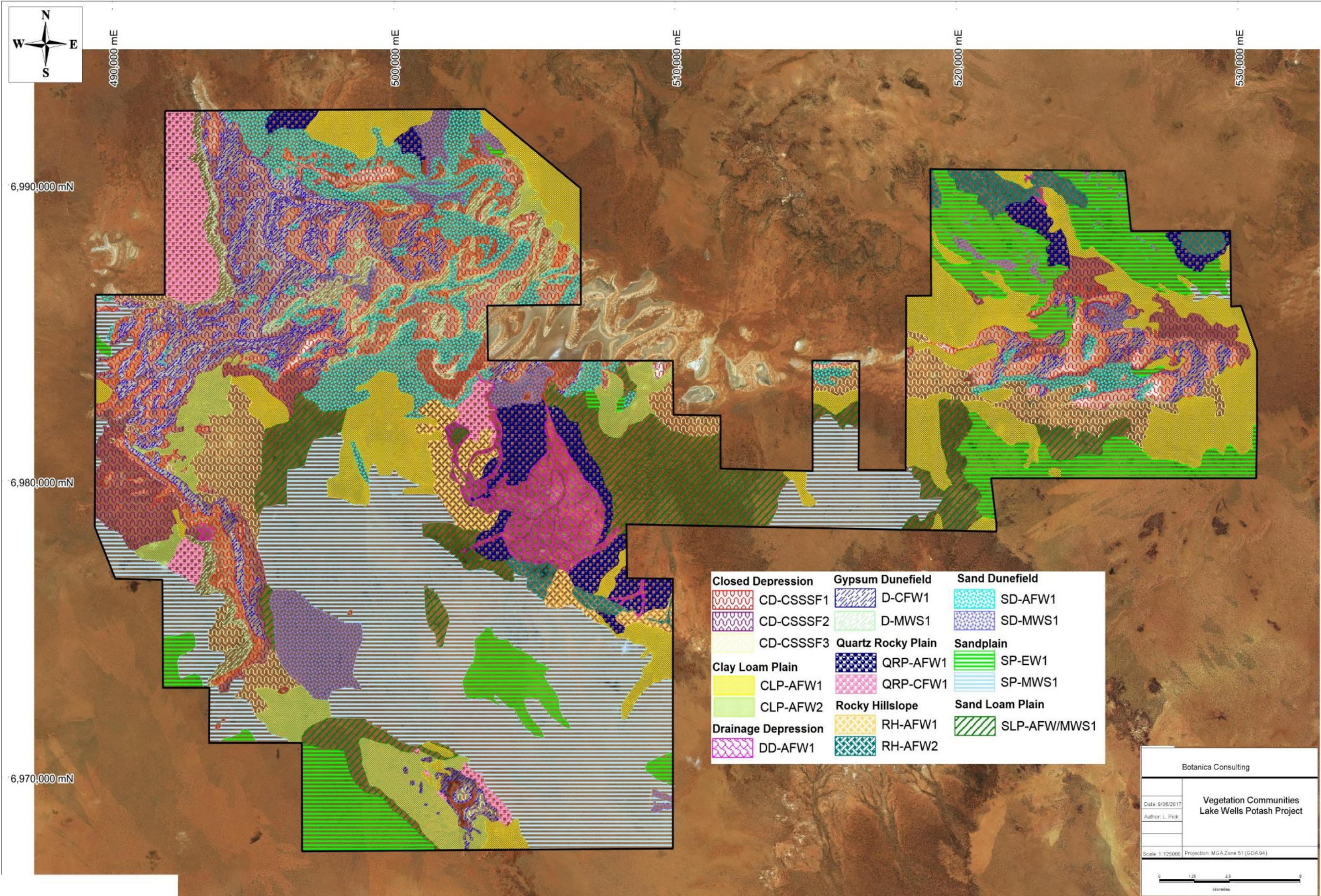
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Appendix 1: Regional map of the Lake Wells Potash Project survey area including DPaW Flora of Conservation Significance and areas of Conservation Significance



Appendix 2: Vegetation maps of the Lake Wells Potash Project survey area



Botanica Consulting

Date: 9/09/2017
 Author: L. Pick

**Vegetation Communities
 Lake Wells Potash Project**

Scale: 1:125000 Projection: MGA Zone 51 (GDA 94)

Family	Genus	Taxon	CD-CSSSF1	CD-CSSSF2	CD-CSSSF3	CLP-AFW1	CLP-AFW2	DD-AFW1	D-CFW1	D-MWS1	QRP-AFW1	QRP-CFW1	RH-AHW1	RH-AFW2	SD-AFW1	SD-MWS1	SLP-AFW/MWS1	SP-EW1	SP-MWS1
Fabaceae	<i>Acacia</i>	<i>quadrimarginea</i>									1		1	1					
Fabaceae	<i>Acacia</i>	<i>ramulosa</i> var. <i>ramulosa</i>				1	1				1				1		1		1
Fabaceae	<i>Acacia</i>	<i>rhodophloia</i>											1						
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>		1		1	1	1			1	1	1	1		1	1		1
Fabaceae	<i>Acacia</i>	<i>tysonii</i>							1										
Fabaceae	<i>Daviesia</i>	<i>eremaea</i>																	1
Fabaceae	<i>Kennedia</i>	<i>prorepens</i>																	1
Fabaceae	<i>Leptosema</i>	<i>chambersii</i>														1		1	1
Fabaceae	<i>Petalostylis</i>	<i>cassioides</i>																	1
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>x coriacea</i>														1			
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>artemisioides</i>						1			1		1						1
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>filifolia</i>			1	1	1	1		1		1			1	1	1	1	1
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>helmsii</i>						1			1		1	1					
Fabaceae	<i>Senna</i>	sp. <i>Meekatharra</i> (E. Bailey 1-26)									1		1	1					
Fabaceae	<i>Jacksonia</i>	<i>arida</i>													1	1			1
Fabaceae	<i>Swainsona</i>	<i>placoides</i>	1																
Frankeniaceae	<i>Frankenia</i>	<i>cinerea</i>	1	1	1		1		1	1									
Frankeniaceae	<i>Frankenia</i>	<i>fecunda</i>		1															
Frankeniaceae	<i>Frankenia</i>	<i>pauciflora</i>			1		1												
Frankeniaceae	<i>Frankenia</i>	<i>setosa</i>					1												
Goodeniaceae	<i>Brunonia</i>	<i>australis</i> (A)				1													1
Goodeniaceae	<i>Dampiera</i>	<i>roycei</i>																	1
Goodeniaceae	<i>Goodenia</i>	<i>gypsicola</i>							1	1									
Goodeniaceae	<i>Goodenia</i>	<i>macropectra</i> (A)					1												
Goodeniaceae	<i>Goodenia</i>	<i>mimuloides</i> (A)										1	1						
Goodeniaceae	<i>Goodenia</i>	<i>peacockiana</i> (A)									1								
Goodeniaceae	<i>Goodenia</i>	<i>xanthosperma</i> (A)															1		
Goodeniaceae	<i>Scaevola</i>	<i>basedowii</i>															1		
Goodeniaceae	<i>Scaevola</i>	<i>collaris</i>	1	1					1	1						1			

Family	Genus	Taxon	CD-CSSSF1	CD-CSSSF2	CD-CSSSF3	CLP-AFW1	CLP-AFW2	DD-AFW1	D-CFW1	D-MWS1	QRP-AFW1	QRP-CFW1	RH-AHW1	RH-AFW2	SD-AFW1	SD-MWS1	SLP-AFW/MWS1	SP-EW1	SP-MWS1
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>		1	1		1	1	1	1		1	1	1	1	1		1	1
Goodeniaceae	<i>Scaevola</i>	<i>deserticola</i>													1				
Goodeniaceae	<i>Scaevola</i>	<i>fimbriolata</i>								1									
Goodeniaceae	<i>Scaevola</i>	<i>parvifolia</i> subsp. <i>acuminata</i>														1			
Haloragaceae	<i>Haloragis</i>	<i>odontocarpa</i> (A)						1					1		1	1	1		1
Hemerocallidaceae	<i>Corynotheca</i>	<i>micrantha</i> var. <i>divaricata</i>														1		1	
Lamiaceae	<i>Dicrastylis</i>	<i>doranii</i>													1	1		1	
Lamiaceae	<i>Dicrastylis</i>	<i>exsuccosa</i>																	1
Lamiaceae	<i>Dicrastylis</i>	<i>flexuosa</i>																1	
Lamiaceae	<i>Prostanthera</i>	<i>althoferi</i> subsp. <i>althoferi</i>														1			
Lamiaceae	<i>Spartothamnella</i>	<i>teucriflora</i>				1					1			1				1	1
Loranthaceae	<i>Amyema</i>	<i>miquelii</i>														1			
Loranthaceae	<i>Amyema</i>	<i>preissii</i>					1												
Malvaceae	<i>Hannafordia</i>	<i>bissillii</i>														1			
Malvaceae	<i>Abutilon</i>	<i>oxycarpum</i>				1		1			1		1						
Malvaceae	<i>Alyogyne</i>	<i>pinoniana</i>														1		1	1
Malvaceae	<i>Androcalva</i>	<i>loxophylla</i>																1	1
Malvaceae	<i>Hibiscus</i>	<i>burtonii</i>											1						
Malvaceae	<i>Hibiscus</i>	sp. <i>Gardneri</i> (A.L Payne PRP 1435)											1						
Malvaceae	<i>Lawrencia</i>	<i>chrysotherma</i>	1																
Malvaceae	<i>Lawrencia</i>	<i>glomerata</i>		1															
Malvaceae	<i>Lawrencia</i>	sp. Sterile								1									
Malvaceae	<i>Lawrencia</i>	<i>squamata</i>	1		1														
Malvaceae	<i>Seringia</i>	<i>integrifolia</i>																1	
Malvaceae	<i>Seringia</i>	<i>velutina</i>																	1
Malvaceae	<i>Sida</i>	<i>calyxhymenia</i>				1	1	1					1						
Malvaceae	<i>Sida</i>	<i>ectogama</i>											1						
Malvaceae	<i>Sida</i>	sp. <i>Excedentifolia</i> (J.L Egan 1925)						1					1						

Family	Genus	Taxon	CD-CSSSF1	CD-CSSSF2	CD-CSSSF3	CLP-AFW1	CLP-AFW2	DD-AFW1	D-CFW1	D-MWS1	QRP-AFW1	QRP-CFW1	RH-AHW1	RH-AFW2	SD-AFW1	SD-MWS1	SLP-AFW/MWS1	SP-EW1	SP-MWS1
Malvaceae	<i>Sida</i>	sp. Golden calyces pubescent (G.J. Leach 1966)				1							1	1			1	1	1
Malvaceae	<i>Sida</i>	sp. Sterile										1							
Malvaceae	<i>Sida</i>	<i>spodochroma</i>		1	1					1		1							
Marsileaceae	<i>Marsilea</i>	<i>hirsuta</i>		1															
Myrtaceae	<i>Aluta</i>	<i>maisonneuvei</i> subsp. <i>auriculata</i>													1	1			
Myrtaceae	<i>Calytrix</i>	<i>desolata</i>											1						
Myrtaceae	<i>Eucalyptus</i>	<i>concinna</i>														1	1		1
Myrtaceae	<i>Eucalyptus</i>	<i>eremicola</i>																1	1
Myrtaceae	<i>Eucalyptus</i>	<i>gongylocarpa</i>														1		1	
Myrtaceae	<i>Eucalyptus</i>	<i>gypsophila</i>								1									
Myrtaceae	<i>Eucalyptus</i>	<i>lucasia</i>															1		1
Myrtaceae	<i>Eucalyptus</i>	<i>trivalva</i>																	1
Myrtaceae	<i>Eucalyptus</i>	<i>youngiana</i>				1											1	1	1
Myrtaceae	<i>Melaleuca</i>	<i>apostiba</i> (P3)			1														
Myrtaceae	<i>Melaleuca</i>	<i>interioris</i>													1				
Myrtaceae	<i>Micromyrtus</i>	<i>flaviflora</i>																	1
Nyctaginaceae	<i>Boerhavia</i>	<i>coccinea</i> (A)						1					1		1	1			1
Oleaceae	<i>Jasminum</i>	<i>didymum</i>												1			1		
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>														1			
Plantaginaceae	<i>Stemodia</i>	<i>florulenta</i>		1	1														
Poaceae	<i>Aristida</i>	<i>contorta</i> (A)		1	1	1	1	1	1		1	1	1	1	1				
Poaceae	<i>Aristida</i>	<i>holathera</i> (A)							1						1	1		1	
Poaceae	<i>Austrostipa</i>	<i>nitida</i>																	
Poaceae	<i>Chloris</i>	<i>truncata</i>					1												
Poaceae	<i>Cymbopogon</i>	<i>ambiguus</i>						1											
Poaceae	<i>Dactyloctenium</i>	<i>radulans</i> (A)								1							1		
Poaceae	<i>Enneapogon</i>	<i>caerulescens</i>						1	1			1	1	1					
Poaceae	<i>Enteropogon</i>	<i>ramosus</i>		1	1	1	1	1							1				

Family	Genus	Taxon	CD-CSSF1	CD-CSSF2	CD-CSSF3	CLP-AFW1	CLP-AFW2	DD-AFW1	D-CFW1	D-MWS1	QRP-AFW1	QRP-CFW1	RH-AHW1	RH-AFW2	SD-AFW1	SD-MWS1	SLP-AFW/MWS1	SP-EW1	SP-MWS1
Poaceae	<i>Eragrostis</i>	<i>dielsii</i> (A)	1	1	1		1		1	1									
Poaceae	<i>Eragrostis</i>	<i>eriopoda</i>			1	1	1	1			1	1	1	1	1	1	1	1	1
Poaceae	<i>Eragrostis</i>	<i>falcata</i>	1							1									
Poaceae	<i>Eragrostis</i>	<i>pergracilis</i> (A)		1	1		1	1	1	1									1
Poaceae	<i>Eragrostis</i>	<i>setifolia</i>								1									
Poaceae	<i>Eriachne</i>	<i>helmsii</i>									1		1	1	1				
Poaceae	<i>Eriachne</i>	<i>lanata</i>													1				1
Poaceae	<i>Eriachne</i>	<i>mucronata</i>											1	1			1		
Poaceae	<i>Eriachne</i>	<i>pulchella</i> (A)					1				1								
Poaceae	<i>Monachather</i>	<i>paradoxus</i>				1									1				1
Poaceae	<i>Paraneurachne</i>	<i>muelleri</i>																1	
Poaceae	<i>Themeda</i>	<i>triandra</i>						1											
Poaceae	<i>Triodia</i>	<i>basedowii</i>				1			1						1	1	1	1	1
Poaceae	<i>Triodia</i>	<i>concinna</i>				1							1				1		
Poaceae	<i>Triodia</i>	<i>desertorum</i>														1			
Poaceae	<i>Triodia</i>	<i>irritans</i>									1								
Portulacaceae	<i>Calandrinia</i>	<i>balonensis</i> (A)													1	1		1	1
Portulacaceae	<i>Calandrinia</i>	<i>creethiae</i> (A)		1			1	1									1		
Portulacaceae	<i>Calandrinia</i>	<i>polyandra</i> (A)		1			1							1	1	1		1	
Portulacaceae	<i>Calandrinia</i>	<i>ptychosperma</i> (A)					1												
Portulacaceae	<i>Calandrinia</i>	<i>sp. Sterile</i> (A)					1												
Portulacaceae	<i>Portulaca</i>	<i>oleracea</i> (A)					1	1	1				1		1				
Proteaceae	<i>Grevillea</i>	<i>berryana</i>											1	1					
Proteaceae	<i>Grevillea</i>	<i>juncifolia</i> subsp. <i>juncifolia</i>														1			
Proteaceae	<i>Grevillea</i>	<i>sarissa</i> subsp. <i>sarissa</i>							1	1									1
Proteaceae	<i>Hakea</i>	<i>francisiana</i>																1	1
Pteridaceae	<i>Cheilanthes</i>	<i>sieberi</i> subsp. <i>sieberi</i>						1			1		1	1			1		
Rubiaceae	<i>Psydrax</i>	<i>latifolia</i>				1		1			1	1	1	1			1		
Rubiaceae	<i>Psydrax</i>	<i>suaveolens</i>				1								1				1	

**Appendix 4: GPS coordinates of Flora of Conservation Significance locations within Lake Wells
Potash Project survey area (GDA94)**

Taxon	Zone	Easting	Northing	Estimated No. Plants
<i>Lepidium xylodes (P1)</i>	51 J	493599	6977302	500+
<i>Melaleuca apostiba (P3)</i>	51 J	514911	6984784	500+
<i>Melaleuca apostiba (P3)</i>	51 J	494694	6982346	10
<i>Melaleuca apostiba (P3)</i>	51 J	494745	6982325	10
<i>Melaleuca apostiba (P3)</i>	51 J	511153	6982002	100+

Appendix 5: GPS coordinates of Quadrat locations (GDA94)

Quadrat	Zone	Easting	Northing	Precision (m)	Vegetation Code
Q1	51 J	493508	6988452	1	D-MWS1
Q2	51 J	493023	6989320	2	QRP-CFW1
Q3	51 J	493964	6989954	2	D-CFW1
Q4	51 J	496814	6991960	2	QRP-AFW1
Q5	51 J	497235	6990636	1	SD-AFW1
Q6	51 J	497026	6986895	1	D-CFW1
Q7	51 J	495428	6985084	1	D-MWS1
Q8	51 J	494756	6982474	1	CD-CSSSF3
Q9	51 J	493516	6977226	1	D-MWS1
Q10	51 J	493791	6977534	5	CD-CSSSF1
Q11	51 J	493060	6977159	2	QRP-CFW1
Q12	51 J	491994	6975686	1	SP-MWS1
Q13	51 J	492482	6974385	1	SP-EW1
Q14	51 J	493923	6973396	0	CD-CSSSF1
Q15	51 J	494186	6973337	1	CD-CSSSF2
Q16	51 J	494360	6973715	5	D-MWS1
Q17	51 J	494338	6972921	2	SP-MWS1
Q18	51 J	495871	6972337	1	CLP-AFW2
Q19	51 J	494587	6976769	1	D-CFW1
Q20	51 J	495718	6977447	1	SP-MWS1
Q21	51 J	499095	6977480	1	SP-MWS1
Q22	51 J	498404	6979844	1	CLP-AFW1
Q23	51 J	496823	6979517	1	SP-MWS1
Q24	51 J	494172	6979210	1	CD-CSSSF1
Q25	51 J	492393	6978458	1	CLP-AFW1
Q26	51 J	492259	6978361	1	CLP-AFW2
Q27	51 J	490452	6978864	2	CD-CSSSF2
Q28	51 J	500771	6981134	1	CLP-AFW1
Q29	51 J	501380	6982456	1	RH-AFW1
Q30	51 J	500626	6984149	1	SD-AFW1
Q31	51 J	502084	6983707	1	D-MWS1
Q32	51 J	502299	6984492	1	SD-AFW1
Q33	51 J	502128	6984989	1	CD-CSSSF1
Q34	51 J	500767	6986216	1	SD-MWS1
Q35	51 J	500178	6987118	1	D-CFW1
Q36	51 J	498082	6986954	1	SD-MWS1
Q37	51 J	498163	6988829	1	CD-CSSSF1
Q38	51 J	498172	6989046	1	SD-AFW1
Q39	51 J	501499	6989531	0	SP-MWS1
Q40	51 J	501273	6989502	1	SP-MWS1
Q41	51 J	503702	6989662	1	SD-AFW1
Q42	51 J	503937	6989202	1	D-MWS1

Quadrat	Zone	Easting	Northing	Precision (m)	Vegetation Code
Q43	51 J	505735	6989452	1	SLP-AFW/MWS1
Q44	51 J	503732	6991020	0	SP-EW1
Q45	51 J	500843	6991070	1	QRP-AFW1
Q46	51 J	497572	6983770	1	CD-CSSSF3
Q47	51 J	497612	6982135	1	SLP-AFW/MWS1
Q48	51 J	530322	6982137	1	CLP-AFW1
Q49	51 J	529882	6984182	1	CD-CSSSF1
Q50	51 J	529420	6984070	1	D-CFW1
Q51	51 J	527631	6985786	0	CD-CSSSF2
Q52	51 J	522977	6985902	1	SP-EW1
Q53	51 J	515177	6982848	1	CLP-AFW1
Q54	51 J	516444	6981226	1	SP-MWS1
Q55	51 J	516933	6978615	1	SP-MWS1
Q56	51 J	520476	6983187	1	CD-CSSSF1
Q57	51 J	520750	6983083	1	SD-AFW1
Q58	51 J	521434	6983440	1	D-CFW1
Q59	51 J	525137	6984208	1	CD-CSSSF1
Q60	51 J	525025	6985331	1	SD-MWS1
Q61	51 J	527705	6982380	1	CD-CSSSF3
Q62	51 J	521749	6980404	1	SP-EW1
Q63	51 J	512774	6979127	1	SLP-AFW/MWS1
Q64	51 J	501419	6980727	1	RH-AFW1
Q65	51 J	502078	6980480	0	DD-AFW1
Q66	51 J	502892	6980424	3	RH-AFW1
Q67	51 J	503384	6980494	1	QRP-AFW1
Q68	51 J	503796	6980659	1	DD-AFW1
Q69	51 J	504518	6980493	1	QRP-AFW1
Q70	51 J	505699	6980497	1	DD-AFW1
Q71	51 J	508404	6979624	2	SLP-AFW/MWS1
Q72	51 J	508900	6982426	2	CLP-AFW2
Q73	51 J	508359	6982704	1	SD-AFW1
Q74	51 J	504668	6983188	1	SD-MWS1
Q75	51 J	502314	6982344	1	QRP-CFW1
Q76	51 J	505567	6986693	1	SD-AFW1
Q77	51 J	505819	6988586	1	CLP-AFW2
Q78	51 J	497885	6974734	1	SD-MWS1
Q79	51 J	490218	6982399	2	CD-CSSSF1
Q80	51 J	489779	6986086	1	SD-AFW1
Q81	51 J	492053	6991446	2	QRP-CFW1
Q82	51 J	529390	6987871	1	RH-AFW2
Q83	51 J	523638	6988371	1	QRP-AFW1
Q84	51 J	523243	6989142	2	CLP-AFW1
Q85	51 J	522818	6989688	2	RH-AFW1

Quadrat	Zone	Easting	Northing	Precision (m)	Vegetation Code
Q86	51 J	521533	6989557	2	RH-AFW2
Q87	51 J	520564	6989248	1	SP-EW1
Q88	51 J	522555	6987369	1	SD-MWS1
Q89	51 J	500461	6973651	1	SP-MWS1
Q90	51 J	503069	6973132	1	SP-EW1
Q91	51 J	506731	6972194	1	SP-MWS1
Q92	51 J	508200	6972181	1	CLP-AFW1
Q93	51 J	509282	6968910	1	SD-MWS1
Q94	51 J	504114	6968626	2	QRP-CFW1
Q95	51 J	502253	6969135	1	D-CFW1
Q96	51 J	502179	6969060	1	CD-CSSSF1
Q97	51 J	504830	6976552	2	RH-AFW2
Q98	51 J	505672	6975760	2	RH-AFW1
Q99	51 J	507591	6975777	2	RH-AFW2
Q100	51 J	503437	6978762	1	RH-AFW1

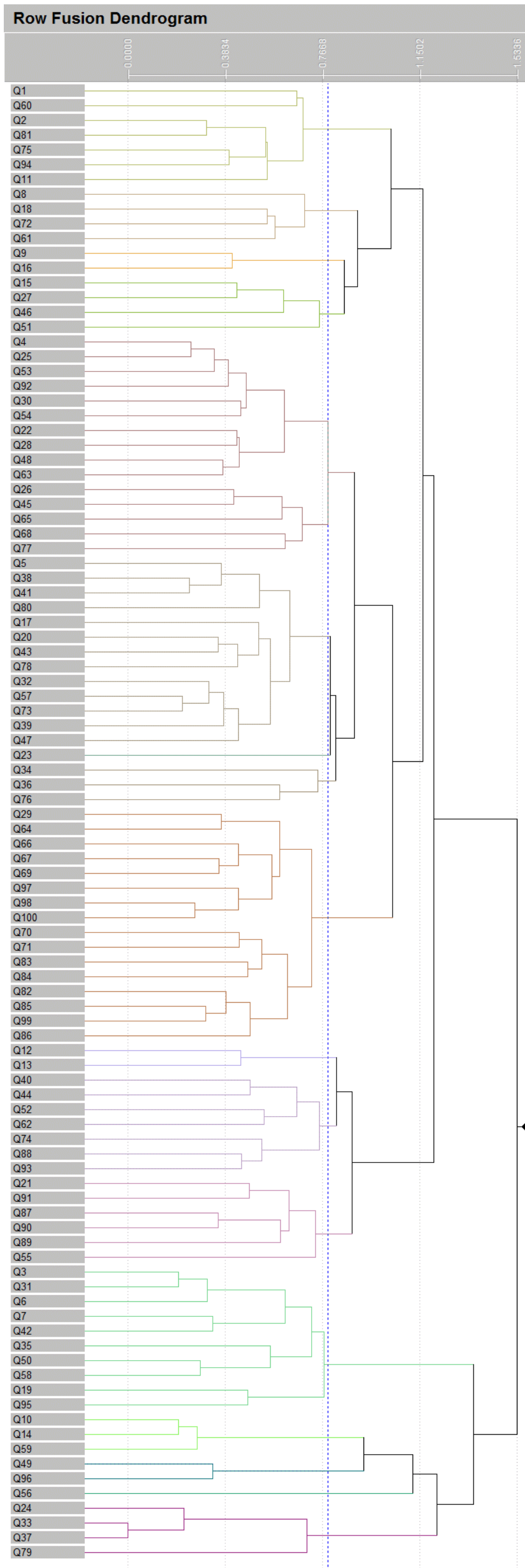
Appendix 6: Quadrat Datasheets

Provided as a separate document

Appendix 7: Quadrat Photographs

Provided as a separate document

Appendix 8: PATN Analysis results

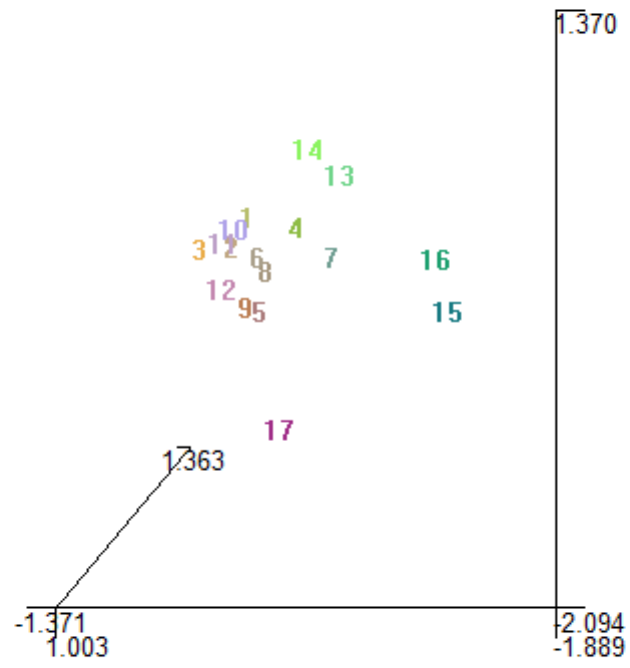


Stress: 0.2263

LEGEND

- Group 1
- Group 2
- Group 3
- Group 4
- Group 5
- Group 6
- Group 7
- Group 8
- Group 9
- Group 10
- Group 11
- Group 12
- Group 13
- Group 14
- Group 15
- Group 16
- Group 17

PATN groups



Appendix 9: Vegetation Condition Rating

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	/
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	/	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

