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## TABLE OF CONTENTS

<b>1</b>	<b>SCOPE.....</b>	<b>2</b>
1.1	Responsible ODC personnel .....	2
1.2	Review and modification .....	2
<b>2</b>	<b>DETAILED PROCEDURE .....</b>	<b>3</b>
2.1	Long-term changes to perennial vegetation.....	3
2.2	Land disturbance .....	3
2.3	Pest plants.....	4
2.4	Great Artesian Basin (GAB) springs wetland vegetation composition assessment .....	5
2.5	‘At-risk’ species – Category 1a.....	6
2.6	‘At-risk’ species – Categories 1b and 2.....	6
2.7	Delivery of environmental offsets.....	7
<b>3</b>	<b>COMMITMENTS .....</b>	<b>9</b>
3.1	Reporting.....	9
3.2	Summary of commitments.....	9
<b>4</b>	<b>DEFINITIONS AND REFERENCES.....</b>	<b>10</b>
4.1	Definitions.....	10
4.2	References .....	10
4.3	Bibliography.....	10
<b>5</b>	<b>APPENDIX A: FLORA MONITORING SITE LOCATIONS.....</b>	<b>12</b>
<b>6</b>	<b>APPENDIX B: VEGETATION COMMUNITIES WITHIN THE GOSSE SPRINGS AND EMERALD SPRINGS SEB AREAS.....</b>	<b>13</b>
<b>7</b>	<b>APPENDIX C: PROPOSED SEB AREAS .....</b>	<b>14</b>
<b>8</b>	<b>APPENDIX D: AT-RISK FLORA SPECIES LIST .....</b>	<b>15</b>
<b>9</b>	<b>APPENDIX E: CLASSIFICATION OF AT-RISK FLORA SPECIES.....</b>	<b>29</b>

## 1 SCOPE

This Monitoring Program (MP) describes the environmental monitoring activities that are undertaken by BHP Billiton Olympic Dam Corporation Pty Ltd (ODC) in relation to flora at Olympic Dam and the surrounding areas that may be impacted by current mining and processing activities. The purpose of this MP is to set out the measures ODC uses to quantify any change in the extent or significance of impacts of its activities on flora, to assess the performance of the control measures employed to limit these impacts, and to meet relevant legal and other requirements.

This MP addresses a number of distinct elements of flora monitoring. For each element, the MP sets out some background information, the purpose of the monitoring and the deliverables which are produced as a result of the monitoring. The MP also includes a description of the methods for measuring achievement of **compliance criteria** and the movement of trends towards **leading indicators** (where applicable).

This MP relates to flora that is normally associated with open rangeland country in central Australia and the Great Artesian Basin (GAB) springs in the wellfield areas.

Flora monitoring within the above-defined area is principally designed to determine the nature, extent and degree of any operational impacts, either positive or negative, on indicator species or functional groups. The causal agents of these impacts, generically known as ‘aspects’ include gaseous, aerosol and dust emissions, liquid waste streams, physical ground disturbance and alteration of groundwater levels. At-risk flora species and weed species are also monitored.

### 1.1 Responsible ODC personnel

The Olympic Dam Asset President is responsible for ensuring that all legal and other requirements described in this MP are met.

ODC employs an environmental scientist and sufficient other staff with experience and qualifications to fulfil the requirements of this MP.

### 1.2 Review and modification

This MP is reviewed annually. Major changes or amendments following the review are documented in the Annual EM Program Targets, Actions and Major Changes document.

It should be noted that as a result of operational activities or through optimisation of sample design some existing monitoring sites may be lost and others added (where possible) to maintain the integrity of the sampling program. Access restrictions can result in some sites occasionally being unable to be monitored.

## **2 DETAILED PROCEDURE**

### **2.1 Long-term changes to perennial vegetation**

#### **2.1.1 Background**

Changes in the composition and structure of vegetation surrounding the Olympic Dam operation have occurred as a result of emission impacts (Fatchen Environmental 2005). Fatchen reported that in areas that continue to be affected by emissions, recovery, either from regrowth of damaged individuals or recruitment of new plants, may be depressed or even inhibited.

This section aims to determine the longer-term effects of these emissions, if any, on the surrounding perennial plant communities. Perennial species are persistent and are an ideal indicator group as they are not likely to change in abundance in response to season or to most short mesic or xeric periods. Recruitment is likely to be aperiodic and in response to unusually high rainfall periods (Griffin and Dunlop 2006).

By collecting annual data at different proximities to the emission sources and using simple assessment methods, changes in perennial plant communities as a result of emissions can be monitored.

#### **2.1.2 Purpose**

- To determine what impact ODC's operations, have on perennial plant communities surrounding the operations.

#### **2.1.3 Deliverables**

- A report on the annual changes in perennial communities within and surrounding the SML.
- Provide a comparative assessment on perennial species existing at different distances from the Main Smelter Stack.

#### **2.1.4 Method**

Monitoring the long-term changes to perennial vegetation occurs within and around the SML on an annual basis. Vegetation monitoring sites are located in a predominantly radial grid (centred on the Main Smelter Stack) surrounding the Olympic Dam operation. Sites are located up to 25 km from the centre (see Appendix A for flora monitoring site locations). Note: EV939, EV929, EV925, EV911, EV910 and EV940 as labelled in Appendix A are not sampled to determine long-term changes to perennial vegetation as they do not fit the criteria required for this sampling.

At each of the sites on the radial grid, a sample quadrat 100 m by 25 m is assessed for perennial vegetation species. Within the quadrat the frequency of occurrence is recorded for all perennials. Annual monitoring of these sites and vegetation composition are undertaken to detect if emission impacts continue and, if so, their effects on perennial plant communities.

### **2.2 Land disturbance**

#### **2.2.1 Background**

All native vegetation in South Australia is protected under the provision of the *Native Vegetation Act 1991* and clearance of vegetation is prohibited unless it is approved by the Native Vegetation Council. Application for clearance approvals are to be accompanied by a management plan that describes a significant environmental benefit (SEB). BHP Billiton has proposed an SEB offset through land that can be protected and managed as a set-aside area.

In 2010 the Gosse Springs Native Vegetation Management Plan was approved to establish a SEB offset area of 10,963 hectares (ha) (see Appendix B for Gosse Springs SEB area, detailing vegetation communities). New SEB areas and native vegetation management plans are progressively developed and implemented as vegetation clearance occurs and to ensure the SEB area is always greater than the SEB obligation (see Appendix C for proposed SEB offset areas in the Arid Lands NRM Region).

The various mine, process and infrastructure development activities involve the clearance of vegetation and ground surface for access roads, laydown areas, new facilities and infrastructure, surface soil stockpiles, general excavation and waste management areas. The results of all development activities include:

- Clearance of topsoil and vegetation (for the construction of newly proposed infrastructure and access tracks, extraction of sand from dunes and rock quarrying, etc.);
- The alteration of surface soils and surface water flows.

All activities that result in land clearance are subject to ODC's internal Application for an Environmental Disturbance Permit (EDP) (Document No. 56830). In addition, management plans direct the handling of vegetation, topsoil and erosion and sediment control measures.

The extent of land disturbance and the impact of drilling activity are controlled through site procedures.

Waste management and infrastructure expansion is subject to the approval of the appropriate authorities and is regulated through discussions with planning personnel and site procedures developed with earthworks contractors.

### 2.2.2 Purpose

- Define the direct disturbance impact footprint of infrastructure, development, resource drilling and associated waste management activities.
- Ensure that all disturbance activities have been undertaken in compliance with the EDP and SEB processes.
- Ensure that the total area of vegetation cleared does not exceed the total area indicated in the **EIS** (17,269 ha) and that the area of SEB is sufficient.

### 2.2.3 Deliverable(s)

- A map of the direct disturbance impact footprint of ODC's Olympic Dam activities.
- A statement of comparison between the impact footprint of ODC's Olympic Dam activities (i.e. within and outside the SML) and the offset areas under SEB processes, to track progress towards a life of mine ratio of 8ha set aside for each hectare disturbed.

### 2.2.4 Method

The extent of physical land disturbance is measured annually using GIS technology and remotely sensed imagery. Geo-referenced imagery of the SML and Roxby Downs Municipality are analysed for physical disturbance during the period prior to image capture. Evidence of disturbance is cross-referenced against the EDP system records for the same period. For land disturbance occurring following image capture until the end of the reporting period, the area is calculated from the EDP database. These figures are adjusted appropriately in the following reporting period to reflect actual disturbance.

As part of the EDP process, each applicable land disturbance is allocated an appropriate SEB offset ratio. Total offset areas are then subtracted from the total SEB offset areas that have been approved by the Native Vegetation Council, and a remaining SEB offset area is reported.

## 2.3 Pest plants

### 2.3.1 Background

Weeds within the Olympic Dam region are managed through the Olympic Dam Weed Management Strategy (BHP Billiton 2015), a collaborative effort driven by ODC, in conjunction with **Arid Recovery**, the Roxby Downs Council and the Andamooka Town Management Committee. The Weed Management Strategy takes significant direction from overarching National and Regional Pest Strategies, especially the South Australian Arid Lands (SAAL) Natural Resource Management (NRM) Board Kingoonya NRM District Weed Strategy (Pest Management Strategy (Reseigh and Shepherd 2010)).

The Weed Management Strategy includes a risk assessment of weed species that are currently found within the Olympic Dam region or which may become a problem in future. In the strategy, a weed's risk is assessed according to its habitat type (developed or rangeland), invasiveness potential and feasibility of control. All infestations of species declared under the NRM Act 2004 must be controlled in accordance with the Act. Species declared under the Act (as of January 2015) that are known to be present within the Olympic Dam region are: Prickly Pear, Buffel Grass (*Cenchrus ciliaris*), Innocent Weed (*Cenchrus incertus*), Bathurst Burr (*Xanthium spinosum*), Caltrop (*Tribulus terrestris*), Salvation Jane (*Echium plantagineum*), Athel Pine (*Tamarix aphylla*), Noogoora Burr (*Xanthium pungens*) and

Three-corner Jack (*Emex australis*). African Boxthorn (*Lycium ferocissimum*) and Horehound (*Marrubium vulgare*) are also found within ODC's high-voltage power line corridor from Port Augusta to Olympic Dam. If any declared species are found on ODC managed land, control and any government notification requirements are to be initiated in accordance with the relevant provisions under the Act.

Targeted weed management strategies may also occur through a coordinated approach between ODC, responsible landowners, **Arid Recovery**, Andamooka Town Management Committee and Roxby Council, aimed at identifying and controlling priority species.

Ground disturbance, including the movement of vehicles and the transfer of soils, can potentially increase the abundance of pest plants. ID 1.2 of the EMP, "Spread of Pest Plants and Animals", provides controls to mitigate the spread of weeds, controlling the spread of soil in known weed infestation areas and ensuring the diligent cleaning of plant, equipment and vehicles before construction work commences and before leaving areas infested by declared weeds.

### 2.3.2 Purpose

- Determine the extent of weed infestations of extreme and high risk weed species within the Olympic Dam region and SML.
- Monitor and control declared weeds and plant pathogens within the SML and surrounding areas.

### 2.3.3 Deliverable(s)

- Define and map the current distribution of extreme and high risk weed species within the Olympic Dam region, Roxby Downs Municipality, the SML and Gosse Springs SEB areas.
- Identification of whether measures are required to control declared weeds and plant pathogens in the operations area.

### 2.3.4 Method

The current distribution of extreme and high risk weed species is determined during scheduled weed monitoring. Construction sites are surveyed prior to construction activities and 12 months after works are completed and/or after significant rains. Routine and opportunistic monitoring is also conducted in high-risk habitats and previous control locations. Areas surveyed include the SML, the Roxby Downs Municipality, pastoral leases and **Arid Recovery**. Monitoring results are used to determine whether control measures are required when an increase in the abundance or area of extreme and high risk weed species is identified attributable to the operations.

## 2.4 Great Artesian Basin (GAB) springs wetland vegetation composition assessment

### 2.4.1 Background

Changes in the GAB springs vegetation composition could arise from changes in spring flow and/or a change in spring water chemistry. Flora species composition at the GAB springs may correlate to the rate of flow of an artesian spring. Changes in wetland vegetation composition may be used to assess the extent of aquifer drawdown resulting from water extraction.

### 2.4.2 Purpose

- Quantify the changes in composition of GAB springs vegetated wetland areas that may be attributed to water extraction from the wellfields.

### 2.4.3 Deliverables

- An evaluation of the composition of vegetated wetlands within the GAB springs.
- Triennial qualitative comparison of GAB spring monitoring data incorporating GAB spring flow, GAB springs vegetated wetland area, GAB springs vegetation composition, 'at risk' flora – Category 1a and 'at risk' fauna – Category 1a.

### 2.4.4 Method

For all 107 vents from 16 different spring groups, inclusive of the Gosse Springs SEB area, the vegetation composition, cover and abundance is recorded (see GAB MP Appendix D). In accordance with the Gosse Springs Native Vegetation Management Plan (NVMP (Environmental and Biodiversity

Services, 2010), this MP includes an assessment of the abundance of *Phragmites australis*, which is known to increase in the absence of large grazing herbivores. The level of grazing is also recorded at each spring to give an indication of the level of the presence of large herbivores in the area.

## 2.5 ‘At-risk’ species – Category 1a

A number of at-risk flora species have been recorded within the project area. At-risk species are those where isolated populations or the species population as a whole have the potential to be adversely impacted by ODC operations. Species include those formally listed under state or national conservation listings and other significant species defined by ODC. At-risk species have been classified by ODC into three main categories: Category 1a, Category 1b and Category 2.

Category 1a includes those at-risk species whose population distribution as a whole is largely restricted to the impact area and which are therefore at a higher risk of being impacted by the operations. This includes flora species restricted to the GAB springs of the Lake Eyre South region in the vicinity of the wellfields.

The degree of at-risk species monitoring undertaken depends largely on the category under which they fall. Monitoring of Category 1a species is intensive in comparison to Category 1b and Category 2 species (see section 2.6), which reflects the species’ reliance on the potential impact area. A list of all at-risk flora occurring in the impact zone is included in Appendix D (see section 8). Appendix E (see Section 9) contains a flow chart detailing how at-risk species are identified.

### 2.5.1 Background

Only one species of Category 1a flora species (Salt Pipewort, *Eriocaulon carsonii*) has been recorded on the SML and surrounding potential impact areas including Roxby Downs Municipality, Pastoral Leases, the transmission line corridor and the Wellfields area.

A diverse and rare group of flora is found within the mound springs of the Great Artesian Basin in South Australia and Queensland. These landforms occupy an extremely small percentage of semi-arid Australia. *Eriocaulon carsonii* is a distinctive plant restricted to the active mound springs of the GAB, where it relies on a constant supply of flowing water. The largest single population exists at the Hermit Hill spring complex near Wellfield A. *E. carsonii* is listed as endangered under state and national legislation. Extraction of water from the GAB has the potential to alter the flow or chemistry of mound spring water within the GAB, which may have an adverse effect on *E. carsonii* populations.

### 2.5.2 Purpose

- Determine if the distribution and abundance of *E. carsonii* is affected by water extraction from the GAB wellfields.

### 2.5.3 Deliverables

- A comparison of the abundance and distribution of *E. carsonii*, per impact zone, with previously reported values, to determine any impacts to GAB springs.
- Triennial qualitative comparison of GAB spring monitoring data incorporating GAB spring flow, GAB springs vegetated wetland area, ‘at risk’ flora – Category 1a and ‘at risk’ fauna – Category 1a.

### 2.5.4 Method

The relative abundance of *E. carsonii* is estimated annually using the Domin-Krajina rank scale. Changes in the cover abundance and the proportion of GAB springs supporting *E. carsonii* are used to assess the dynamics of the population. To simplify analysis, spring groups are allocated to predicted impact zones that reflect the anticipated level of hydrological influence caused by water extraction from the wellfields (see Figure 8.3, Great Artesian Basin Monitoring Program (Document No. 2789)).

## 2.6 ‘At-risk’ species – Categories 1b and 2

Category 1b includes at-risk species that have an **important population** (where there are few other populations within the region or interstate) that may be critically reliant on the area of impact and the population has the potential to be impacted. Currently there are no at-risk flora species that fall into the category.

Category 2 includes all other species known to occur in the region that are listed under state, national and/or international conservation listings, but can include other regionally or locally significant species that may be adversely impacted by operations (i.e. includes some resident unlisted species) (see Appendix D). Populations of Category 2 at-risk species are not critically reliant on the potential area of operations impact (i.e. only individuals of the species are likely to be impacted). This includes species that have a wider distribution within the state, interstate or overseas and are not considered to be dependent on existing populations within the potential impact area.

### 2.6.1 Background

There have been 36 at-risk flora species recorded within the SML, surrounding infrastructure areas, Roxby Downs Municipality, Pastoral Leases, the transmission line and the Wellfields area. Species location data is derived from government and ODC databases, the Australian Virtual Herbarium website and the field studies conducted as part of the DEIS. All species were found to be non-dependent on the populations that exist within the impact area and have been classified as Category 2. This includes species that are not listed as threatened, but are considered to be regionally/locally significant.

No specific monitoring programs apply to individual Category 2 species, however all at-risk species are protected where possible under the EDP procedure. This procedure includes the requirement to seek alternative locations for disturbance in an attempt to avoid individuals of **listed species**, or to justify the decision that a relocation of the infrastructure is not possible.

### 2.6.2 Purpose

- Determine if there is a requirement to implement any management activity for the protection of Category 1b and/or 2 species in the vicinity of the operations.
- Identify species and areas of habitat that should be avoided where possible during land disturbance activities.

### 2.6.3 Deliverable(s)

- A map of the known locations of Category 1b and 2 species within the impact area of the Olympic Dam operation.
- A statement of impacts to, and measures undertaken to avoid, Category 1b at-risk species.

### 2.6.4 Method

Locations will be investigated opportunistically for annual and/or ephemeral at-risk species after periods of substantial rain and added to the EDP spatial database for future reference. Locations of these species and perennial at-risk species will be retained in the spatial database and considered when applications for EDPs are lodged.

A flora assessment is undertaken in areas known or likely to support at-risk species prior to any significant land disturbance activities. Where threatened flora or habitats considered important to threatened species (Category 1b or 2) are found, the EDP conditions flag 'no go' areas, seek justification for disturbance in these areas, and in certain circumstances require relocation of affected species where disturbance is unavoidable.

## 2.7 Delivery of environmental offsets

### 2.7.1 Background

As discussed in section 2.2, an SEB offset is being implemented to compensate for vegetation clearance and other **environmental impacts** arising from vegetation clearances that are required (under the Native Vegetation Regulations, 2003) to be offset. An existing SEB (Gosse Springs) has been approved by the South Australian Government. Additional proposed areas in the Arid Lands NRM region include Emerald Springs and One Box to the west of Lake Eyre National Park and two further adjoining properties; Black Swan and Bedourie. In conjunction with existing national parks and reserves, the proposed offsets will aid in the formation of a contiguous conservation area of 15,650 km<sup>2</sup>. Appendix C provides a map of the potential future SEB areas.

The objective of the SEB offset area is to not only compensate for **environmental impacts** associated with any expansion, but to also achieve a net gain in biodiversity and conservation value for the region. To achieve this outcome management actions and strategies will be progressively implemented, within

each SEB area, that focus on weed and feral animal control, rehabilitation of disturbed areas and other strategies that ensure the protection and recovery of native flora and fauna.

A native vegetation management plan has been developed for Gosse Springs, detailing the actions that will be undertaken to manage the area. This document also details the contributions the SEB areas will give to the biodiversity conservation priorities of the Australian and South Australian Governments. The development of each SEB area is undertaken in stages, commencing with Emerald Springs, and in correlation with offset requirements arising from vegetation clearances.

To ensure the successful and timely delivery of the actions, monitoring of these plans is conducted as part of this MP and reported in the Annual EPMP Report each year.

#### **2.7.2 Purpose**

- To monitor the delivery of strategies and management actions required for the SEB offset areas.

#### **2.7.3 Deliverable(s)**

- A summary of actions achieved from the SEB implementation plan within the fiscal year through the Annual EPMP Report.
- An annual report to the government on SEB management outcomes through the Annual EPMP Report.
- Shapefiles of the SEB areas for inclusion in relevant departmental databases.

#### **2.7.4 Method**

The implementation plans for the Emerald Springs, Bedourie, One Box and Black Swan SEB areas, which form part of the overall SEB offset plan, will be compiled and routinely reviewed to ensure management actions are being addressed in a timely manner and to make modifications to proposed actions if required.

Details of actions achieved from these plans, within the fiscal year, are reported through the Annual EPMP Report.



### 3 COMMITMENTS

#### 3.1 Reporting

The results and a discussion of the results will be presented in the Annual EPMP Report, as outlined in the EMM.

#### 3.2 Summary of commitments

Table 3.1: Summary of commitments

Action	Parameter	Frequency
Monitor	The total area of direct impact on vegetation	Annually
Monitor	Changes in perennial vegetation in response to emissions from the Olympic Dam Operation	Annually
Monitor	Great Artesian Basin (GAB) springs wetland vegetation assessment	Annually
Monitor	The current status of key pest plant species within the Olympic Dam region	Ongoing
Monitor	Relative abundance of Category 1a species within the wellfields	Annually
Monitor	Presence of Category 1b and 2 species within the expanded SML, region and wellfields	Opportunistically
Assess	Changes in population status of <b>listed species</b>	Annually
Assess	Actions achieved from implementation plans for SEB areas	Annually
Rehabilitate	Cleared areas and take measures to avoid disturbance to at-risk species in accordance with the methods prescribed in the EDP procedure	As prescribed
Report	Annual land disturbance for the SML and Municipal Leases defined as either being credited to an SEB or not	Annually
Report	Monitoring results in the Annual EPMP Report to the Indenture Minister	Annually
Review	The Flora MP and modify as appropriate	Annually

## 4 DEFINITIONS AND REFERENCES

### 4.1 Definitions

Throughout the EPMP some terms are taken to have specific meaning. These are indicated in bold text in the documentation and are defined in the glossary in section 5 of the EMM. Defined terms have the same meaning wherever they appear in bold text. Some other terms and acronyms are also defined in the glossary, but do not appear in bold text.

### 4.2 References

BHP Billiton 2009, 'Olympic Dam Expansion – Draft Environmental Impact Statement 2009', BHP Billiton, Adelaide.

BHP Billiton 2015, 'Olympic Dam Weed Management Strategy', unpublished report for BHP Billiton, Olympic Dam.

Environmental and Biodiversity Services. 2010. *Gosse Springs Paddock Native Vegetation Management Plan*. Kurralt Park, SA: Environmental and Biodiversity Services.

Griffin, GF & Dunlop, SR 2006, 'Long term changes in the composition of perennial vegetation in response to emission from the Olympic Dam Operations', unpublished report for BHP Billiton Olympic Dam.

Griffin, GF & Dunlop, SR 2007, 'Emissions dispersal patterns and impacts on soils and vegetation in the Olympic Dam operation area', unpublished report to BHP Billiton, Pillar Valley, NSW.

Griffin, GF & Dunlop, SR 2007a, 'Impact of Emissions from the Olympic Dam Mine Operation on the Flora and Soil of the Special Mining Lease', unpublished report to BHP Billiton, Pillar Valley, NSW: Datasticians.

ICRP 2008, Environmental Protection: the Concept and Use of Reference Animals and Plants, ICRP Publication 108, Annals of the ICRP 38 (4–6).

Niejalke, DP & Lamb, KJ 2002, 'Can remote sensing monitor GAB spring impacts? A progress update'. Conference paper presented to the Mound Spring Researchers Forum, Toowoomba, March 2002.

Reseigh, J & Shepherd, B 2010. 'Kingoonya NRM District Weed Strategy', South Australian Arid Lands Natural Resource Management Board, Adelaide.

Williams, AF & Holmes, JW 1978, 'A novel method of estimating the discharge of water from mound springs of the Great Artesian Basin, Australia', *Journal of Hydrology* 38, pp. 263–272.

### 4.3 Bibliography

Badman, FJ 1995, 'Changes in the incidence of alien plant species at Olympic Dam between 1986 and 1994', Qualifying masters thesis, University of Adelaide.

Bailey, PT, Martin, JH, Noyes, JS & Austin, AD 2001, 'Taxonomy and biology of a new species of *Zaphanera* (Hemiptera: Aleyrodidae) and its association with the widespread death of Western Myall trees, *Acacia papyrocarpa*, near Roxby Downs, South Australia', *Transactions of the Royal Society of South Australia* 125 (2), pp. 83–96.

Fatchen, TJ & Fatchen, DH 1993, 'Mound spring vegetation in the Hermit Hill region: Dynamics, responses to borefield operation and management implications', TJ Fatchen and Associates, Adelaide.

Fatchen Environmental. 2005. An assessment of WMC (Olympic Dam Corporation) emissions impact on the flora of the special mining lease and surrounds [2004]. Report for WMC (Olympic Dam Corporation) Pty Ltd. Mt Barker, SA: Fatchen Environmental Pty Ltd.

Habermehl, MA 1982, 'Springs in the Great Artesian Basin, Australia – Their origin and nature', Australian Government Printing Service.

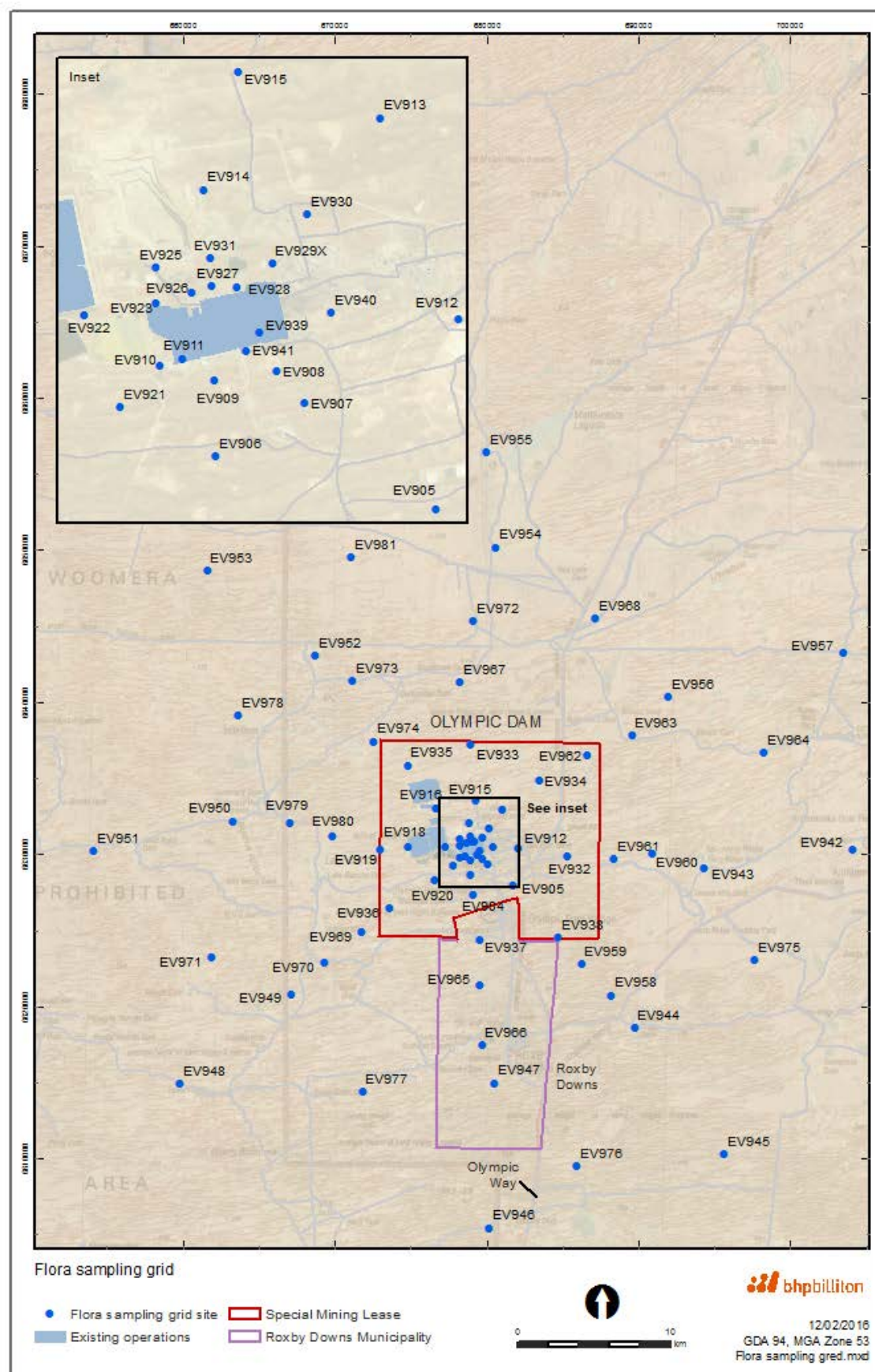
Harris, CR 1992, 'Mound springs: South Australian conservation initiatives', *Rangeland Journal* 14 (2), pp. 157–173.

Read, JL 1995, 'Recruitment characteristics of the white cypress pine (*Callitris glaucophylla*) in arid South Australia', *Rangeland Journal* 17, pp. 228–240.

Read, JL 2004, 'Catastrophic drought-induced die-off of perennial chenopod shrubs in arid Australia following intensive cattle browsing', *Journal of Arid Environments* 58, pp. 535–544.

Read, JL, Kovac, K & Fatchen, TJ 2005, 'Biohyets: a method for displaying the extent and severity of environmental impacts', *Journal of Environmental Management*, 77, pp. 157–164.

## 5 APPENDIX A: FLORA MONITORING SITE LOCATIONS



**Figure 5.1: Sampling grid for OD flora emissions monitoring and long term vegetation monitoring**

## 6 APPENDIX B: VEGETATION COMMUNITIES WITHIN THE GOSSE SPRINGS AND EMERALD SPRINGS SEB AREAS

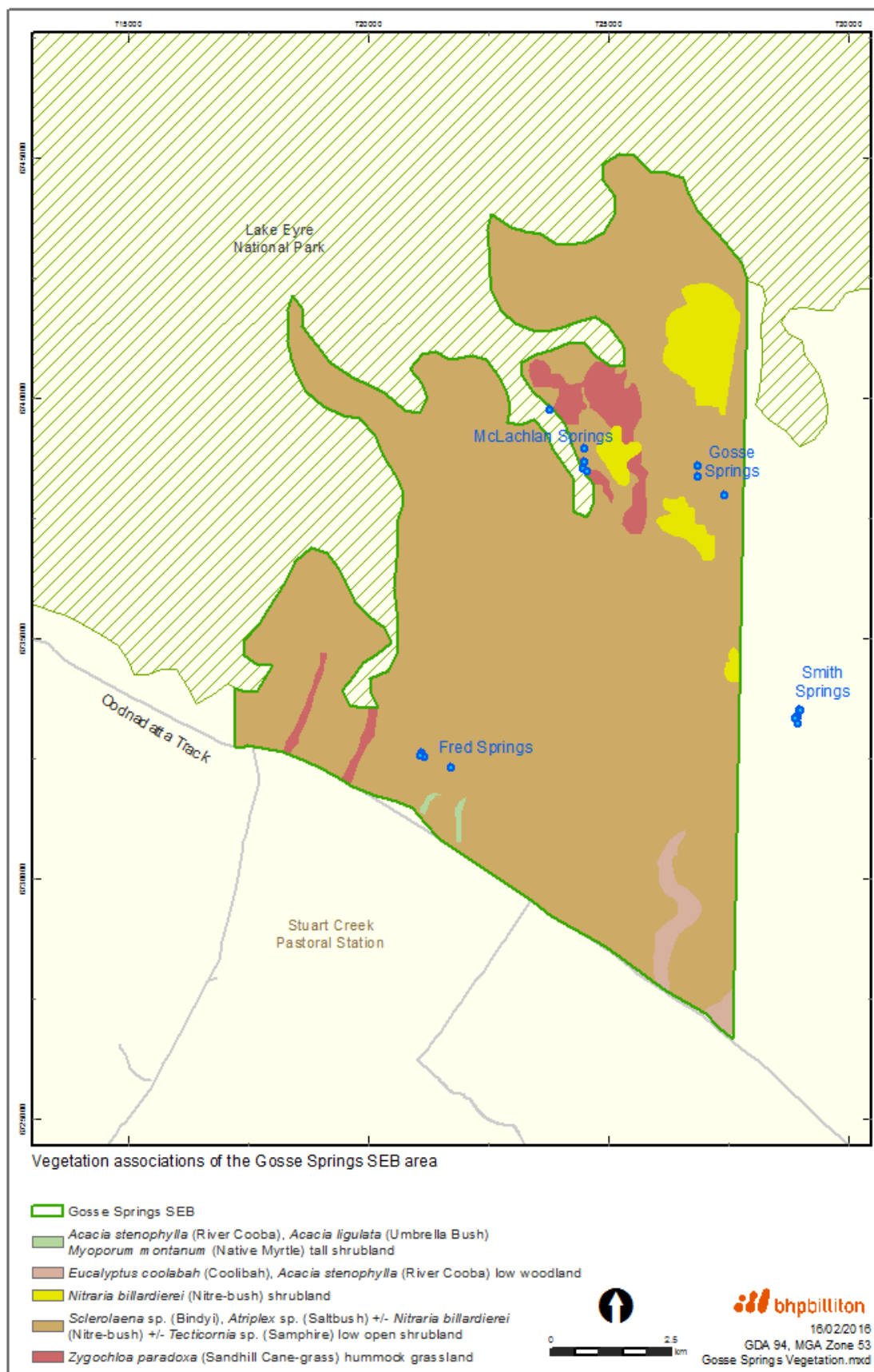


Figure 6.1: Gosse Springs SEB area vegetation associations



## 7 APPENDIX C: PROPOSED SEB AREAS

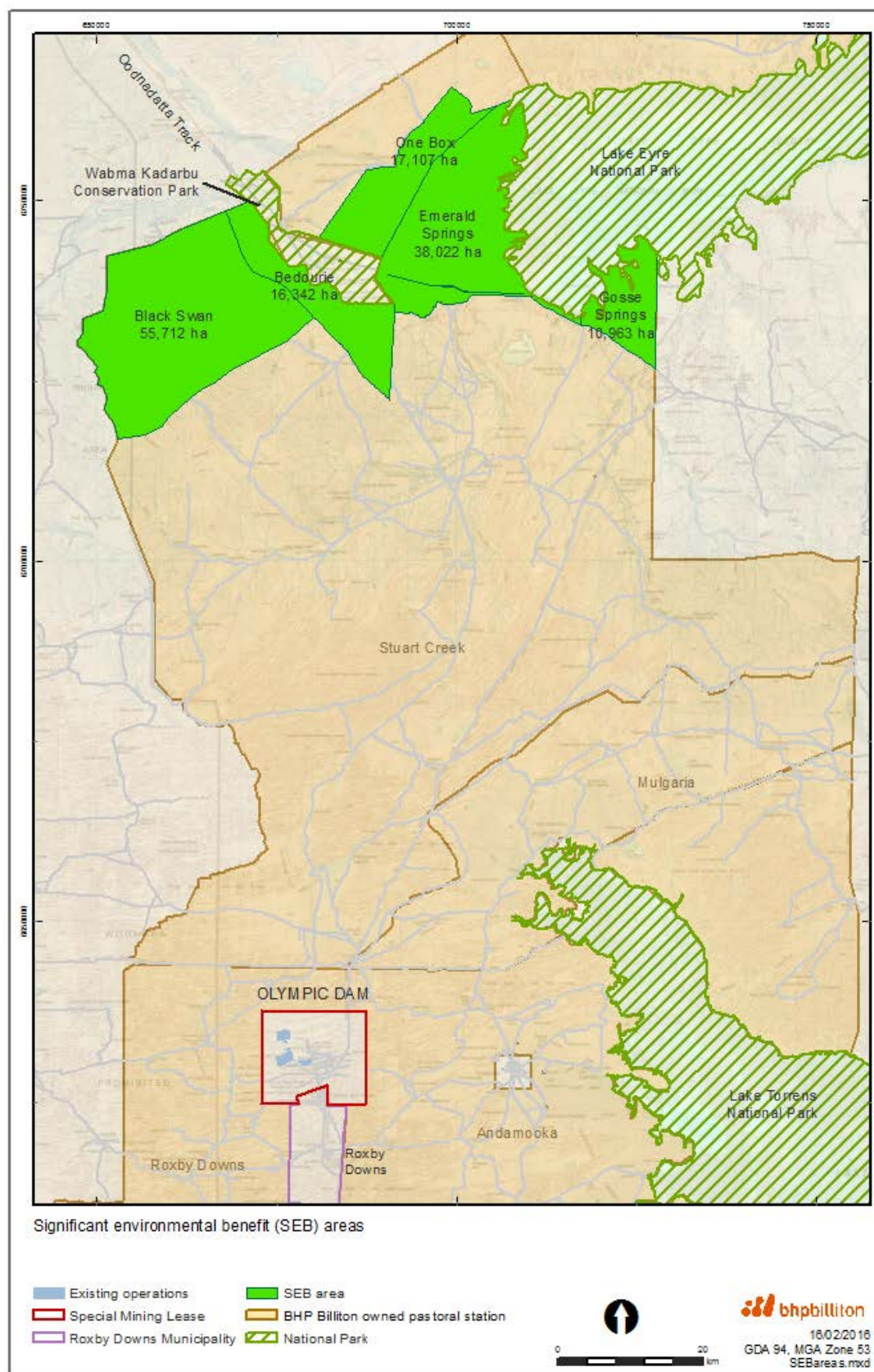


Figure 7.1: SEB offset areas

## 8 APPENDIX D: AT-RISK FLORA SPECIES LIST

Table 8.1: At-risk flora species list

Common name	Scientific name	Well-fields	OD leases	OD region	Transmission line *	EPBC	IUCN	NPW (SA)	DEWNR Regional Species	Species category	Comments
Flora											
Hill Lantern-bush	<i>Abutilon cryptopetalum</i> ssp. <i>cryptopetalum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Dwarf Lantern-bush	<i>Abutilon fraseri</i> ssp. <i>diplotrichum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Plains Lantern-bush	<i>Abutilon halophilum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Scrambling Lantern-bush	<i>Abutilon malvaefolium</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Mulga	<i>Acacia aneura</i>	✓	✓	✓	✓	-	-	-	-	2	Regionally significant. Six variants.
	<i>Acacia</i> sp. Blyth Range (W.V.Fitzgerald s.n. 1898)					-	-	-	R	2	DEWNR records in the Roxby Region.
Northern Myall	<i>Acacia calcicola</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Desert Mulga	<i>Acacia minyura</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Western Myall	<i>Acacia papyrocarpa</i>		✓	✓	✓	-	-	-	-	2	Regionally significant. Are long lived and very slow growing – can take 75 years to mature.
Bastard Mulga	<i>Acacia sibirica</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Sweet Wattle	<i>Acacia suaveolens</i>			✓	✓ ?			V	-	2	DEH record from Purple Downs Station within 5km of transmission line.
Steel Bush	<i>Acacia tarcuensis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Elegant Wattle	<i>Acacia victoriae</i> ssp. <i>victoriae</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bullock Bush	<i>Alectryon oleifolius</i> ssp. <i>canescens</i>	✓	✓	✓	✓	-	-	-	-	2	Regionally significant – can regenerate from root suckers. Life span of approximately 600 years.
Narrow-leaf Joyweed	<i>Alternanthera angustifolia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Jerry-jerry	<i>Ammannia multiflora</i>					-	-	-	R	2	DEWNR records in the Roxby Region.

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Long Grey-beard Grass	<i>Amphipogon caricinus</i> var. <i>caricinus</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Smooth Angianthus	<i>Angianthus glabratus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Creeping Cress	<i>Arabidella procumbens</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Yellow Three-awn	<i>Aristida anthoxanthoides</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Feather-top Wire-grass	<i>Aristida latifolia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Aristida nitidula	<i>Aristida nitidula</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Curly Mitchell-grass	<i>Astrebla lappacea</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Pointed Saltbush	<i>Atriplex acutibractea</i> ssp. <i>acutibractea</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Eichler's Saltbush	<i>Atriplex eichleri</i>			✓		-	-	R	-	2	Specimen from New Years Gift Bore (Stuart Creek Station). Gibber habitat. Possibly on SML.
	<i>Atriplex incrassata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Atriplex intermedia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Koch's Saltbush	<i>Atriplex kochiana</i>		✓	✓		-	-	V	-	2	Many locations from OD region including Andamooka, <b>Arid Recovery</b> . Possibly on SML also.
Baldoo	<i>Atriplex lindleyi</i> ssp. <i>conduplicata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Corky Saltbush	<i>Atriplex lindleyi</i> ssp. <i>inflata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Lagoon Saltbush	<i>Atriplex suberecta</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Atriplex turbinata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Desert Cucumber	<i>Austrobryonia micrantha</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Common Wallaby-grass	<i>Austrodanthonia caespitosa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Tall Spear-grass	<i>Austrostipa nodosa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Club Spear-grass	<i>Austrostipa nullanulla</i>					-	-	V	R	2	DEWNR records in the Roxby Region.
Rough Spear-grass	<i>Austrostipa scabra</i> ssp. <i>scabra</i>					-	-	-	R	2	DEWNR records in the Roxby Region.



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Spreading Saltbush	<i>Atriplex pseudocampanulata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Kidney-fruit Saltbush	<i>Atriplex quinii</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Wild Stock	<i>Blennodia pterosperma</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Hairy-edged Arm-grass	<i>Brachiaria notochthona</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Brachyscome eriogona</i>			✓		-	-	R	-	2	Records from Andamooka Opal Fields/Township.
Smooth Daisy	<i>Brachyscome trachycarpa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Desert Blue-grass	<i>Bothriochloa ewartiana</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Red-leg Grass	<i>Bothriochloa macra</i>			✓		-	-	R	-	2	DENR records from Andamooka Station. Numerous specimens found interstate.
Winged Bulbine-lily	<i>Bulbine alata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Bulbostylis barbata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Bulbostylis turbinata</i>				✓	-	-	-	-	2	Condition 144, SA Govt. Gazette, vegetation types that are likely to support threatened species.
Two-seed Purslane	<i>Calandrinia disperma</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Tiny Purslane	<i>Calandrinia pumila</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Round-leaf Parakeelya	<i>Calandrinia remota</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bead Purslane	<i>Calandrinia sphaerophylla</i>				✓	-	-	-	-	2	Condition 144, SA Govt. Gazette vegetation types that are likely to support threatened species.
Matted Water Starwort	<i>Callitriche sonderi</i>			✓		-	-	R	-	2	Specimen from old homestead ruins (Stuart Creek Station). Creek bed habitat – unlikely to be on SML or ML.
Northern Cypress Pine	<i>Callitris glaucophylla</i>		✓	✓	✓	-	-	-	-	2	Regionally significant. Long-lived, with extremely infrequent regeneration. Significant stabilisers of dune systems.
Woolley-headed Burr-daisy	<i>Calotis multicaulis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.

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Woolley-headed Burr-daisy	<i>Calotis plumulifera</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Channel Burr-daisy	<i>Calotis porphyroglossa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Dryland Centrolepis	<i>Centrolepis eremica</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Woolly Cloak-fern	<i>Cheilanthes lasiophylla</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Cottony Goosefoot	<i>Chenopodium curvispicatum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Windmill Grass	<i>Chloris truncata</i>					-		-	R	2	DEWNR records in the Roxby Region.
Desert Lime	<i>Citrus glauca</i>			✓	✓	-	-	V	-	2	Isolated occurrences recorded within transmission line corridor (BHP Billiton, 2009) and south-east of Olympic Dam. Found interstate at numerous locations.
Silver Bindweed	<i>Convolvulus crispifolius</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Silver Bindweed	<i>Convolvulus eyreanus</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Convolvulus recurvatus ssp. nullarborensis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Sieber Crassula	<i>Crassula sieberiana</i>		✓	✓		-	-	E	-	2	Specimens recorded on ML and Stuart Creek Station. Open woodland habitat – likely to also exist on the SML. Numerous specimens found interstate.
Dense Crassula	<i>Crassula colorata</i> var. <i>acuminata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bluebush Daisy	<i>Cratystylis conocephala</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Murray Lily	<i>Crinum flaccidum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Tall Scurf-pea	<i>Cullen australasicum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Prostate Scurf-pea	<i>Cullen discolor</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Cullen graveolens</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
White scurf-pea	<i>Cullen pallidum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Spreading Scurf-pea	<i>Cullen patens</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Mother-of-misery	<i>Cuphonotus humistratus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Umbrella Flat-sedge	<i>Cyperus alterniflorus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.

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Downs Flat-sedge	<i>Cyperus bifax</i>	✓				-	-	R	-	2	DEWNR records from Stuart Creek Station. Numerous populations interstate.
Bulbous Flat-sedge	<i>Cyperus bulbosus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Cyperus iria</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Yelka	<i>Cyperus victoriensis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Zig-zag Bitter-pea	<i>Daviesia pectinata</i>				✓	-	-	R	-	2	Recorded within transmission line corridor (BHP Billiton, 2009). Found at multiple locations interstate.
Showy Speedwell	<i>Derwentia decorosa</i>			✓				R		2	DEWNR record from Andamooka Station. Numerous records from other areas within SA. Not directly impacted by operations.
Silky Blue-grass	<i>Dichanthium sericeum</i> <i>ssp. sericeum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Woolly Sand-sage	<i>Dicrastylis beveridgei</i> <i>var. lanata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Spider Grass	<i>Digitaria ammophila</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Spider Grass	<i>Digitaria coenicola</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Dimorphocoma minutula</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Dissocarpus fontinalis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Lobed-leaf hop-bush	<i>Dodonaea lobulata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Brilliant Hop-bush	<i>Dodonaea microzyga</i> <i>var. microzyga</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Pituri	<i>Duboisia hopwoodii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Globular Crumbweed	<i>Dysphania glomulifera</i> <i>ssp. glomulifera</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Flat-fruit Crumbweed	<i>Dysphania platycarpa</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Climbing Saltbush	<i>Einadia nutans</i> ssp. <i>nutans</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Pale Spike-rush	<i>Eleocharis pallens</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Water Wort	<i>Elatine gratioloides</i>			✓		-	-	R		2	Specimen recorded at Wimbrinna Dam (Stuart Creek Station). Also found interstate and overseas.

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Flat Spike-rush	<i>Eleocharis plana</i>				✓	-	-	R	-	2	Condition 144, SA Govt. Gazette, vegetation types that are likely to support threatened species.
Smooth Ruby Saltbush	<i>Enchylaena tomentosa</i> <i>var. glabra</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Tall Bottle-washers	<i>Enneapogon intermedius</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Black-head Grass	<i>Enneapogon nigricans</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Umbrella Grass	<i>Enteropogon acicularis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Umbrella Grass	<i>Enteropogon ramosus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Neat Love-grass	<i>Eragrostis basedowii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Woollybutt	<i>Eragrostis lanipes</i>					-	-	-	V	2	DEWNR records in the Roxby Region.
Small Love-grass	<i>Eragrostis pergracilis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Eremophila decussata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Turkey-bush	<i>Eremophila deserti</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Macdonnell's Emubush	<i>Eremophila macdonnellii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Spotted Emubush	<i>Eremophila maculata</i> <i>ssp. maculata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Opposite-leaved Emubush	<i>Eremophila oppositifolia</i> <i>ssp. oppositifolia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Eremophila pentaptera</i>					-	-	R	V	2	DEWNR records in the Roxby Region.
Three-awn Wanderrie	<i>Eriachne aristidea</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Swamp Wanderrie	<i>Eriachne ovata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Salt Pipewort	<i>Eriocaulon carsonii</i>	✓				E	-	E	-	1a	Extremely limited distribution. Largest single population at Hermit Hill Spring complex within the Wellfield region.
	<i>Fimbristylis ferruginea</i>					-	LC	-	R	2	DEWNR records in the Roxby Region.
Northern River Red Gum	<i>Eucalyptus camaldulensis</i> <i>ssp. arida</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Coolibah	<i>Eucalyptus coolabah</i>					-	-	-	V	2	DEWNR records in the Roxby Region.

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	<i>Eucalyptus socialis ssp. eucentrica</i>					-		-	NE	2	DEWNR records in the Roxby Region.
Wheeler's Spurge	<i>Euphorbia wheeleri</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Sea-heath	<i>Frankenia cupularis</i>	✓		✓		-	-	R		2	Specimen from Blower Waterhole (Stuart Creek Station) and Coward Springs reserve. Found interstate.
	<i>Frankenia plicata</i>			✓		E		V		2	Several DEWNR locations in eastern area of Andamooka Station. Not directly impacted by operations.
Western Tarvine	<i>Gilesia biniflora</i>			✓		-	-	R	NT	2	Specimens recorded in the Roxby Downs region in 2011. Found in other regional areas in SA.
Silky Glycine	<i>Glycine canescens</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Native Liquorice	<i>Glycyrrhiza acanthocarpa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Serrated Goodenia	<i>Goodenia cycloptera</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Silky Goodenia	<i>Goodenia fascicularis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Goodenia modesta</i>					-		-	R	2	DEWNR records in the Roxby Region.
Cut-leaf Goodenia	<i>Goodenia pinnatifida</i>					-		-	R	2	DEWNR records in the Roxby Region.
Small-flower Goodenia	<i>Goodenia pusilliflora</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Gratwickia monochaeta</i>				✓	-	-	R	-	2	Recorded within transmission line corridor (BHP Billiton, 2009). Specimens elsewhere in SA region.
Honeysuckle Grevillea	<i>Grevillea juncifolia ssp. juncifolia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Green Pigface	<i>Gunniopsis septifraga</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bushy Wheel-fruit	<i>Gyrostemon ramulosus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Twin-leaf Pigface	<i>Gunniopsis zygophylloides</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Common Heliotrope	<i>Heliotropium europaeum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Sand Indigo	<i>Indigofera psammophila</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Iseilema eremaeum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.

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Small Flinders-grass	<i>Iseilema membranaceum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Red Flinders-grass	<i>Iseilema vaginiflorum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Grass Cushion	<i>Isoetopsis graminifolia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Southern Club-rush	<i>Isolepis australiensis</i>					-		-	NT	2	DEWNR records in the Roxby Region.
Inland Rush	<i>Juncus aridicola</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Toad rush	<i>Juncus bufonius</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Fleshy Kippistia	<i>Kippistia suaedifolia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Davenport Daisy	<i>Lawrencella davenportii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Wires-and-wool	<i>Lemooria burkittii</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Fine-leaf Peppergrass	<i>Lepidium sagittulatum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Small-fruit Water-mat	<i>Lepilaena bilocularis</i>					-	-	-	V	2	DEWNR records in the Roxby Region.
	<i>Leptorhynchos baileyi</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Hoary Sunray	<i>Leucochrysum molle</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Lesser Loosestrife	<i>Lythrum hyssopifolia</i>					-	LC	-	R	2	DEWNR records in the Roxby Region.
Short-leaf Bluebush	<i>Maireana brevifolia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Hairy Fissure-plant	<i>Maireana ciliata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Crown Fissure-plant	<i>Maireana coronata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Lobed Bluebush	<i>Maireana lobiflora</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Swamp Bluebush	<i>Maireana microcarpa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Salt Bluebush	<i>Maireana oppositifolia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Hairy Bluebush	<i>Maireana pentagona</i>		✓	✓		-	-	R	-	2	Recorded in a canegrass swamp near Borefield Road and at Stuart Creek Station. Commonly found in Atriplex vesicaria communities and open woodland.
Split-fruit Bluebush	<i>Maireana schistocarpa</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Silky Bluebush	<i>Maireana villosa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.

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Slender Soft-horns	<i>Malacocera gracilis</i>			✓	✓	-	-	V	R	2	Recorded within transmission line corridor (BHP Billiton, 2009). Recorded on Andamooka Station.
Swayback Nardoo	<i>Marsilea exarata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Inland Paper-bark	<i>Melaleuca glomerata</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Boree	<i>Melaleuca xerophila</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Fairy Spectacles	<i>Menkea australis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Broad-leaf Millotia	<i>Millotia myosotidifolia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Creeping Monkey-flower	<i>Mimulus repens</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Murchisonia volubilis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Native Myrtle	<i>Myoporum montanum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
False Sandalwood	<i>Myoporum platycarpum</i> <i>ssp. platycarpum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Red Milfoil	<i>Myriophyllum verrucosum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Window Mulga-grass	<i>Neurachne munroi</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Large Adder's-tongue	<i>Ophioglossum polyphyllum</i>				✓	-	-	R	-	2	Recorded within transmission line corridor (BHP Billiton, 2009).
Australian Broomrape	<i>Orobancha cernua</i> var. <i>australiana</i>	✓				-	-	R	-	2	Found in other SA regions, interstate and overseas. Specimen from near Marree.
Hairy Panic	<i>Panicum effusum</i> var. <i>effusum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Panicum laevinode</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Peplidium aithocheilum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Dwarf Peplidium	<i>Peplidium foecundum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Butterfly Bush	<i>Petalostylis labicheoides</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Downy Cress	<i>Phlegmatospermum cochlearinum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Spreading Cress	<i>Phlegmatospermum eremaeum</i>			✓	✓			R		2	Spread widely throughout state. Recorded in locations north of Olympic Dam to Moomba.

Common name	Scientific name	Well-fields	OD leases	OD region	Transmission line *	EPBC	IUCN	NPW (SA)	DEWNR Regional Species	Species category	Comments
Desert Riceflower	<i>Pimelea simplex</i> ssp. <i>simplex</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Spiked Riceflower	<i>Pimelea trichostachya</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
White Rochelia	<i>Plagiobothrys plurisepaleus</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Many-stem Plantain	<i>Plantago multiscapa</i>					-	-	V	R	2	DEWNR records in the Roxby Region.
	<i>Pluchea rubelliflora</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Grey Copper-wire Daisy	<i>Podolepis canescens</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Striated Mintbush	<i>Prostanthera striatiflora</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Small-leaf Mulla Mulla	<i>Ptilotus parvifolius</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Smooth Buttercup	<i>Ranunculus pentandrus</i> var. <i>platycarpus</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Ferny Buttercup	<i>Ranunculus pumilio</i> var. <i>pumilio</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Annual Buttercup	<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Pigmy Daisy	<i>Rhodanthe pygmaea</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bush Bean	<i>Rhyncharrhena linearis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Pink Tongues	<i>Rostellularia adscendens</i> var. <i>pogonanthra</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Widgeon Grass	<i>Ruppia polycarpa</i>					-	LC	-	V	2	DEWNR records in the Roxby Region.
Quandong	<i>Santalum acuminatum</i>		✓	✓	✓	-	-	-		2	Regionally significant – locally uncommon species with cultural significance.
Sandalwood	<i>Santalum spicatum</i>		✓	✓	✓	-	-	V	NT	2	Recorded within transmission line corridor (BHP Billiton, 2009) and north of Olympic Dam. Specimens on pastoral leases.
Inland Club-rush	<i>Schoenoplectus dissachanthus</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Black's Bindyi	<i>Sclerolaena blackiana</i>			✓			-	R	-	2	Recorded at Coward Cliffs, Stuart Creek Station.
Smooth Bindyi	<i>Sclerolaena glabra</i>					-	-	-	R	2	DEWNR records in the Roxby Region.



Common name	Scientific name	Well-fields	OD leases	OD region	Transmission line *	EPBC	IUCN	NPW (SA)	DEWNR Regional Species	Species category	Comments
Pearl Bindyi	<i>Sclerolaena limbata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Small-flower Bindyi	<i>Sclerolaena parviflora</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Four-leaf Deasert Senna	<i>Senna artemisioides ssp. quadrifolia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Setaria reflexa</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Twin-leaf Desert Senna	<i>Senna artemisioides ssp. zygophylla</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Curved-leaf Senna	<i>Senna cardiosperma ssp. microphylla</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Setaria basicalada</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Clement's Paspalidium	<i>Setaria clementii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Diel's Pigeon-grass	<i>Setaria dielsii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Tall Sida	<i>Sida calyxhymentia</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Sida spodochroma</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Shy Nightshade	<i>Solanum cleistogamum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Quena	<i>Solanum esuriale</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Lagoon Nightshade	<i>Solanum lacunarium</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Flannel Bush	<i>Solanum lasiophyllum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Yakka Grass	<i>Sporobolus caroli</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Rail-tail Couch	<i>Sporobolus mitchellii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Velvet Thread-petal	<i>Stenopetalum velutinum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Violet Swainson-pea	<i>Swainsona adenophylla</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Swainsona campylantha</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Wild Violet	<i>Swainsona microcalyx</i>			✓	✓	-	-	R	NT	2	Recorded within transmission line corridor (BHP Billiton, 2009). Populations also found interstate.
Small-Flower Swainson-pea	<i>Swainsona minutiflora</i>	✓		✓		-	-	V	-	2	Specimen from Priscilla Springs (Stuart Creek Station).

Common name	Scientific name	Well-fields	OD leases	OD region	Transmission line *	EPBC	IUCN	NPW (SA)	DEWNR Regional Species	Species category	Comments
	<i>Swainsona oligophylla</i>			✓		-	-	R	-	2	Specimen from horse springs (Stuart Creek Station). Also found in other SA regions and interstate.
Dwarf Swainson-pea	<i>Swainsona phacoides</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Purple Swainson-pea	<i>Swainsona purpurea</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Orange Swainson-pea	<i>Swainsona stipularis</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Swainsona tenuis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Synaptantha tillaeacea</i> <i>var. hispidula</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Tecticornia disarticulata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Grey Samphire	<i>Tecticornia halocnemoides</i> ssp. <i>halocnemoide</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
	<i>Tecticornia indica</i> ssp. <i>bidens</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Black-seed Samphire	<i>Tecticornia pergranulata</i> ssp. <i>pergranulata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Bluish Samphire	<i>Tecticornia pruinosa</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Broombush Templetonia	<i>Templetonia egena</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Kangaroo Grass	<i>Themeda triandra</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Inland Fringe-lily	<i>Thysanotus exiliflorus</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Narrow-leaf Bulrush	<i>Typha domingensis</i>					-	LC	-	R	2	DEWNR records in the Roxby Region.
Window Mulga-grass	<i>Thyridolepis mitchelliana</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Thyridolepis multiculmis</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Mallee Fringe-lily	<i>Thysanotus baueri</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Spiky Caltrop	<i>Tribulus hystrix</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Spinifex	<i>Triodia irritans</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Rough New Holland Daisy	<i>Vittadinia pterochaeta</i>					-	-	-	R	2	DEWNR records in the Roxby Region.

Common name	Scientific name	Well-fields	OD leases	OD region	Transmission line *	EPBC	IUCN	NPW (SA)	DEWNR Regional Species	Species category	Comments
Furrowed New Holland Daisy	<i>Vittadinia sulcata</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
Dryland Bluebell	<i>Wahlenbergia aridicola</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Annual Bluebell	<i>Wahlenbergia gracilentia</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Green-flower Nancy	<i>Wurmbea citrina</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Zygophyllum aurantiacum</i> ssp. <i>cuneatum</i>					-	-	-	NT	2	DEWNR records in the Roxby Region.
	<i>Zygophyllum aurantiacum</i> ssp. <i>simplicifolium</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Thick Twinleaf	<i>Zygophyllum crassissimum</i>					-	-	R	R	2	DEWNR records in the Roxby Region.
Pale Twinleaf	<i>Zygophyllum glaucum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Clasping Twinleaf	<i>Zygophyllum howittii</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Small Fruit Twinleaf	<i>Zygophyllum humillimum</i>	✓		✓		-	-	R		2	Specimen from Stuart Creek Station. Also found in other SA regions and interstate.
Violet Twinleaf	<i>Zygophyllum iodocarpum</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Square-fruit Twinleaf	<i>Zygophyllum marliesiae</i>					-	-	-	R	2	DEWNR records in the Roxby Region.
Ecological communities											
	The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	✓				E (TEC)	-	-	-	1a	Includes a number of species of endemic aquatic invertebrates.
Mulga Woodlands	<i>Acacia aneura</i>		✓	✓	✓	-	-	-	-	2	Relatively common throughout northern South Australia.

✓ = Species recorded within Olympic Dam, Wellfields region or transmission line corridor.

Letters under column EPBC, and NPW (SA) and DEWNR regional species columns represent the category of threat listed in the Environment Protection and Biodiversity Conservation Act 1999, and the National Parks and Wildlife Conservation Act 1972 (species listed as at 1625/0511/20131) and the Department of Environment, Water and Natural Resources Regional Species Conservation Assessment Project, Outback Region, Technical Report 2013.

CR = Critically Endangered  
Threatened ecological community

E = Endangered

V = Vulnerable

R = Rare

NT = Near Threatened

LC = Least Concern

TEC =

\* Records of species located within the transmission corridor between the Roxby Downs Municipality and the Davenport Substation at Port Augusta have been sourced from internal databases and BHP Billiton (2009). Species include those recorded within 5 km of the transmission line (DEIS)

## 9 APPENDIX E: CLASSIFICATION OF AT-RISK FLORA SPECIES

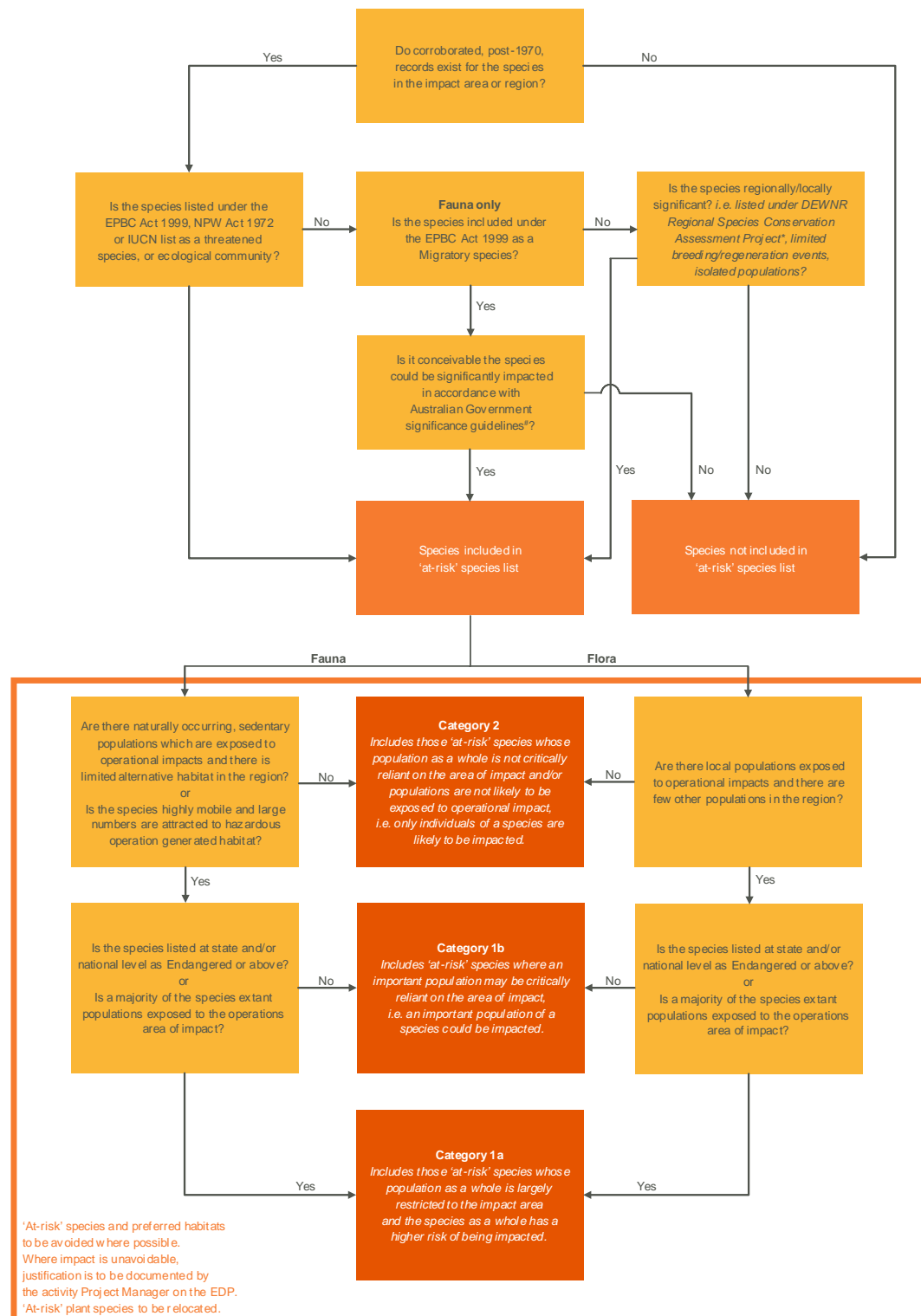


Figure 9.1: Classification of at-risk flora species