

# Salt Water Gully Downstream

# **Reconnaissance Flora and Vegetation Survey**

Prepared for Talison Lithium Australia 29 June 2023



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# **EXECUTIVE SUMMARY**

Talison Lithium Australia (Talison) currently operates a lithium mine at Greenbushes, situated approximately 250 km south of Perth in south-west Western Australia. Talison is proposing to increase output from the Greenbushes Mine and require additional water storage options that include construction of the Salt Water Gully (SWG) Dam. Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned by Talison to undertake a reconnaissance flora and vegetation survey of the downstream environment along Salt Water Gully to inform studies and environmental modelling of potential impacts on flora and habitat in support of approvals, and environmental management more broadly.

The flora and vegetation survey was completed by a Principal Botanist between the 5<sup>th</sup> and 7<sup>th</sup> of May 2023. A total number of 99 plant taxa (including varieties and subspecies) from 34 families and 76 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Myrtaceae, Poaceae, Cyperaceae, Proteaceae, Asteraceae and Juncaceae families. The most speciose genus was *Acacia*, followed by *Bossiaea*, *Eucalyptus, Juncus* and *Kennedia*.

None of the plant taxa recorded from the study area were listed as Threatened Flora under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the Western Australian *Biodiversity Conservation Act 2016* (BC Act). Additionally, no species were listed as Priority flora by the Department of Biodiversity Conservation and Attractions (DBCA) or were considered to represent significant range extensions.

The total flora included 28 introduced plant species, including four species listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act).

Four native vegetation types were described and mapped from the study area. None of the vegetation types were aligned with any Commonwealth or State listed Threatened Ecological Communities (TECs) or State listed Priority Ecological Communities (PECs).

Vegetation condition across the largest proportion of the study area was rated as completely degraded (60% of the study area) or degraded (36% of the study area), with lateritic hill slopes supporting Jarrah and Marri woodland and forest rated as good (4% of the study area). The major disturbances were related to clearing for plantation timber and farmland, historical grazing of remnant native vegetation by domestic stock, harvesting of hardwood timber, edge effects around cleared farmland and plantation timber, and elevated weed loading.

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# 1.0 INTRODUCTION

## 1.1 Preamble

Talison is a Western Australian mining company with operations based adjacent to the town of Greenbushes in south-west Western Australia. The Greenbushes Mine is located approximately 250 km south of Perth and 80 km south-east of the port of Bunbury (Figure 1). The site comprises a number of open cut mining operations for tantalum, tin and spodumene (lithium). An underground tantalum operation has also been developed but is currently under care and maintenance. The Greenbushes pegmatitie is the world's largest hard rock tantalum resource and the largest and highest-grade lithium minerals resource in the world. Minerals produced at Talison's Greenbushes Mine can be found in many different applications including mobile phones, computers, surgical implants, electronic devices, glassware, ceramics and batteries.

Talison has recently commenced an expansion at the Greenbushes Mine aimed at increasing supply of lithium to the world market. Longer term mine planning has identified the requirement for additional water storage options. To support environmental approvals, Onshore Environmental was commissioned by Talison to undertake a reconnaissance flora and vegetation survey downstream of the proposed SWG Dam to inform studies and environmental modelling of potential impacts on flora and habitat in support of approvals, and environmental management more broadly (Figure 1).

The study area encompasses a mixture of freehold farmland and Vacant Crown Land (VCL) managed by the DBCA.

## 1.2 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of the Environment and Energy 2013). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System. The study area is located within the Southern Jarrah Forest (JF2) sub-region within the Jarrah Forest bioregion but is close to the border of the Northern Jarrah Forest sub-region. The Southern Jarrah Forest sub-region is described as "Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. The climate is Warm Mediterranean" (Hearn et al. 2002). The vegetation of the sub-region is described as "Jarrah-Marri forest in the west grading to Marri and Wandoo woodlands in the east. There are extensive areas of swamp vegetation in the south-east, dominated by Paperbarks and Swamp Yate. The understorey component of the forest and woodland reflects the more mesic nature of this area. Much of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions" (Hearn et al. 2002).



## 1.3 Climate

The study area occurs on a boundary between the dry Mediterranean region to the north which experiences six dry months per year, and the moderate Mediterranean region to the south which experiences four dry months per year (Beard 1981). The Greenbushes region has cool wet winters and hot dry summers. Average annual rainfall for the nearby town of Bridgetown is 730.7 mm (approximately 10 km southeast of the study area) (Bureau of Meteorology [BOM] 2023), with most falls occurring during the winter months of June and July associated with cold fronts moving across the south-west of Western Australia.

The rainfall at Bridgetown for the four-month autumn period prior to the early May 2023 field survey was 107.4 mm, compared to the long-term average of 101.7 mm (Figure 2). Despite not being within the recommended spring period, seasonal conditions were rated as good for autumn 2023.



# Figure 2 Rainfall and temperature data from the Bridgetown Weather Station (Bureau of Meteorology 2023).

## 1.4 Land Use

The major land uses in the Greenbushes region are state forest, residential, mining and agriculture. The study area intersects a mixture of privately owned farmland, a small portion of the Greenbushes State Forest, and road reserve along the South Western Highway. Nearby towns include Bridgetown (approximately 10 km to the south-east) and Balingup (approximately 10 km to the north-west).

## 1.4.1 Agriculture and Associated Industry

Bridgetown is the oldest town in the south-west of Western Australia. It was first settled by sheep farmers E. Hester and John Blechyden in 1857. The Bridgetown Agricultural Society was formed in 1885 and by this time the area had a well-established agricultural industry, including sheep, cattle, dairy products, timber, fruit and nuts. In 1889 the railway line was extended to Bridgetown allowing the expansion of the fruit and timber markets. Many of these agricultural industries are still operational with wineries and olive farms also established in the area.

#### 1.4.2 Mining

The Greenbushes Mine is situated on the oldest mining tenement in Western Australia and has a long history of mining activities dating back to 1888. Tin was first reported in 1886 in a Government geological survey, and mining commenced in 1888. Since it was first discovered, tin has been mined almost continuously in the Greenbushes area, although lower tin prices and emergence of tantalum as a major revenue earner have relegated tin to the position of a by-product. The presence of tantalite was noted as far back as 1893 but at that time the mineral had no value in its own right and was seen as a nuisance because it downgraded the value of tin. Open cut mining began to be practiced on a small scale in the 1900s however much of the tin mined in the early years by small operators came from underground workings to access weathered pegmatite below the caprock. Shafts were blasted in the surface rock and tunnels dug out into the tin bearing alluvium. The dirt was hauled to the surface and stockpiled during the summer months then puddled and sluiced in winter when there was an abundance of water. Tin mining continued more or less as a cottage industry under the control of many small mining companies up to the early 1960s when, for the first time, a major mining company became involved in the tinfields.

For several years a dredge was used to recover surface deposits of tin and tantalum. By 1970 alluvial resources were dwindling and it was necessary to increase exploration activity. As a direct result of this work development of the weathered pegmatite commenced in 1974. This tin/tantalum source sustained the operation until 1992. Small parcels of tantalite were sold occasionally, but it was not until 1944, when war had stimulated interest in the element tantalite, that the mineral began to be produced steadily for use in telecommunications, electronics and radar equipment.

Spodumene, the major lithium mineral, was first identified by the Western Australian Government Survey in 1949 from a specimen collected in 1928 which was initially thought to be feldspar. During the extensive diamond drilling programme for tantalum that took place between 1977 and 1980, substantial spodumene rich zones were identified. Later drilling confirmed the existence of the richest spodumene ore body ever discovered, with resources sufficient to maintain production well into the 21st Century. However, being a new product, markets had to be developed, so it was not until 1983 that the initial development of the lithium ore body at Greenbushes commended, and the first lithium processing plant was commissioned in 1985. Since that time, the lithium processing plant has been expanded several times to produce a range of lithium concentrates, with the most recent expansion of the Greenbushes operations occurring in 2012. The Greenbushes Mine is currently undergoing a significant expansion.

#### 1.4.3 Tourism

Tourism is the other major industry in the area with the scenery, historical sites, wineries, and galleries serving as the major attractions. Events such as the annual Blues at Bridgetown Festival also draw large numbers of people to the area.

## 1.5 Landforms, Soils

Tille (1996) has mapped soils of the Wellington-Blackwood District, which includes the town sites of Greenbushes and Bridgetown on its southern boundary. The study area occurs within the Hester Sub-system of the Darling Plateau System, and consists of undulating ridges and hill crests formed on laterite and gneiss which typically slope downwards off the main plateau into the surrounding Lowden Valleys System. The soils are mostly loamy gravels, sandy gravels and loamy earths.

The geology of the Greenbushes area is described as Archean granite of the Yilgarn Block (Wilde and Walker 1982) and the major soil types have been mapped by Tille (1961). The study area intersects two subsystems, all of the Darling Plateau system within the Western Darling Range zone:

- Balingup subsystem (BL) moderately incised major valleys with sands and sandy gravels; and
- Yarragil (YG) minor valleys in lateritic terrain with gentle to low slopes and swampy floors. Soils are mainly loamy gravels and sandy gravels with some loamy earths and deep sands.

## 1.6 Flora and Vegetation

The study area occurs in the Menzies Sub-district of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies Sub-district (southern jarrah forest) covers a total area of 26,572 km<sup>2</sup>, of which 18,715 km<sup>2</sup> (70%) originally supported jarrah and jarrah-marri forest (Beard 1990). It is estimated that approximately 61% of the total area has been cleared since European settlement, mainly in the valleys which are free of laterite, leaving the forest intact on laterised higher plateau levels.

The Menzies Sub-district is characterised by Jarrah stands on laterite within some Marri and Wandoo woodlands. Valley soils are often richer and Blackbutt (*Eucalyptus patens*) is more dominant in these areas. Flooded Gum (*Eucalyptus rudis*) is common along stream banks and Bullich (*Eucalyptus megacarpa*) is also present in some areas. Within the Greenbushes area vegetation is dominated by Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest over the tall shrubs bull banksia (*Banksia grandis*) and snotty gobble (*Persoonia longifolia*). The lower understorey strata generally contains a range of plant genera including *Hakea*, *Acacia*, *Xanthorrhoea*, *Adenanthos*, *Hovea*, *Leucopogon*, *Macrozamia*, *Leucopogon*, *Bossiaea*, *Daviesia*, *Grevillea*, *Patersonia*, *Styphelia* and *Kennedia*.

A variety of published studies that relate to flora and vegetation of the southern jarrah forest are listed below:

- Distribution and prehistory of karri, jarrah and marri (Churchill 1968);
- Structure and composition of the karri forest around Pemberton (McArthur and Clifton 1975);
- Vegetation mapping of the Manjimup-Pemberton area (Smith 1972);
- Vegetation mapping of the Swan area (Beard 1981, see Figure 3);
- Vegetation mapping of the Darling System (Heddle *et al.* 1980); and

• Vegetation mapping as part of the Regional Forest Agreement (Mattiske and Havel 1998, see Figure 4).

Vegetation complexes of the southern jarrah forest have most recently been defined by Heddle *et al.* (1980) and updated by Mattiske and Havel (1998). Mattiske and Havel (1998) map the study area as occurring within the Grimwade (GR) and Balingup (BL) complexes (Figure 4).



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# 2.0 METHODOLOGY

## 2.1 Legislation and Guidance Statements

The reconnaissance flora and vegetation survey was carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of flora and vegetation in Western Australia:

- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a);
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016b); and
- Statement of Environmental Principles, Factors and Objectives (EPA 2020).

## 2.2 Desktop Assessment

#### 2.2.1 Literature Review

Regional scale reports relevant to the study area locality were reviewed, including:

- a summary of bioregional data (Hearn et al. 2002); and
- vegetation description and mapping by Beard (1981), and more recently by Heddle, Loneragan and Havel (1980), and by Mattiske and Havel (1998).

In addition, there was a review of all publicly available literature and internal reports commissioned and held by Talison. There were 14 flora and vegetation surveys previously completed between 1991 and 2022 in the vicinity of the study area. As part of the desktop review total flora lists for these surveys were reviewed to ensure nomenclature was accurate, consistent and current. The previous survey work is summarised in more detail in Section 3.1.

## 2.2.2 Database Searches

Desktop searches included databases relating to significant flora, TECs and PECs previously collected or described within, or in close proximity to, the study area. The search was extended beyond the study area to place flora values into a local and regional context. The following databases were searched:

- DBCA's Threatened and Priority flora database was searched to confirm the Naturemap results (30 km radial search) (DBCA 2022a);
- DBCA's TEC, PEC and Environmentally Sensitive Areas (ESAs) database was searched to identify significant communities (50 km radial search) (DBCA 2022b);
- Environmental Protection and Biodiversity Conservation (EPBC) Act Protected Matters Database (30 km radial search) (DCCEEW 2022); and
- Atlas of Living Australia (ALA) spatial database search of the study area boundary (ALA 2022).

## 2.2.3 Assessment of Conservation Significance

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

International Level:

• IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1).

Commonwealth Level:

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

State Level:

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

#### Local Level:

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

## 2.2.4 Assessment of Likelihood of Occurrence in the Study Area

A list of conservation significant flora species occurring within a 50 km radius of the study area was compiled during the literature review and database searches. The likelihood of each taxon occurring within the study area was assessed using a set of rankings and criteria (as described in Table 1). The criteria are based on presence of suitable landform (inferred from aerial imagery with contours overlayed, and from knowledge of the adjacent areas) and distance to known records.

| Table 1 | Ranking system used to assign the likelihood that a flora species would |
|---------|---|
|         | occur in the study area.  |

| Rank              | Criteria   |
|-------------------|--|
| Recorded          | The species has been recorded in the study area.   |
| Likely to occur   | The species has previously been recorded from a landform/habitat which is present within the study area, and there are previous records within a 10 km radius of the study area. |
| Possible to occur | The species has previously been recorded from a landform/habitat which is present within the study area, and there are previous records within a 30 km radius of the study area. |
| Unlikely to occur | The landform/habitat from which the species has previously been recorded is absent within the study area.  |

## 2.3 Survey Methodology

## 2.3.1 Timing and Personnel

The reconnaissance flora and vegetation survey was completed by Principal Botanist Dr Jerome Bull between the 5<sup>th</sup> and 7<sup>th</sup> of May 2023.

#### 2.3.2 Relevé Sites

There were 13 relevé sites assessed throughout the study area to increase the accuracy of vegetation mapping and capture additional information on a variety of environmental parameters within the study area. Relevé sites targeted the broad vegetation type present, as well as specific features of geology, soil and landforms.

At each relevé sites there was a record made of the flora, vegetation type, vegetation condition, landform, aspect, soil colour and soil type, rock type, slope (angle), disturbance, and age since fire. Vegetation condition was determined using a recognised rating scale (based on Keighery 1994, see Appendix 2).

#### 2.3.3 Targeted Surveys for Conservation Significant Species

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

Targeted searches were not undertaken within the southern half of the study area where direct access into remnant native vegetation was denied by the private landowner.

## 2.3.4 Weed Survey and Mapping

Introduced species were recorded from the relevé sites assessed within the study area. Opportunistic collections were also made while moving throughout the study area, with targeted weed searches completed in high moisture habitats.

## 2.3.5 Vegetation Type Mapping

The classification of vegetation types within the study area follow the height, life form and density classes of Muir (1997) (see Appendix 3). This is largely a structural classification suitable for broader scale mapping but taking all ecologically significant strata into account.

Vegetation mapping utilised high-resolution aerial photography of the entire study area at a scale of 1:5,000, with definition of vegetation polygons based on contrasting shading patterns. Ground-truthing of the study area was completed during the survey with vegetation descriptions made within selected vegetation polygons to confirm dominant structural layers and associated plant taxa. The 13 relevé sites were overlaid on the aerial photography, and associated flora and vegetation data was used to provide vegetation type descriptions for individual polygons defined.

#### 2.3.6 Vouchering

At least one voucher specimen was taken for each species collected to verify identification. Taxonomy was completed by Dr Jerome Bull at the Western Australian Herbarium (WAH) with use made of the WAH for confirmation of species identification.

## 2.3.7 Field Survey Constraints

The EPA Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2016a) list seven potential limitations that field surveys may encounter. These limitations are addressed in Table 2.

# Table 2Relevance of limitations, as identified by EPA (2016a), to the flora and<br/>vegetation survey.

| Constraint   | Relevance  |  |  |  |  |
|--|--|--|--|--|--|
| Availability of contextual information at a regional and local scale           | There has been 14 previous flora and vegetation surveys completed within state forest adjacent to the study area, providing a comprehensive local database.  |  |  |  |  |
| Proportion of flora<br>recorded and/or collected,<br>any identification issues | A reconnaissance level survey was completed during autumn. The<br>timing likely resulted in the absence of several annual and ephemeral<br>flora (only present during spring). As well, direct access into remnant<br>native vegetation in the southern half of the study area was denied by<br>the private landowner; hence flora within this sector was not intensively<br>surveyed. |  |  |  |  |
| Survey timing, rainfall, season of survey                                      | The field survey was completed in early May 2023 and outside of the recommended primary survey period (spring). Rainfall during the four-<br>month period preceding the field survey was in line with the long-term average.   |  |  |  |  |

| Constraint  | Relevance   |
|---|---|
| Disturbance that may<br>have affected the results<br>of the survey such as fire,<br>flood or clearing                 | There were no disturbances recorded within the study area that<br>influenced survey outcomes. However, disturbances within the study<br>area were widespread and included clearing for annual pasture, access<br>tracks, hardwood logging, historical ground disturbance along SWG, and<br>plantation timber establishment (Pines and Blue Gums). A large<br>proportion of the study area supported vegetation condition rated as<br>degraded or completely degraded. |
| Was the appropriate area fully surveyed (effort and extent)   | One Principal Botanist formally assessed vegetation within 13 relevé<br>sites assessed. This represented an appropriate effort for a<br>reconnaissance level survey.  |
| Access restrictions within the survey area  | The study area was accessed on foot, noting that vegetation mapping<br>was facilitated by high-resolution aerial photography. Access into<br>remnant native vegetation in the southern half of the study area was<br>denied by the private landowner representing a major limitation.<br>Vegetation type was described from boundary assessment and<br>inference.   |
| Competency/experience<br>of the team carrying out<br>the survey, including<br>experience in the<br>bioregion surveyed | The Principal Botanist working on the survey (Dr Jerome Bull) has over 20 years' experience working locally and has completed numerous surveys around Greenbushes since 2012.   |

# 3.0 RESULTS

## 3.1 Desktop Review

#### 3.1.1 Previous Flora Surveys within the study area

The results from previous flora and vegetation surveys completed within close proximity to the study area are presented in Table 3 and summarised below. The 14 surveys have recorded one Threatened Flora taxon and four Priority flora taxa within a 20 km radius of the study area:

- Caladenia harringtoniae (Threatened, Vulnerable);
- Eucalyptus relicta (Priority 2);
- *Melaleuca viminalis* (Priority 2)<sup>1</sup>;
- Tetratheca parvifolia (Priority 3); and
- Acacia semitrullata (Priority 4).

Two species have been identified as occurring outside of their known distribution (i.e. range extensions):

- \*Cyperus involucratus (80 km southeast of nearest known population); and
- *Hybanthus epacroides* (180 km west of nearest known population).

Vegetation types recorded during the previous surveys are not aligned with any Commonwealth or State listed TECs or DBCA listed PECs, and are regarded as well represented and adequately reserved.

The previous surveys have typically recorded a high representation of introduced species within the total flora reflecting heavy logging and related disturbance of the state forest precinct around Greenbushes.

<sup>&</sup>lt;sup>1</sup> Likely introduced through revegetation around the Greenbushes Swimming Pool

#### Table 3 Results from flora and vegetation surveys previously completed within, or in close proximity to, the study area.

| Survey  | Consultant                              | Year | Field Survey Date  | Flora Statistics                            | Significant Flora   | Introduced (Weed) Taxa   |
|---|---|------|--|---|---|--|
| A Flora and Vegetation<br>Survey of Part of the<br>Greenbushes Leases   | Trudgen and<br>Morgan                   | 1991 | 13-14 April 1991   | 91 plant taxa<br>35 families<br>65 genera   | None  | 9 introduced taxa including one<br>Declared Plant listed under the<br>BAM Act; <i>*Rubus</i><br><i>anglocandicans</i> (Blackberry)   |
| Flora and Vegetation Survey<br>Greenbushes Mine Site:<br>Vegetation surrounding south<br>east corner of the TSF | Onshore<br>Environmental<br>Consultants | 2006 | 13 <sup>th</sup> April 2006  | 135 plant taxa<br>37 families<br>97 genera  | None  | 27 introduced taxa including<br>one Declared Plant listed under<br>the BAM Act; <i>*Rubus</i><br><i>anglocandicans</i> (Blackberry)  |
| Bridgetown RWSS Pipelines<br>Millstream Dam to<br>Greenbushes Link Biological<br>Survey                         | AECOM Australia<br>Pty Ltd              | 2010 | Spring 2009  | 86 plant taxa<br>37 families<br>70 genera   | None  | 29 introduced taxa including<br>three Declared Plant listed<br>under the BAM Act; <i>*Rubus</i><br><i>ulmifolius</i> (Blackberry),<br><i>*Asparagus asparadoidies</i><br>(Bridal Creeper), <i>*Echium</i><br><i>plantagineum</i> (Paterson's<br>Curse) |
| Flora and Vegetation Survey<br>Greenbushes Mining Leases  | Onshore<br>Environmental<br>Consultants | 2012 | 13-21 October 2011   | 368 plant taxa<br>73 families<br>208 genera | Caladenia harringtoniae<br>(T); Tetratheca parvifolia<br>(P3)           | 86 introduced taxa including<br>three Declared Plants listed<br>under the BAM Act; *Asparagus<br>asparagoides (Bridal Creeper),<br>*Galium aparine (Goosegrass),<br>*Rubus ulmifolius (Blackberry)   |
| Greenbushes Mining<br>Operations Detailed Flora and<br>Vegetation Survey  | Onshore<br>Environmental<br>Consultants | 2018 | 27 February - 2<br>March and 26<br>September, 4, 16-18<br>October 2018 | 365 plant taxa<br>63 families<br>200 genera | Acacia semitrullata (P4),<br>*Cyperus involucratus<br>(range extension) | 66 introduced taxa, including<br>three Declared Plants listed<br>under the BAM Act; *Asparagus<br>asparagoides (Bridal Creeper),<br>*Rubus anglocandicans<br>(Blackberry) and *Rumex<br>acetosella (Sorrell)   |

| Survey  | Consultant                              | Year  | Field Survey Date   | Flora Statistics                                 | Significant Flora   | Introduced (Weed) Taxa  |
|---|---|-------|---|--|---|---|
| Greenbushes Infrastructure<br>Corridors Detailed Flora and<br>Vegetation Survey                       | Onshore<br>Environmental<br>Consultants | 2019a | 30 July - 6 August<br>and 26-27, 29-30<br>September, 3-4 and<br>18 October 2018 | 280 plant taxa<br>60 families<br>157 genera      | Acacia semitrullata (P4),<br>Melaleuca viminalis (P2),<br>Hybanthus epacroides<br>(range extension) | 45 introduced taxa, including<br>two Declared Plants listed under<br>the BAM Act; *Asparagus<br>asparagoides (Bridal Creeper)<br>and *Rubus anglocandicans<br>(Blackberry)                              |
| Targeted Flora Survey<br>Greenbushes Lithium Mine   | Onshore<br>Environmental<br>Consultants | 2019b | 19-20 September<br>and 10 October<br>2019                                       | Not assessed                                     | Acacia semitrullata (P4)  | Not assessed  |
| Targeted Survey for<br><i>Eucalyptus relicta</i><br>Greenbushes Lithium<br>Operations                 | Onshore<br>Environmental<br>Consultants | 2020  | 20-24 July and 5-15<br>August 2020  | Not assessed                                     | Eucalyptus relicta (P2)   | Not assessed  |
| Detailed Flora and Vegetation<br>Survey Greenbushes Mine<br>Expansion Area 2 and Area 4               | Onshore<br>Environmental<br>Consultants | 2021  | 26 -31 of October<br>2021   | 272 plant taxa, 60<br>families and 162<br>genera | None  | 49 introduced taxa  |
| Greenbushes Proposed<br>Village - Reconnaissance<br>Flora and Vegetation Survey                       | Onshore<br>Environmental<br>Consultants | 2022a | 20 September 2022   | Not recorded                                     | None  | One Declared Plant listed under<br>the BAM Act; <i>*Rubus ulmifolius</i><br>(Blackberry)  |
| Greenbushes Mine Access<br>Road - Reconnaissance Flora<br>and Vegetation Survey                       | Onshore<br>Environmental<br>Consultants | 2022b | 19-20 September<br>2022   | Not recorded                                     | None  | Three plant taxa were listed as<br>Declared Plants under the BAM<br>Act; *Rubus ulmifolius<br>(Blackberry), *Asparagus<br>asparagoides (Bridal Creeper)<br>and *Zantedeschia aethiopica<br>(Arum Lilly) |
| Greenbushes Rehabilitation<br>Materials Stockpiles -<br>Reconnaissance Flora and<br>Vegetation Survey | Onshore<br>Environmental<br>Consultants | 2022c | 21 September 2022   | Not recorded                                     | None  | One Declared Plant listed under<br>the BAM Act; <i>*Rubus ulmifolius</i><br>(Blackberry)  |

| Survey   | Consultant                              | Year  | Field Survey Date       | Flora Statistics                                 | Significant Flora | Introduced (Weed) Taxa   |
|--|---|-------|-------------------------|--|-------------------|--|
| Detailed Flora and Vegetation<br>Survey - New Water Storages                       | Onshore<br>Environmental<br>Consultants | 2022d | 1-5 October 2022        | 236 plant taxa, 55<br>families and 142<br>genera | None              | Four plant taxa listed as<br>Declared Plants under the BAM<br>Act; *Rubus anglocandicans<br>(Blackberry), *Asparagus<br>asparagoides (Bridal Creeper),<br>*Zantedeschia aethiopica (Arum<br>Lilly) and *Galium aparine<br>(Cleavers) |
| Detailed Flora and Vegetation<br>Survey - Floyd's Waste Rock<br>Landform Extension | Onshore<br>Environmental<br>Consultants | 2022e | 26-30 September<br>2022 | 132 plant taxa, 45<br>families and 102<br>genera | None              | 14 introduced species (none<br>listed as Declared Plants under<br>the BAM Act  |

## 3.1.2 Threatened Flora listed under the EPBC Act

A search of the EPBC Protected Matters database was undertaken for a 10 km radius around the study area (DCCEEW 2022). The search identified three records of Threatened flora potentially occurring within the buffer of the study area; *Caladenia hoffmanii* (Endangered), *Caladenia harringtoniae* and *Diuris micrantha* (Vulnerable) (Table 4).

## 3.1.3 Threatened Flora listed under the BC Act

A total of three Threatened Flora taxa were identified from the DBCA rare flora database search (DBCA 2022a) as occurring within a 40 km radius of the study area; *Caladenia harringtoniae, Caladenia christineae* and *Diuris drummondii* (Table 4).

## 3.1.4 Priority Flora recognised by the DBCA

A total of 23 Priority flora taxa were identified as potentially occurring within a 40 km radius of the study area (DBCA 2022a) (Table 4).

## 3.1.5 Likelihood of Occurrence

The combined database searches resulted in a list of 23 species of conservation significance with the potential to occur within the study area (Table 4). None of the 23 taxa were considered 'likely' to occur within the study area (as per criteria set out in Table 1) based on occurrence of habitat and proximity of previous records (Table 4). Three taxa were considered 'possible' to occur within the study area, and the remaining 20 taxa were determined as 'unlikely' to occur within the study area.

## 3.1.6 TECs listed under State and Federal Legislation

A search of the EPBC Protected Matters database (DCCEEW 2022) confirmed there were no Commonwealth listed TECs previously recorded within a 30 km radius of the study area.

A search of the DBCA ecological community database (DBCA 2022b) confirmed there were no state listed TEC records within a 50 km radius of the study area.

## 3.1.7 PECs recognised by DBCA

A search of DBCA's ecological community database (DBCA 2022b) confirmed that there were no PECs occurring within a 50 km radius of the study area.

#### 3.1.8 Environmentally Sensitive Areas

There was one Environmentally Sensitive Area (ESA) identified approximately 7 km west of the study area, and 560 m northwest from the intersection of Huitson Road and Maranup Ford Road. The ESA incorporates the winter-wet dampland supporting the Threatened orchid species *Caladenia harringtoniae*. While this landform was evident within the study area, historical disturbances and the current condition make it unlikely that *Caladenia harringtoniae* would be supported.

# Table 4 Priority flora taxa previously recorded within a 40 km radius of the study area, and the likelihood of these taxa occurring within the study area.

| Taxon  | Cons | Habitat Preference  | Likelihood in |
|--|------|---|---------------|
|  | Code |   | study area    |
| Acacia parkerae                                    | 3    | Loam soils.   | Unlikely      |
| Acacia semitrullata                                | 4    | Grey sand.  | Possible      |
| Acacia tayloriana                                  | 4    | Grey or yellow/orange sandy soils, lateritic gravel, clay loam.               | Unlikely      |
| Andersonia barbata                                 | 2    | White sand. Swampy areas.   | Unlikely      |
| Aponogeton hexatepalus                             | 4    | Freshwater: ponds, rivers, claypans.  | Unlikely      |
| Caladenia uliginosa subsp. patulens                | 1    | Clay loam and gravel. Well drained soils amongst dense shrubs.                | Unlikely      |
| Carex tereticaulis                                 | 3    | Black peaty sand.   | Unlikely      |
| Chorizema carinatum                                | 3    | Sand, sandy clay.   | Unlikely      |
| Dampiera heteroptera                               | 3    | Sandy soils. Swampy areas.  | Unlikely      |
| Dillwynia sp. Capel (P.A. Jurjevich 1771)          | 1    | Littered grey loamy sand, rocky soils. Valleys, rangelands.                   | Unlikely      |
| Eucalyptus relicta                                 | 2    | Grey clay-loam. Undulating upper slopes, along creeklines.                    | Possible      |
| Gastrolobium formosum                              | 3    | Clay loam. Along river banks or in swamps.                                    | Unlikely      |
| Grevillea bronwenae                                | 3    | Grey sand over laterite, lateritic loam. Hillslopes.                          | Unlikely      |
| Grevillea ripicola                                 | 4    | Sandy clay, clay or gravelly loam. Swampy flats, granite outcrops, drainages. | Unlikely      |
| Melaleuca viminalis                                | 2    | Drainage lines and flats.   | Unlikely      |
| Pultenaea skinneri                                 | 4    | Sandy or clayey soils. Winter-wet depressions.                                | Unlikely      |
| Scaevola ballajupensis                             | 1    | Brown sandy gravel, laterite, granite. Outcrops.                              | Unlikely      |
| Synaphea otiostigma                                | 3    | Clayey laterite, gravelly loam, sand.   | Unlikely      |
| Netrostylis sp. Blackwood River (A.R. Annels 3043) | 3    | Loam soil.  | Unlikely      |
| Netrostylis sp. Nannup (P.A. Jurjevich 1133)       | 1    | Laterite.   | Unlikely      |
| Tetratheca parvifolia                              | 3    | Loam soils.   | Possible      |
| Thysanotus formosus                                | 1    | Clayey sand, sandy loam. In situations often inundated in winter.             | Unlikely      |
| Thysanotus gageoides                               | 3    | Sand, clay, granite, sandstone, laterite.                                     | Unlikely      |

# 3.2 Flora Species

A total number of 99 plant taxa (including varieties and subspecies) from 34 families and 76 genera were recorded from the study area (Table 5, Appendix 4). Species representation was greatest among the Fabaceae, Myrtaceae, Poaceae, Cyperaceae, Proteaceae, Asteraceae and Juncaceae families. The most speciose genus was *Acacia,* followed by *Bossiaea, Eucalyptus, Juncus* and *Kennedia.* 

| Overview                              | No. Taxa |
|---------------------------------------|----------|
| Families                              | 34       |
| Genera                                | 76       |
| Taxa (species, subspecies, varieties) | 99       |
| Native Taxa                           | 71       |
| Introduced Taxa                       | 28       |
| Threatened Flora                      | 0        |
| Priority Flora                        | 0        |
| Range Extensions                      | 0        |
| Speciose Families                     | No. Taxa |
| Fabaceae                              | 19       |
| Myrtaceae                             | 10       |
| Poaceae                               | 9        |
| Cyperaceae                            | 6        |
| Proteaceae                            | 5        |
| Juncaceae                             | 4        |
| Asteraceae                            | 4        |
| Asparagaceae                          | 3        |
| Iridaceae                             | 3        |
| Ericaceae                             | 3        |
| Speciose Genera                       | No. Taxa |
| Acacia                                | 6        |
| Juncus                                | 4        |
| Eucalyptus                            | 4        |
| Kennedia                              | 3        |
| Bossiaea                              | 3        |

#### Table 5 Statistics for total flora recorded from the study area.

## 3.3 Significant Flora

## 3.3.1 Threatened Flora listed under the EPBC Act and BC Act

None of the plant taxa recorded from the study area were listed as Threatened Flora under the Commonwealth EPBC Act or the Western Australian BC Act.

## 3.3.2 Significant Flora

None of the plant taxa recorded from the study area were listed by the DBCA as Priority Flora.

#### 3.3.3 Species of Interest

None of the flora recorded from the study area represented species occurring outside its known distribution, i.e. range extension. One taxon recorded on outcropping dolerite along the

levee banks of drainage lines (not in drainage channels). It appears to be closely affiliated with *Lepidosperma effusum* but requires additional taxonomic work. It is noted that a revision of the *Lepidosperma* group commenced at the Western Australian Herbarium a number of years ago and remains incomplete.

## 3.4 Introduced Flora

A total of 28 introduced species were recorded from the study area:

- \*Acacia decurrens;
- \*Acacia longifolia subsp. longifolia;
- \*Arrhenatherum elatius;
- \*Asparagus asparagoides Declared Pest s22(2);
- \*Avena barbata;
- \*Briza maxima;
- \*Briza minima;
- \*Bromus diandrus;
- \*Chamaecytisus palmensis;
- \*Cirsium arvense Declared Pest s22(2);
- \*Cortaderia selloana subsp. selloana;
- \*Erigeron bonariensis;
- \*Eucalyptus globulus;
- *\*Hypochaeris glabra;*
- \*Juncus microcephalus;
- \*Lavandula stoechas subsp. stoechas;
- \*Lolium rigidum;
- \*Lotus subbiflorus;
- \*Lysimachia arvensis;
- \*Oxalis glabra;
- \*Oxalis pes-caprae;
- \*Pinus pinaster;
- \*Pinus radiata;
- \*Podalyria sericea;
- \*Romulea rosea;
- \*Rubus anglocandicans Declared Pest s22(2);
- \*Watsonia marginata; and
- *\*Zantedeschia aethiopica* Declared Pest s22(2).

Four of the introduced species were listed as Declared Pests listed under the BAM Act.

## 3.5 Vegetation Condition

Vegetation condition within the study area was rated as either degraded (36% of the study area) or completely degraded (60% of the study area) apart from lateritic hill slopes supporting Jarrah and Marri woodland and forest where condition was rated as good (4% of the study area) (Figure 5, Table 6).

The major disturbances were related to clearing for plantation and farmland, historical grazing of remnant native vegetation by domestic stock, harvesting of hardwood timber, edge effects around cleared farmland and plantation timber, and elevated weed loading.

| Condition           | Area (ha) | % of Total |
|---------------------|-----------|------------|
| Good                | 2.73      | 4.19       |
| Degraded            | 23.34     | 35.80      |
| Completely Degraded | 39.12     | 60.02      |
| Total               | 65.19     | 100.00     |

#### Table 6Vegetation condition within the study area.



## 3.6 Vegetation

A total of six vegetation types were described and mapped from the study area (Figure 6, Table 6).

Vegetation broadly comprised Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest and woodland on lateritic hill crests and hill slopes, changing to Marri and Yarri (*Eucalyptus patens*) forest on footslopes. The main SWG drainage line supported Flooded Gum (*Eucalyptus rudis* subsp. *rudis*) forest, with adjacent drainage flats supporting mixed Flooded Gum - Marri open woodland (Figure 6).

None of the vegetation types described and mapped from the study area were found to be aligned with any TECs or PECs documented from the Jarrah Forest bioregion.

| Table 7 | Vegetation types mapped within the study area. |  |
|---------|--|--|
|---------|--|--|

| Vegetation<br>Code   | Broad<br>Floristic<br>Formation | Description  | Condition              | Area (ha) and<br>% of study<br>area |
|----------------------|---------------------------------|--|------------------------|-------------------------------------|
| HS CcEm<br>Hp Xp Ha  | Corymbia<br>Woodland            | Woodland of Corymbia calophylla, Eucalyptus marginata subsp. marginata and Eucalyptus patens over<br>Open Scrub of Hakea prostrata, Acacia saligna and Acacia celastrifolia over Open Low Scrub A of<br>Xanthorrhoea preissii and Acacia pulchella over Dwarf Scrub D of Hypocalymma angustifolium, Banksia<br>dallanneyi and Lysiandra calycina over Open Low Sedges of Netrostylis sp. Jarrah Forest (R. Davis<br>7391), Lepidosperma leptostachyum and Desmocladus fasciculatus on brown loamy sand on lateritic hill<br>slopes | Good                   | 2.73 ha<br>(4.2%)                   |
| FS CcEpEm<br>BIXp Pe | Corymbia<br>Forest              | Forest of Corymbia calophylla, Eucalyptus patens and Eucalyptus marginata subsp. marginata over<br>Scrub of Bossiaea linophylla and Xanthorrhoea preissii over Low Scrub B of Pteridium esculentum<br>(Xanthorrhoea preissii, Leucopogon verticillatus, Macrozamia riedlei) over Open Dwarf Scrub D of<br>Leucopogon capitellatus, Chorizema cordatum and Styphelia propinqua on brown loam on lower hill<br>slopes and footslopes   | Degraded               | 12.34 ha<br>(18.9%)                 |
| WE ErCc<br>TIAsCl Mr | Eucalyptus<br>Open<br>Woodland  | Open Woodland of Eucalyptus rudis subsp. rudis and Corymbia calophylla over Scrub of Taxandria linearifolia, Astartea scoparia and Callistachys lanceolata over Low Scrub A of of Pteridium esculentum over Open Low Sedges of Machaerina rubiginosa and Netrostylis sp. Jarrah Forest (R. Davis 7391) on brown sandy clay loam on minor drainage lines and artificial wetlands  | Completely<br>Degraded | 4.53 ha<br>(7.0%)                   |
| ME ErCc              | Eucalyptus<br>Forest            | Forest of Eucalyptus rudis subsp. rudis and Corymbia calophylla (Eucalyptus patens) over Low<br>Woodland A of Banksia littoralis, Callistachys lanceolata and Acacia saligna (*Acacia longifolia, *Acacia<br>decurrens) over Low Scrub A of Taxandria linearifolia, Pteridium esculentum and *Rubus<br>anglocandicans (Astartea scoparia) over Very Open Tall Sedges of Lepidosperma effusum and Juncus<br>pallidus on brown loam on medium drainage lines and floodplains   | Degraded               | 10.99 ha<br>(16.9%)                 |
| PC                   | Corymbia<br>Forest              | Forest of Corymbia calophylla and Eucalyptus marginata subsp. marginata (Parkland Cleared)   | Completely<br>Degraded | 0.11 ha<br>(0.2%)                   |
| Plantation           |                                 | Plantation (*Pinus radiata, *Eucalyptus globulus)  | Completely<br>Degraded | 25.74 ha<br>(39.4%)                 |
| Pasture              |                                 | Annual Pasture (Farmland)  | Completely<br>Degraded | 8.75 ha<br>(13.4%)                  |



## TALISON

Salt Water Gully

Vegetation Type Legend

Figure 6

| Legend                |  |
|-----------------------|--|
| Study Area            |  |
| Vegetation Types      |  |
| Hillslopes            |  |
| HS CcEm Hp Xp Ha      | Woodland of Corymbia calophylla, Eucalyptus marginata subsp. marginata and Eucalyptus patens over Open Scrub of Hakea prostrata, Acacia<br>saligna and Acacia celastrifolia over Open Low Scrub A of Xanthorrhoea preissii and Acacia pulchella over Dwarf Scrub D of Hypocalymma<br>angustifolium, Banksia dallanneyi and Lysiandra calycina over Open Low Sedges of Netrostylis sp. Jarrah Forest (R. Davis 7391), Lepidosperma<br>leptostachyum and Desmocladus fasciculatus on brown loamy sand on lateritic hill slopes |
| Footslopes            |  |
| FS CcEpEm BIXp P      | Forest of Corymbia calophylla, Eucalyptus patens and Eucalyptus marginata subsp. marginata over Scrub of Bossiaea linophylla and Xanthorrhoea<br>e preissii over Low Scrub B of Pteridium esculentum (Xanthorrhoea preissii, Leucopogon verticillatus, Macrozamia riedlei) over Open Dwarf Scrub D<br>of Leucopogon capitellatus, Chorizema cordatum and Styphelia propinqua on brown loam on lower hill slopes and footslopes   |
| Artificial Wetlands   |  |
| WE ErCc TIAsCI Mr     | Open Woodland of Eucalyptus rudis subsp. rudis and Corymbia calophylla over Scrub of Taxandria linearifolia, Astartea scoparia and Callistachys<br>lanceolata (*Acacia pycnantha) over Low Scrub A of of Pteridium esculentum over Open Low Sedges of Machaerina rubiginosa and Netrostylis sp.<br>Jarrah Forest (R. Davis 7391) on brown sandy clay loam on minor drainage lines and artificial wetlands  |
| Medium Drainage Lines |  |
| ME ErCc               | Forest of Eucalyptus rudis subsp. rudis and Corymbia calophylla (Eucalyptus patens) over Low Woodland A of Banksia littoralis, Callistachys<br>lanceolata and Acacia saligna (*Acacia longifolia, *Acacia decurrens) over Low Scrub A of Taxandria linearifolia, Pteridium esculentum and *Rubus<br>anglocandicans (Astartea scoparia) over Very Open Tall Sedges of Lepidosperma effusum and Juncus pallidus on brown loam on medium drainage<br>lines and floodplains  |
| Other                 |  |
| Pine Plantation       |  |
| Open Woodland         | Open Woodland of Corymbia calophylla (parkland cleared)  |
| Bluegum Plantation    |  |
| Cleared               |  |
|                       |  |
|                       |  |
|                       |  |
|                       |  |

| Date:               | 21/06/2023          |
|---------------------|---------------------|
| Status:             | Draft               |
| Figure:             | 6                   |
| Sheet Size:         | A3                  |
| Internal Reference: | SWG Veg_Types Leger |
| Drawn by:           | GSM                 |
| Requested by:       | DB                  |
|                     |                     |





| Code                           | HS CcEm Hp Xp Ha   |  |  |
|--------------------------------|--|--|--|
| Broad Floristic Formation      | <i>Corymbia</i> Woodland   |  |  |
| Vegetation Type                | Woodland of Corymbia calophylla, Eucalyptus marginata subsp.<br>marginata and Eucalyptus patens over Open Scrub of Hakea prostrata,<br>Acacia saligna and Acacia celastrifolia over Open Low Scrub A of<br>Xanthorrhoea preissii and Acacia pulchella over Dwarf Scrub D of<br>Hypocalymma angustifolium, Banksia dallanneyi and Lysiandra<br>calycina over Open Low Sedges of Netrostylis sp. Jarrah Forest (R.<br>Davis 7391), Lepidosperma leptostachyum and Desmocladus<br>fasciculatus on brown loamy sand on lateritic hill slopes |  |  |
|                                |  |  |  |
|                                |  |  |  |
|                                |  |  |  |
| Area (ha)                      | 2.73 ha (4.2% of the study area)   |  |  |
| Soils and Geology              | Brown loam   |  |  |
| Land Form                      | Lateritic hill slopes  |  |  |
| Priority Ecological Community  | No   |  |  |
| Conservation Significant Flora | None   |  |  |
| Vegetation Condition           | Good   |  |  |

plantation, blue gums, overgrazing

Old (>6 years)

Bordering on degraded condition, access tracks, weeds, pine

Disturbances

Average Fire Age

| Code                      | FS CcEpEm BIXp Pe  |  |  |  |
|---------------------------|--|--|--|--|
| Broad Floristic Formation | Corymbia Forest  |  |  |  |
| Vegetation Type           | Forest of Corymbia calophylla, Eucalyptus patens and Eucalyptus<br>marginata subsp. marginata over Scrub of Bossiaea linophylla and<br>Xanthorrhoea preissii over Low Scrub B of Pteridium esculentum<br>(Xanthorrhoea preissii, Leucopogon verticillatus, Macrozamia riedlei)<br>over Open Dwarf Scrub D of Leucopogon capitellatus, Chorizema<br>cordatum and Styphelia propinqua on brown loam on lower hill slopes<br>and footslopes |  |  |  |
|                           |  |  |  |  |
|                           |  |  |  |  |
| Area (ha)                 | 12.34 ha (18.9% of the study area)   |  |  |  |

| Area (ha)                      | 12.34 ha (18.9% of the study area)  |
|--------------------------------|---|
| Soils and Geology              | Brown loam  |
| Land Form                      | Lower hill slopes and foot slopes   |
| Priority Ecological Community  | No  |
| Conservation Significant Flora | None  |
| Vegetation Condition           | Degraded  |
| Disturbances                   | Access tracks, weeds, pine plantation, rabbits, kangaroos, historical disturbances, fenceline |
| Average Fire Age               | Moderate (3 to 5 yrs)   |

| Code   | ME ErCc  |  |  |
|--|--|--|--|
| Broad Floristic Formation                          | Eucalyptus Forest  |  |  |
| Vegetation Type                                    | Forest of Eucalyptus rudis subsp. rudis and Corymbia calophylla<br>(Eucalyptus patens) over Low Woodland A of Banksia littoralis,<br>Callistachys lanceolata and Acacia saligna (*Acacia longifolia, *Acacia<br>decurrens) over Low Scrub A of Taxandria linearifolia, Pteridium<br>esculentum and *Rubus anglocandicans (Astartea scoparia) over Very<br>Open Tall Sedges of Lepidosperma effusum and Juncus pallidus on<br>brown loam on medium drainage lines and floodplains |  |  |
| STATISTICS AND |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Area (ha)  | 10.99 ha (16.9% of the study area)   |  |  |
| Soils and Geology                                  | Red brown clay loam  |  |  |
| Land Form  | Medium drainage lines and floodplains  |  |  |
| Priority Ecological Community                      | I NO   |  |  |

| Land Form                      | Medium dramage lines and hoodplains |
|--------------------------------|-------------------------------------|
| Priority Ecological Community  | No                                  |
| Conservation Significant Flora | None                                |
| Vegetation Condition           | Degraded                            |
| Disturbances                   | Access tracks, grazing, very weedy  |
| Average Fire Age               | Moderate (3 to 5 yrs)               |

| Code  | WE ErCc TIAsCI Mr  |  |  |  |
|---|--|--|--|--|
| Broad Floristic Formation   | Eucalyptus Open Woodland   |  |  |  |
| Vegetation Type   | Open Woodland of Eucalyptus rudis subsp. rudis and Corymbia<br>calophylla over Scrub of Taxandria linearifolia, Astartea scoparia and<br>Callistachys lanceolata (*Acacia pycnantha) over Low Scrub A of of<br>Pteridium esculentum over Open Low Sedges of Machaerina<br>rubiginosa and Netrostylis sp. Jarrah Forest (R. Davis 7391) on brown<br>sandy clay loam on minor drainage lines and artificial wetlands |  |  |  |
|   |  |  |  |  |
| Area (ha)   | 4.53 ha (7.0% of the study area)   |  |  |  |
| Soils and Geology   | Brown sandy clay loam  |  |  |  |
| Land Form   | Medium drainage lines  |  |  |  |
| Priority Ecological Community   | No   |  |  |  |
| Conservation Significant Flora  | None   |  |  |  |
| Vegetation Condition  | Completely Degraded  |  |  |  |
| Disturbances Access tracks, rubbish, very weedy, Pine trees, Blackberry |  |  |  |  |
| Average Fire Age  | Old (>6 years)   |  |  |  |

## 3.7 Representation and Reservation of Vegetation

## 3.7.1 Beard (1981) Vegetation Associations

Regional vegetation mapping completed by Beard (1981) was utilised to assess representation of vegetation within the study area. A single Beard vegetation association was represented within the study area; 3 Medium forest; jarrah-marri (Table 8, Figure 3). In terms of representation, the Western Australian Government is committed to the National Objectives Targets for Biodiversity Conservation which includes a target that prevents clearance of ecological communities with an extent below 30% of that present at pre-European settlement (Department of Natural Resources and Environment 2002, EPA 2000). When considering representation at the State level, Beard vegetation association 3 currently has 67.76% of the pre-European extent remaining (Table 8, Government of Western Australia 2018). The study area is located within the Jarrah Forest Bioregion, specifically within the Southern Jarrah Forest Subregion (as discussed in Section 1.3). When considering the representation of vegetation association 3 at the IBRA regional and sub-regional levels, 67.10% and 59.40% of the pre-European extent remains respectively (Table 8). The study area falls entirely within the Shire of Bridgetown-Greenbushes. At this local level 56.35% of the pre-European extent remains for vegetation association 3 (Table 8). Vegetation within the study area is therefore determined to be well represented at all levels (state-wide, bioregional [IBRA region and IBRA sub-region] and local government authority).

In terms of reservation, there is a benchmark for a minimum of 15% of each Beard (1981) vegetation association to be protected in Class I-IV reserves (Commonwealth of Australia 1997). The proportion of the current extent of vegetation association 3 occurring within Class I-IV reserves at a state-wide, bioregional and local government authority level ranges between 23.44% and 31.13%, noting that larger proportions (ranging from 78.50% to 86.77%) occur within DBCA managed lands (Table 8). Hence the reservation status is determined to be above the minimum benchmark confirming adequate reservation for vegetation association 3.

## 3.7.2 Mattiske and Havel (1998) Vegetation Complexes

The pre-1750 distribution of vegetation complexes of the South West Forest Region of Western Australia has been mapped at 1:50,000 scale by Mattiske and Havel (1998) as part of the biodiversity assessment for the comprehensive regional assessment for the South West Forest Region. Interrogation of this database confirmed the Balingup (BL) complex intersected most of the study area, with one other vegetation complex occurring in the northwest corner (Figure 4):

- Grimwade (GR) Tall open forest to open forest of *Corymbia calophylla-Eucalyptus marginata* subsp. *marginata* with *Eucalyptus patens* on slopes and *Eucalyptus rudis* over some *Agonis flexuosa* on lower slopes in the humid zone; and
- BL (Balingup) Tall open forest to open forest of *Corymbia calophylla-Eucalyptus* marginata with *Eucalyptus patens* on slopes and *Eucalyptus rudis* over some *Agonis flexuosa* on lower slopes in the humid zone.

The Grimwade vegetation complex currently 50.3% of the pre-European extent remaining within the South West Forest Region. The Balingup (BL) complex has marginally less than the 30% benchmark (29.4%), noting the major portion of this

complex within the study area has historically been cleared for plantation or supports heavily disturbed remnant native vegetation rated as degraded or completely degraded.

The current extent of the two complexes within Class I-IV conservation reserves is less than the 15% benchmark (Table 8), however the current extent represented within DBCA managed lands is 43.4% (GR) and 15.3% (BL) respectively (Table 8). On this basis vegetation within the study area is determined to be well reserved in terms of occurrence within DBCA managed lands but would benefit from increased formal reservation within Class I-IV reserves.

| Vegetation System / Association | Pre-European<br>Extent (ha) | Current Extent<br>(ha) | % Pre-<br>European<br>Extent<br>Remaining | Current Extent<br>in Class I-IV<br>Reserves (ha) | % Current<br>Extent in<br>Class I-IV<br>Reserves | Current Extent<br>DBCA<br>Managed<br>Lands (ha) | % Current<br>Extent DBCA<br>Managed<br>Lands |
|---------------------------------|-----------------------------|------------------------|---|--|--|---|--|
| State-wide                      |                             |                        |   |  |  |   |  |
| 3 Medium forest; jarrah-marri   | 2,661,404.62                | 1,803,437.48           | 67.76                                     | 485,223.00                                       | 26.91  | 1,469,765.60                                    | 81.50  |
| Beard Vegetation System         |                             |                        |   |  |  |   |  |
| 3 Bridgetown                    | 700,920.83                  | 455,092.38             | 64.93                                     | 131,748.88                                       | 28.95  | 377,759.27                                      | 83.01  |
| IBRA Region                     |                             |                        |   |  |  |   |  |
| 3 Jarrah Forest                 | 2,390,591.54                | 1,604,101.56           | 67.10                                     | 385,183.08                                       | 24.01  | 1,299,263.74                                    | 81.00  |
| IBRA Sub-Region                 |                             |                        |   |  |  |   |  |
| 3 Southern Jarrah Forest        | 1,482,491.85                | 880,655.65             | 59.40                                     | 274,167.05                                       | 31.13  | 691,319.44                                      | 78.50  |
| Local Government Authority      |                             |                        |   |  |  |   |  |
| Shire of Bridgetown-Greenbushes | 121,152.70                  | 68,275.41              | 56.35                                     | 16,006.81  | 23.44  | 59,243.12                                       | 86.77  |
| Mattiske & Havel Complexes      |                             |                        |   |  |  |   |  |
| Grimwade, GR                    | 22,046.59                   | 11,083.33              | 50.27                                     | 1,307.17   | 5.93   | 9,556.20  | 43.35  |
| Balingup, BL                    | 59,446.57                   | 17,466.47              | 29.38                                     | 883.65   | 1.49   | 9,120.37  | 15.34  |

#### Table 8 Pre-European extent of vegetation represented on the basis of identified datasets (Government of Western Australia 2018).

## 3.8 Conservation Significance of Vegetation

## 3.8.1 National Significance

None of the vegetation types recorded from the study area supported Threatened Flora listed under the EPBC Act or were aligned with any Commonwealth listed TECs. Therefore, vegetation within the study area was not considered to be of national significance.

#### 3.8.2 State Significance

None of the vegetation types recorded from the study area supported Threatened Flora listed under the Western Australian BC Act or were aligned with any state listed TEC or PEC. As well, vegetation types did not support Priority flora taxa listed by the DBCA.

## 3.8.3 Local Significance

Vegetation within the study area did not support plant taxa considered to represent significant range extensions outside of their known distribution, and hence was not determined to be of local conservation significance.

# 4.0 SUMMARY

A reconnaissance flora and vegetation survey of vegetation occurring downstream of the proposed SWG Dam recorded 99 plant taxa (including varieties and subspecies) from 34 families and 76 genera. Species representation was greatest among the Fabaceae, Myrtaceae, Poaceae, Cyperaceae, Proteaceae, Asteraceae and Juncaceae families. The most speciose genus was *Acacia*, followed by *Bossiaea*, *Eucalyptus*, *Juncus* and *Kennedia*.

None of the plant taxa recorded from the study area were listed as Threatened Flora under the Commonwealth EPBC Act or the Western Australian BC Act. Additionally, no species were listed as Priority flora by the DBCA or were considered to represent significant range extensions.

The total flora included 28 introduced plant species, with four of these weed species listed as Declared Pests under the BAM Act.

Four native vegetation types were described and mapped from the study area. None of the vegetation types were aligned with any Commonwealth or State listed TECs or State listed PECs.

Vegetation condition was predominantly rated as completely degraded (60% of the study area) or degraded (36% of the study area), with isolated areas of lateritic hill slopes supporting Jarrah and Marri woodland and forest rated as good (4% of the study area). The major disturbances were related to clearing for plantation and farmland, historical grazing of remnant native vegetation by domestic stock, harvesting of hardwood timber, edge effects around cleared farmland and plantation timber, and elevated weed loading.

# 5.0 STUDY TEAM

The reconnaissance flora and vegetation survey was planned, co-ordinated and executed by the following personnel:

Onshore Environmental Consultants P/L ABN 41 095 837 120 PO Box 227 YALLINGUP WA 6282 M 0427 339 842 Email info@onshoreenvironmental.com.au

#### **Project Staff**

| Dr Darren Brearley | PhD    | Project Manager   |
|--------------------|--------|---|
| Dr Jerome Bull     | PhD    | Principal Botanist (Flora licence number: FB62000102-2) |
| Mr Carmel Griffin  | GIS Sp | pecialist   |

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**Conservation Codes** 

#### Conservation codes for Western Australian Flora and Fauna



Conservation codes for Western Australian flora and fauna

#### Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

#### EX Extinct species

Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.

#### EW Extinct in the wild species

Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

#### Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest, migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

#### MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention* on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

#### CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

#### OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

#### Conservation codes for Western Australian flora and fauna

#### P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

#### 1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

#### 2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

#### 3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

#### 4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

<sup>1</sup>The definition of flora includes algae, fungi and lichens <sup>2</sup>Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Last updated 3 January 2019

#### Conservation categories for flora described under the EPBC Act

| Category                       | Description  |
|--------------------------------|--|
| Extinct (Ex)                   | A species is extinct if there is no reasonable doubt that the last member of the species has died.   |
| Extinct in the Wild<br>(EW)    | A species is categorised as extinct in the wild if it is only known to survive in cultivations, in captivity, or as a naturalised population well outside its past range; or if it has not been recorded in its known/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<br>Endangered (CE)  | The species is facing an extremely high risk of extinction in the wild and in the immediate future.  |
| Endangered (EN)                | The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival, or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.   |
| Vulnerable (VU)                | Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.  |
| Conservation<br>Dependent (CD) | The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.   |

#### Conservation categories for species described under the IUCN

| Category                      | Description   |
|-------------------------------|---|
| Extinct (Ex)                  | A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.   |
| Extinct in the Wild<br>(EW)   | A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity<br>or as a naturalized population (or populations) well outside the past range. A taxon is<br>presumed Extinct in the Wild when exhaustive surveys in known and/or expected<br>habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range<br>have failed to record an individual. Surveys should be over a time frame appropriate to<br>the taxon's life cycle and life form.  |
| Critically<br>Endangered (CE) | A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.   |
| Endangered (EN)               | A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.   |
| Vulnerable (VU)               | A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.  |
| Near Threatened<br>(NT)       | A taxon is Near Threatened when it has been evaluated against the criteria but does<br>not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to<br>qualifying for or is likely to qualify for a threatened category in the near future.   |
| Data Deficient (DD)           | A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified. |

Vegetation condition scale (as developed by Keighery 1994)

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

Vegetation classifications for the study area based on Muir (1997).

| LIFE FORM / HEIGHT  |                     | Canopy Cover                 |                                  |  |
|---------------------|---------------------|------------------------------|----------------------------------|--|
| CLASS               | DENSE               | MID DENSE                    | SPARSE                           | VERY SPARSE                                |
|                     | 70 % - 100%         | 30% - 70%                    | 10% - 30%                        | 2% - 10%                                   |
| Trees > 30 m        | Dense Tall Forest   | Tall Forest                  | Tall Woodland                    | Open Tall Woodland                         |
| Trees 15 - 30 m     | Dense Forest        | Forest                       | Woodland                         | Open Woodland                              |
| Trees < 5 m         | Dense Low Forest A  | Low Forest A<br>Low Forest B | Low Woodland A<br>Low Woodland B | Open Low Woodland A<br>Open Low Woodland B |
| Mallee tree form    | Dense Tree Mallee   | Tree Mallee                  | Open Tree Mallee                 | Very Open Tree Mallee                      |
| Mallee shrub form   | Dense Shrub Mallee  | Shrub Mallee                 | Open Shrub Mallee                | Very Open Shrub Mallee                     |
| Shrubs > 2 m        | Dense Thicket       | Thicket                      | Scrub                            | Open Scrub                                 |
| Shrubs 1.5 – 2 m    | Dense Heath A       | Heath A                      | Low Scrub A                      | Open Low Scrub A                           |
| Shrubs 1 - 1.5 m    | Dense Heath B       | Heath B                      | Low Scrub B                      | Open Low Scrub B                           |
| Shrubs 0.5 – 1 m    | Dense Low Heath C   | Low Heath C                  | Dwarf Scrub C                    | Open Dwarf Scrub C                         |
| Shrubs 0 - 0.5 m    | Dense Low Heath D   | Low Heath D                  | Dwarf Scrub D                    | Open Dwarf Scrub D                         |
| Mat plants          | Dense Mat Plants    | Mat Plants                   | Open Mat Plants                  | Very Open Mat Plants                       |
| Hummock grass       | Dense Hummock Grass | Mid-Dense Hummock Grass      | Hummock Grass                    | Open Hummock Grass                         |
| Bunch grass > 0.5 m | Dense Tall Grass    | Tall Grass                   | Open Tall Grass                  | Very Open Tall Grass                       |
| Bunch grass < 0.5 m | Dense Low Grass     | Low Grass                    | Open Low Grass                   | Very Open Low Grass                        |
| Herbaceous spp.     | Dense Herbs         | Herbs                        | Open Herbs                       | Very Open Herbs                            |
| Sedges > 0.5 m      | Dense Tall Sedges   | Tall Sedges                  | Open Tall Sedges                 | Very Open Tall Sedges                      |
| Sedges < 0.5 m      | Dense Low Sedges    | Low Sedges                   | Open Low Sedges                  | Very Open Low Sedges                       |
| Ferns               | Dense Ferns         | Ferns                        | Open Ferns                       | Very Open Ferns                            |
| Mosses, liverworts  | Dense Mosses        | Mosses                       | Open Mosses                      | Very Open Mosses                           |

## Total flora list from the study area

\* Denotes introduced flora species

| Family            | Genus          | Species         | Rank   | Infra Name |
|-------------------|----------------|-----------------|--------|------------|
| Fabaceae          | *Acacia        | decurrens       |        |            |
| Fabaceae          | *Acacia        | longifolia      | subsp. | longifolia |
| Poaceae           | *Arrhenatherum | elatius         |        |            |
| Asparagaceae      | *Asparagus     | asparagoides    |        |            |
| Poaceae           | *Avena         | barbata         |        |            |
| Poaceae           | *Briza         | maxima          |        |            |
| Poaceae           | *Briza         | minor           |        |            |
| Poaceae           | *Bromus        | diandrus        |        |            |
| Fabaceae          | *Chamaecytisus | palmensis       |        |            |
| Asteraceae        | *Cirsium       | arvense         |        |            |
| Poaceae           | *Cortaderia    | selloana        | subsp. | selloana   |
| Asteraceae        | *Erigeron      | bonariensis     |        |            |
| Myrtaceae         | *Eucalyptus    | globulus        |        |            |
| Asteraceae        | *Hypochaeris   | glabra          |        |            |
| Juncaceae         | *Juncus        | microcephalus   |        |            |
| Lamiaceae         | *Lavandula     | stoechas        | subsp. | stoechas   |
| Poaceae           | *Lolium        | rigidu <b>m</b> |        |            |
| Fabaceae          | *Lotus         | subbiflorus     |        |            |
| Primulaceae       | *Lysimachia    | arvensis        |        |            |
| Oxalidaceae       | *Oxalis        | glabra          |        |            |
| Oxalidaceae       | *Oxalis        | pes-caprae      |        |            |
| Pinaceae          | *Pinus         | pinaster        |        |            |
| Pinaceae          | *Pinus         | radiata         |        |            |
| Fabaceae          | *Podalyria     | sericea         |        |            |
| Iridaceae         | *Romulea       | rosea           |        |            |
| Rosaceae          | *Rubus         | anglocandicans  |        |            |
| Iridaceae         | *Watsonia      | marginata       |        |            |
| Araceae           | *Zantedeschia  | aethiopica      |        |            |
| Fabaceae          | Acacia         | celastrifolia   |        |            |
| Fabaceae          | Acacia         | nervosa         |        |            |
| Fabaceae          | Acacia         | pulchella       |        |            |
| Fabaceae          | Acacia         | saligna         |        |            |
| Hemerocallidaceae | Agrostocrinum  | hirsutum        |        |            |
| Myrtaceae         | Astartea       | scoparia        |        |            |
| Poaceae           | Austrostipa    | campylachne     |        |            |
| Myrtaceae         | Babingtonia    | camphorosmae    |        |            |
| Proteaceae        | Banksia        | dallanneyi      | subsp. | sylvestris |
| Proteaceae        | Banksia        | littoralis      |        |            |
| Pittosporaceae    | Billardiera    | fusiformis      |        |            |
| Fabaceae          | Bossiaea       | aquifolium      |        |            |
| Fabaceae          | Bossiaea       | linophylla      |        |            |
| Fabaceae          | Bossiaea       | ornata          |        |            |
| Colchicaceae      | Burchardia     | congesta        |        |            |
| Ranunculaceae     | Clematis       | pubescens       |        |            |
| Haemodoraceae     | Conostylis     | aculeata        | subsp. | aculeata   |
| Myrtaceae         | Corymbia       | calophylla      |        |            |
| Goodeniaceae      | Dampiera       | alata           |        |            |

| Family            | Genus        | Species        | Rank   | Infra Name                    |
|-------------------|--------------|----------------|--------|-------------------------------|
| Fabaceae          | Daviesia     | decurrens      | subsp. | decurrens                     |
| Fabaceae          | Daviesia     | horrida        |        |                               |
| Droseraceae       | Drosera      | bulbosa        |        |                               |
| Myrtaceae         | Eucalyptus   | marginata      | subsp. | marginata                     |
| Myrtaceae         | Eucalyptus   | patens         |        |                               |
| Myrtaceae         | Eucalyptus   | rudis          | subsp. | rudis                         |
| Cyperaceae        | Ficinia      | nodosa         |        |                               |
| Geraniaceae       | Geranium     | solanderi      |        |                               |
| Haemodoraceae     | Haemodorum   | laxum          |        |                               |
| Proteaceae        | Hakea        | amplexicaulis  |        |                               |
| Proteaceae        | Hakea        | lissocarpha    |        |                               |
| Lamiaceae         | Hemigenia    | incana         |        |                               |
| Dilleniaceae      | Hibbertia    | amplexicaulis  |        |                               |
| Dilleniaceae      | Hibbertia    | commutata      |        |                               |
| Fabaceae          | Hovea        | chorizemifolia |        |                               |
| Myrtaceae         | Hypocalymma  | angustifolium  |        |                               |
| Juncaceae         | Juncus       | pallidus       |        |                               |
| Juncaceae         | Juncus       | subsecundus    |        |                               |
| Juncaceae         | Juncus       |                | sp.    | indet                         |
| Fabaceae          | Kennedia     | carinata       |        |                               |
| Fabaceae          | Kennedia     | coccinea       |        |                               |
| Fabaceae          | Kennedia     | prostrata      |        |                               |
| Fabaceae          | Labichea     | punctata       |        |                               |
| Cyperaceae        | Lepidosperma | leptostachyum  |        |                               |
| Cyperaceae        | Lepidosperma |                | sp.    | indet                         |
| Ericaceae         | Leucopogon   | capitellatus   |        |                               |
| Campanulaceae     | Lobelia      | anceps         |        |                               |
| Asparagaceae      | Lomandra     | pauciflora     |        |                               |
| Asparagaceae      | Lomandra     | preissii       |        |                               |
| Phyllanthaceae    | Lysiandra    | calycina       |        |                               |
| Cyperaceae        | Machaerina   | rubiginosa     |        |                               |
| Zamiaceae         | Macrozamia   | riedlei        |        |                               |
| Myrtaceae         | Melaleuca    | rhaphiophylla  |        |                               |
| Cyperaceae        | Morelotia    | octandra       |        |                               |
| Cyperaceae        | Netrostylis  |                | sp.    | Jarrah Forest (R. Davis 7391) |
| Rubiaceae         | Opercularia  | hispidula      |        |                               |
| Iridaceae         | Patersonia   | occidentalis   | subsp. | occidentalis                  |
| Proteaceae        | Persoonia    | longifolia     |        |                               |
| Dennstaedtiaceae  | Pteridium    | esculentum     |        |                               |
| Goodeniaceae      | Scaevola     | calliptera     |        |                               |
| Asteraceae        | Senecio      | quadridentatus |        |                               |
| Stylidiaceae      | Stylidium    | schoenoides    |        |                               |
| Hemerocallidaceae | Stypandra    | glauca         |        |                               |
| Ericaceae         | Styphelia    | pallida        |        |                               |
| Ericaceae         | Styphelia    | propinqua      |        |                               |
| Myrtaceae         | Taxandria    | linearifolia   |        |                               |
| Poaceae           | Tetrarrhena  | laevis         |        |                               |
| Elaeocarpaceae    | Tetratheca   | hirsuta        | subsp. | viminea                       |
| Elaeocarpaceae    | Tremandra    | diffusa        |        |                               |
| Rhamnaceae        | Trymalium    | odoratissimum  | subsp. | trifidum                      |

| Family           | Genus        | Species  | Rank | Infra Name |
|------------------|--------------|----------|------|------------|
| Xanthorrhoeaceae | Xanthorrhoea | gracilis |      |            |
| Xanthorrhoeaceae | Xanthorrhoea | preissii |      |            |