Greenbushes Infrastructure Corridors
Detailed Flora and Vegetation Survey

Prepared for Talison Lithium
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EXECUTIVE SUMMARY

Talison Lithium Pty Ltd (Talison) currently operates a lithium mine at Greenbushes, situated approximately 250km south of Perth in south-west Western Australia (Figure1). Talison is proposing to increase output from the Greenbushes Mine and as part of the current expansion of mining operations, requires flora and vegetation survey work to be completed within three proposed infrastructure corridors surrounding the mine site (Figure 2).

Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned by Talison to undertake a two season detailed flora and vegetation survey of remnant native vegetation occurring within the proposed infrastructure corridors, herein referred to as the study area.

The field survey was completed by two Principal Botanists and one Senior Botanist from Onshore Environmental working over a six day period from the 30th July to the 6th August 2018, with a second season assessment completed over six spring days; 26th, 27th, 29th and 30th September, 3rd, 4th and 18th October 2018. A total number of 280 plant taxa (including varieties and subspecies) from 60 families and 157 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Orchidaceae, Asparagaceae, Myrtaceae, Asteraceae, Cyperaceae, Proteaceae and Poaceae families. The most speciose genus was *Acacia* (17 taxa), followed by *Caladenia* (11 taxa), *Lomandra* (10 taxa), *Stylidium* (8 taxa), *Hibbertia* (7 taxa each), *Drosera* and *Pterostylis* (6 taxa each).

None of the plant taxa recorded from the study area was gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the *Wildlife Conservation Act (1950)* (WC Act), or listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

One Priority 4 flora taxon was recorded from within the study area; *Acacia semitrullata. Acacia semitrullata* was recorded as four plants from a single point location in state forest along the proposed powerline corridor.

The Priority 2 flora taxon *Melaleuca viminalis* was recorded approximately 70 metres east (outside) of the proposed northern bypass road. Three plants were recorded in riparian vegetation adjacent to the Greenbushes “swimming pool”, a popular recreation site. The close proximity of this location to the ablution block and other exotic plantings suggests the individuals may have been introduced to the site.

One taxon recorded from within the study area was identified to represent a significant range extension; *Hybanthus epacroides.* The nearest known record is from Gnowangerup approximately 180 km east of the study area. *Hybanthus epacroides* is known to occur in white or yellow sand in association with laterite. Within the study area it was recorded on orange sands weathered and deposited from laterite positioned higher in the landscape. This habitat type was specific and localised.

A total of 45 introduced species were recorded from the study area, of which two taxa were listed as Declared Plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act):

- **Asparagus asparagoides* (Bridal Creeper) - s22(2); and
- **Rubus anglocandicans* (Blackberry) - s22(2) (C3 Exempt).

A total of ten vegetation types from four broad landforms were described and mapped from within the corridor study area. Extensive field assessment confirmed there were no Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) represented within the study area.

Vegetation condition across the majority of the study area was rated as *degraded* (44.5 ha or 41% of the study area) reflecting a high proportion of the area having been disturbed and rehabilitated as part of historical tin mining operations. Approximately 12.6 ha (11% of the study area) had been cleared for a mixture of annual pasture, existing road infrastructure, and as part of historical mining activities; these areas do not support any native vegetation cover. Blocks of vegetation rated as *completely degraded* totaled 19.9 ha (18% of the study area) and included a mix of pine and bluegum plantation, and historical rehabilitation. Intact native vegetation was rated as *very good* (22.8 ha or 21% of the study area) or *good* (9.8 ha or 9% of the study area) with the primary disturbances resulting from hardwood logging activities or close proximity to disturbed ground, i.e. road verges.

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1.0 INTRODUCTION

1.1 Preamble

Talison is a Western Australian mining company with operations based at Greenbushes in the south-west of 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 is proposing to increase output from the Greenbushes Mine and as part of the current expansion of mining operations, requires flora and vegetation survey work within three proposed infrastructure corridors surrounding the mine site (Figure 2). Onshore Environmental was commissioned by Talison to undertake a two season detailed flora and vegetation survey of remnant native vegetation occurring within the proposed infrastructure corridors. This work was completed by three botanists working over a total of 12 days between July and October 2018.

1.2 Previous Surveys

There have been five previous flora and vegetation surveys undertaken within the Greenbushes Mine area that partially overlap with the study area. These surveys are listed below and described in more detail in Section 3.1.1:

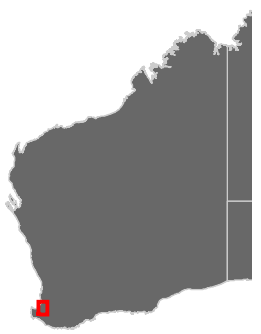
- Trudgen and Morgan (1991) *A Flora and Vegetation Survey of part of the Greenbushes Leases*;
- Onshore Environmental Consultants (2006) *Flora and Vegetation Survey Greenbushes Mine Site: Vegetation surrounding south east corner of the TSF*;
- AECOM Australia Pty Ltd (2010) *Bridgetown RWSS Pipelines Millstream Dam to Greenbushes Link Biological Survey*;
- Onshore Environmental (2012) *Flora and Vegetation Survey Greenbushes Mining Leases;* and
- Onshore Environmental (2018) *Greenbushes Mining Operations, Detailed Flora and Vegetation Survey.*

TALISON

Study Area Location

Legend

Talison DEC Active Mining Location



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Kilometers

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Date:	31/01/2018
Status:	Draft
Figure:	1
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Internal Reference:	Talison Location
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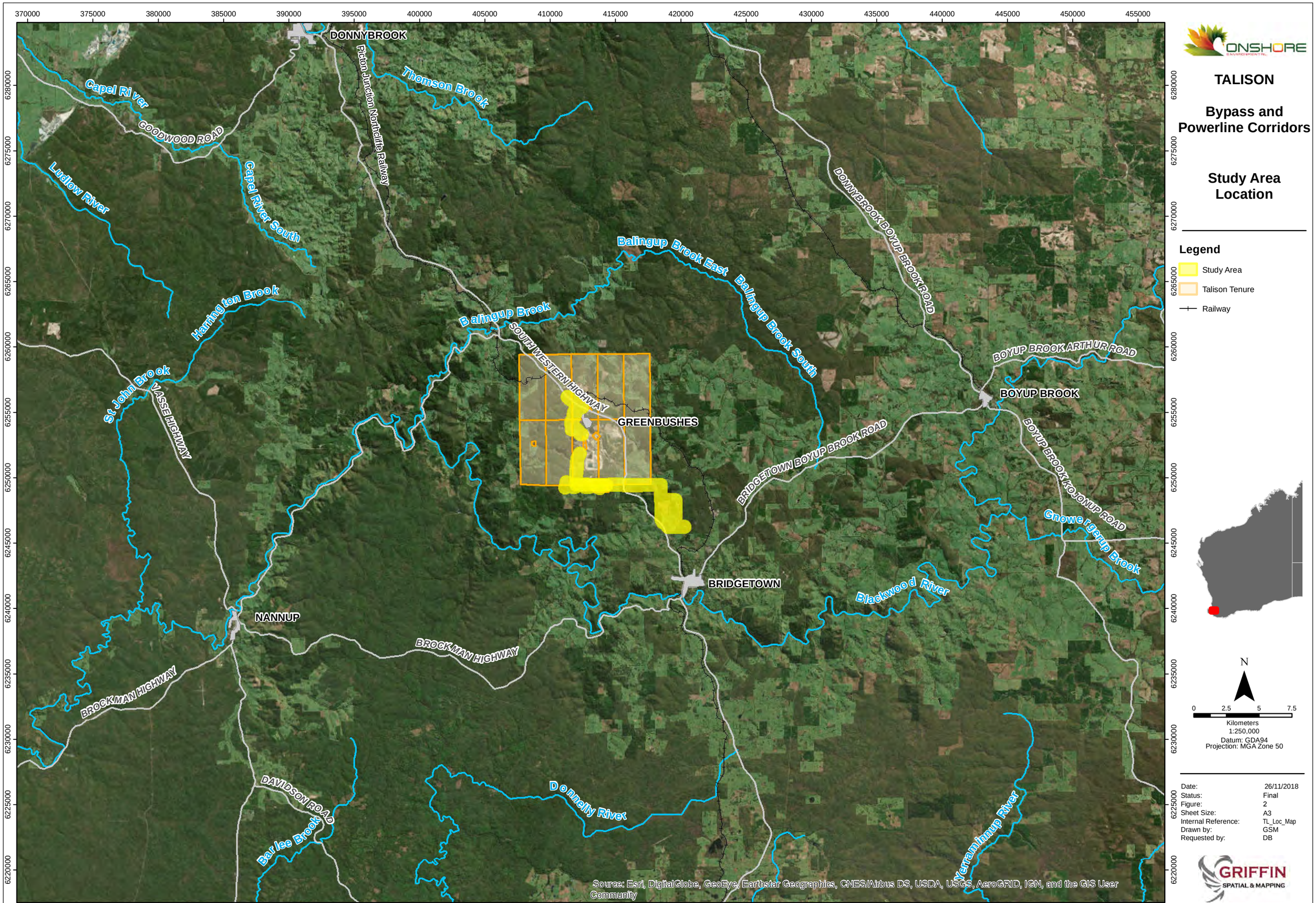
GRIFFIN SPATIAL & MAPPING



ONSHORE ENVIRONMENTAL

TALISON

Bypass and Powerline Corridors

Study Area Location

Legend

- Study Area
- Talison Tenure
- Railway

N

0 2.5 5 7.5

Kilometers
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Projection: MGA Zone 50

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Status:	Final
Figure:	2
Sheet Size:	A3
Internal Reference:	TL_Loc_Map
Drawn by:	GSM
Requested by:	DB

GRIFFIN SPATIAL & MAPPING

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 town of Greenbushes is 973.2 mm (Bureau of Meteorology [BOM] 2018), with the majority of falls occurring during the winter months of June and July associated with cold fronts moving across the south-west of Western Australia.

The annual rainfall for the three-month period prior to the February/March 2018 and September/October 2018 field surveys was 77 mm and 455 mm respectively (Figure 3). This provided excellent survey conditions with a wide variety of plant taxa flowering across two seasons.

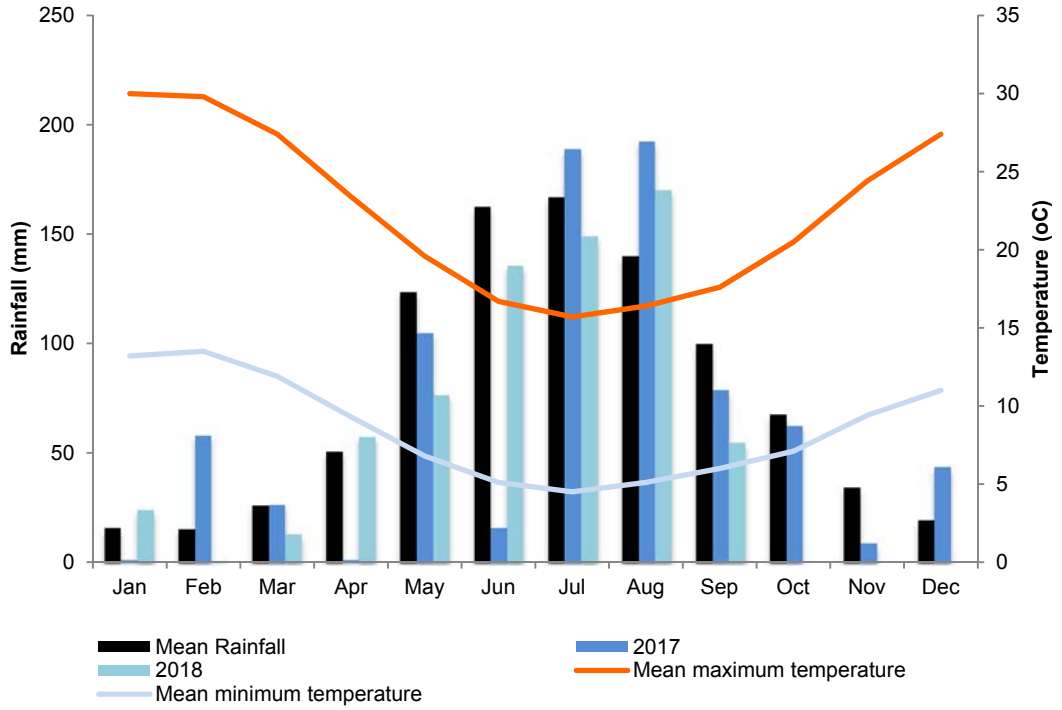

Figure 3 **Climatic data for Greenbushes with monthly rainfall figures from January 2017 to September 2018. Rainfall data is from the Greenbushes Weather Station and temperature data from the Bridgetown Weather Station (Bureau of Meteorology 2018).**

1.4 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of Environment 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. 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 understory component of the forest and woodland reflects the more mesic nature of this area. The majority 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).

1.5 Land Use

The major land uses within the study area and surroundings are State Forest, residential, mining and agriculture. The study area predominantly encompasses State Forest with a smaller block of privately-owned farmland to the south. Nearby towns include Bridgetown (approximately 15 km to the south-east) and Balingup (approximately 10 km to the north-west).

1.5.1 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. Currently one of the largest employers in the area is Auswest Timbers, a local timber milling company.

1.5.2 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 in recent years the lower tin prices and emergence of tantalum as the 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. Although open cut mining began to be practiced on a small scale in the 1900s 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.

1.5.3 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.

1.6 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.

In 2010 AECOM reviewed the Environmental Geology Series maps prepared by the Geological Survey of Western Australia (1980) for a nearby project area (described in more detail in Section 3.1.1). The geology of this project area was described as Archean granite of the Yilgarn Block and the soils of this area are listed below:

- Bt - Shallow red and yellow earths and rock outcrops on slopes and narrow alluvial terraces;
- Ba - Red and yellow earths, duplex soils on slopes, narrow alluvial terraces, swampy floors;
- G - Grey sands and some swamps;
- Hr - Duricrust and gravels flanked by gravelly duplex soils; and
- Cc - Yellow and duplex soils and red earths on slopes, and narrow alluvial terraces.

1.7 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^2, of which 18,715 km^2 (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 study 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 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 & prehistory of karri, jarrah & marri - Churchill (1968);
- Structure & 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);
- Vegetation mapping of the Darling System - Heddle *et al.* (1980); and
- Vegetation mapping as part of the Regional Forest Agreement - Mattiske and Havel (1998).

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) describe vegetation of the survey area as ‘mixture of open forest of *Eucalyptus marginata - Corymbia calophylla* with some *Eucalyptus patens* on slopes’.

2.0 METHODOLOGY

2.1 Legislation and Guidance Statements

The two season detailed 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); and
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016b).

A specific requirement for 'linear corridor surveys' is to incorporate vegetation unit characterisation using survey data and aerial photography from 500 m to 1,000 m on both sides of the infrastructure corridor (where this is not already part of the survey area) to provide context for environmental impact assessment (EPA 2016a). To address this requirements, vegetation mapping along the defined infrastructure corridor was merged with adjacent mapping recently completed within the Mine Development Envelope (Onshore Environmental 2018). Vegetation mapping was then inferred for any open areas remaining within a 500 metre buffer of the infrastructure corridor.

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 Lithium. There were five flora and vegetation surveys previously completed between 1991 and 2018 within, or immediately surrounding, the study area. As part of the desktop review total flora lists for the five flora assessments were reviewed to ensure nomenclature was accurate, consistent and current. The previous survey work is summarised in more detail in Section 3.1.1.

2.2.2 Database Searches

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

- NatureMap1: This database represents the most comprehensive source of information on the distribution of Western Australia's flora, comprising records from the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened Flora database, and the Western Australian Herbarium (WAH) Specimen Database (20 km radial search around the central point GDA94 Zone 50 - 413000E 6252000N, accessed 22 March 2018);

- DBCA's Threatened and Priority flora database was searched to confirm the NatureMap results (50 km radial search around the central point GDA94 Zone 50 - 413000E 6252000N, accessed 20 February 2018) (DBCA 2018a);
- DBCA's TEC, PEC and Environmentally Sensitive Areas (ESAs) database was searched to identify significant communities (20 km radial search around the central point GDA94 Zone 50 - 413000E 6252000N, accessed 2 March 2018) (DBCA 2018b);
- EPBC Act Protected Matters database (DoEE 2018, accessed 22 March 2018); and
- International Union for Conservation of Nature (IUCN) database (IUCN 2018, accessed 22 March 2018).

2.2.3 Assessment of Likelihood of Occurrence in the study area

A list of conservation significant 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 (Table 1) 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 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 which is present within the study area, and there are previous records within a 20 km radius of the study area.
Possible to occur	The species has previously been recorded from a landform which is present within the study area, and there are previous records within a 50 km radius of the study area.
Unlikely to occur	The landform from which the species has previously been recorded is absent within the study area, and/or there are no previous records within a 50 km radius of the study area.

2.3 Field Survey Methodology

2.3.1 Timing and Personnel

The two season flora and vegetation survey was completed by two Principal Botanists and one Senior Botanist from Onshore Environmental, Dr Darren Brearley, Dr Jerome Bull and Ms Jessica Waters, working over a six day period from the 30th July to the 6th August 2018, with a second season assessment completed over six spring days; 26th, 27th, 29th and 30th September, 3rd, 4th and 18th October 2018.

2.3.2 Sampling of Study Sites

The field survey involved systematic sampling using quadrats (referred to as study sites). Relevé vegetation descriptions were made to increase the accuracy of vegetation mapping and targeted searches were completed in habitats where it was anticipated significant flora might occur.

The study sites were 10 m by 10 m in dimension which is standard for the Southern Jarrah Forest bioregion. The number of study sites sampled was determined by the size and heterogeneity of the study area, and confirmed by a species accumulation curve (Figure 4) following the second season survey. A total of 22 quadrats were formally assessed. The locations of all quadrats sampled are provided in Figure 5.

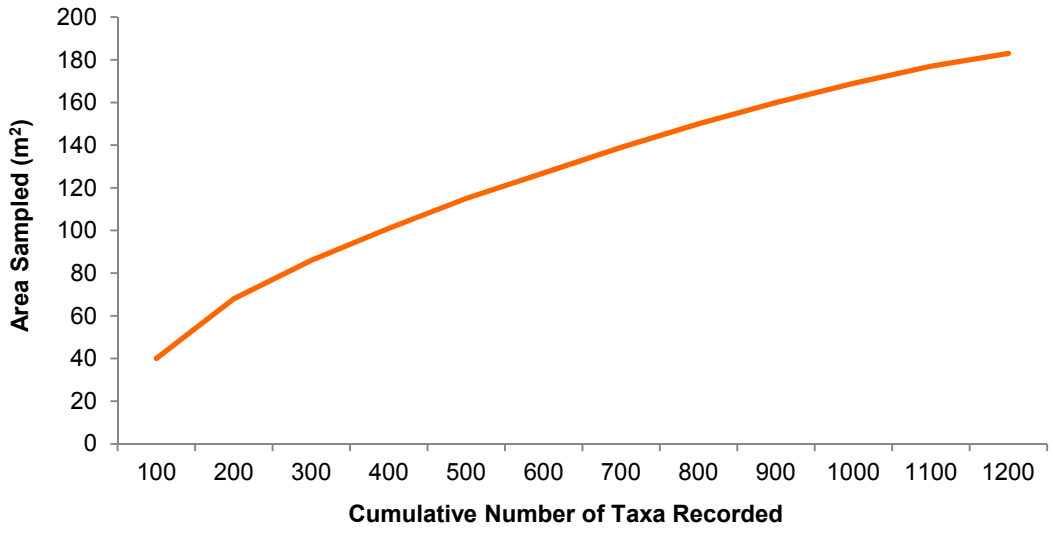

Figure 4 **Species accumulation curve for the 22 quadrats formally assessed within the study area.**

The study sites were assessed to provide a list of the total flora occurring within the study area and a description of the vegetation structure. Data collected covered a range of environmental parameters including:

- Landform and habitat;
- Aspect;
- Soil colour and soil type;
- Rock type;
- Slope (angle);
- Vegetation condition;
- Disturbance (caused by fire, clearing, grazing etc);
- Age since fire;
- Broad floristic formation;
- Vegetation association description; and
- Height and percentage ground cover provided by individual plant taxa.

Other parameters recorded for each study site were:

- Study site number and date of assessment;
- Names of the botanists undertaking the assessment;
- Location description and waypoint - GPS coordinate (GDA94) using a handheld GPS; and
- Photograph number.

2.3.3 Targeted Surveys for Conservation Significant Species

Targeted searches for species of conservation significance likely to occur within the study area were completed. All vegetation polygons defined were ground truthed during the survey to record opportunistic records for significant flora. This coverage also allowed for closer examination of specific landforms where significant flora may

be expected to occur. These landforms included lower grey sandy slopes and winter wet drainage lines.

2.3.4 Weed Survey and Mapping

Introduced species were recorded from the 22 quadrats formally assessed within the study area. Additional opportunistic collections were also made while moving throughout the study area, with targeted weed searches were completed in high moisture habitats including drainage lines and riparian features.

2.3.5 Floristic Analysis

A multivariate statistical analysis of the floristic quadrat data (22 quadrats) was completed to assist in understanding the vegetation-habitat relationships within the study area. A two-way classification (Agglomerative Hierarchical Fusion) of the presence/absence quadrat data was carried out on the 275 taxon x 22 quadrat dataset using the program PATN (Belbin, 2003). The flexible UPGMA classification strategy was used (β = -0.1), together with the Bray-Curtis site similarity measure. The number of groups to be determined was set at ten. The primary output of the classification was in the form of a dendrogram and a two-way table of taxa and quadrats (Appendix 1).

2.3.6 Vegetation Association and Condition Mapping

The vegetation mapping utilised high-resolution aerial photography of the study area at a scale of 1:4,000, with definition of vegetation polygons based on 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 location of 22 quadrats assessed during the survey was overlayed on the aerial photography, and associated flora and vegetation data used to provide vegetation association descriptions for individual polygons defined. Description of vegetation structure follows the height, life form and density classes of Muir (1977) (see Appendix 2). This is largely a structural classification suitable for broader scale mapping, but taking all ecologically significant strata into account. Vegetation condition for each of the study sites was determined using a recognised rating scale (based on Keighery 1994, see Appendix 3).

2.3.7 Vouchering

Voucher specimens were taken for all taxa where the identification could not be confirmed in the field. Taxonomy was completed by Dr Jerome Bull, and use was made of the Western Australian Herbarium.

2.3.8 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 2 Relevance of limitations to the Greenbushes flora and vegetation survey, as identified by EPA (2016a).

Constraint	Relevance
Availability of contextual information at a regional and local scale	There have been five previous flora and vegetation surveys which partly overlap the study area, providing a comprehensive local database.
Proportion of flora recorded and/or collected, any identification issues	The high sampling intensity by three experienced botanists ensured good coverage of the study area and resulted in a high proportion of the total flora present across two seasons during 2018 being recorded. Flowering of specific taxa across the two seasons increased likelihood of maximising total flora recorded, with a variety of annual and ephemeral plant taxa recorded under excellent seasonal conditions during spring 2018.
Survey timing, rainfall, season of survey	The survey was completed by three experienced botanists over six field days in July/August 2018 and six field days in September/October 2018. Seasonal conditions during both assessments were determined to be optimum, with good rainfall experienced during the preceding months and a wide variety of plant flowering during both survey periods.
Disturbance that may have affected the results of survey such as fire, flood or clearing	There were no disturbances recorded within the study area that influenced survey outcomes.
Was the appropriate area fully surveyed (effort and extent)	Three botanists spent a total of 12 field days covering the entire study area. A total of 22 quadrats and numerous relevé sites were assessed within the study area. This represents an appropriate effort to survey remnant native vegetation within the study area.
Access restrictions within the survey area	The study area was accessed by vehicle and on foot, noting that vegetation mapping was facilitated by high-resolution aerial photography (1:4,000). There were no access restrictions encountered.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	The Principal Botanist, Dr Darren Brearley, has 25 years' experience working within the southern jarrah forest, and has worked annually in state forest surrounding the Greenbushes Mine since 2001. The accompanying Principal Botanist and Senior Botanist have in excess of 15 years and seven years' experience working in the region, respectively. Together the team has completed surveys of the Greenbushes Mine area and the wider region.

2.3.9 Assessment of Conservation Significance

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

Commonwealth Level:

- EPBC Act: The Department of Environment (DoE) lists Threatened Flora, Fauna 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 4).

State Level:

- WC Act: At a State level native flora and fauna species are protected under the *WC 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.
- DBCA Priority list: DBCA produces a list of Priority species and ecological communities (PECs) 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 5). 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.

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6255000 6252500 6250000 6247500

GBC-01 GBC-02 GBC-03 GBC-04 GBC-05 GBC-06 GBC-15 GBC-16 GBC-07 GBC-08 GBC-09 GBC-12 GBC-11 GBC-10

Northern Road Bypass

GBC-23 GBC-24 A23

Southern Road Bypass

GBC-13 GBC-22 GBC-25

Powerline Corridor

Pieton Junction Northcliffe Railway

GBC-20 GBC-21 GBC-14

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ONSHORE ENVIRONMENTAL

TALISON

Bypass and Powerline Corridors

Survey Study Site Locations

Legend

- Study Areas
- Study Site Locations
- Talison Tenure

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Datum: GDA94
Projection: MGA Zone 50

Date:	26/11/2018
Status:	Final
Figure:	5
Sheet Size:	A3
Internal Reference:	TL_Study Sites
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GRIFFIN SPATIAL & MAPPING

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, or in close proximity to, the study area are presented in Table 3 and summarised below.

A Flora and Vegetation Survey of part of the Greenbushes Leases (Trudgen and Morgan 1991)

In 1991 Trudgen and Morgan undertook a flora and vegetation survey over the south-east sector of the Greenbushes mining leases which were intended to be used for future storage of waste rock. The survey occurred over two days in April 1991 and a total of ten sites were assessed.

A total of 91 plant taxa were recorded from the area. The most species rich families were Proteaceae (8 taxa), Mimosaceae (5 taxa), Papilionaceae (7 taxa), Myrtaceae (7 taxa), Epacridaceae (6 taxa) and Cyperaceae (5 taxa). No currently listed Declared Rare Flora (DRF) or Priority flora was recorded. However, three species deemed to be of significance at the time were identified; *Pentapeltis silvatica*, *Xanthorrhoea ?gracilis* and *Grevillea* sp. (BM 28). *Pentapeltis silvatica* was listed as Declared Rare Flora (now known as Threatened Flora) but is no longer listed as a species of conservation significance. The form of *Xanthorrhoea ?gracilis* found in this survey was considered to be different to the common *Xanthorrhoea gracilis* present over the larger area; it has been confirmed as the same taxon. The *Grevillea* sp. located during this survey could not be matched to specimens at the Western Australian Herbarium at the time, but subsequent investigations have confirmed that it is not of conservation significance.

The following four vegetation associations were described from the area assessed:

1. *Eucalyptus marginata*, *Eucalyptus (now Corymbia) calophylla,* Open Forest over *Bossiaea linophylla* High Shrubland over *Pteridium esculentum* Open Heath on lateritic loamy sand on upper hill slopes;
2. *Eucalyptus marginata*, *Eucalyptus (now Corymbia) calophylla,* Open Forest over *Banksia grandis* Low Woodland over *Bossiaea ornata* Low Shrubland;
3. *Eucalyptus marginata*, *Eucalyptus (now Corymbia) calophylla,* Open Forest over *Bossiaea ornata* Low Open Heath in sandy loam and some clay; and
4. *Eucalyptus rudis, Eucalyptus (*now *Corymbia) calophylla* Open to Closed Forest in creeklines.

None of these vegetation associations are considered to be of conservation significance, being widely present over a large area of the Menzies Sub-district.

Flora and Vegetation Survey of the Greenbushes Mine Site: Vegetation surrounding south-east corner of the TSF (Onshore Environmental Consultants 2006)

Onshore Environmental was commissioned by Sons of Gwalia Ltd to undertake a survey of flora and vegetation surrounding the south-east corner of the tailings storage facility (TSF). A total number of 135 plant taxa (including varieties and subspecies) from 37 families and 97 genera were recorded from the survey in April 2006. Species representation was greatest among the Papilionaceae (17 taxa), Poaceae (11 taxa), Myrtaceae (9 taxa), Mimosaceae (9 taxa), Proteaceae (7 taxa),

Cyperaceae (6 taxa), Epacridaceae (5 taxa), Asteraceae (5 taxa) and Haemodoraceae (5 taxa). No plant taxa gazetted as Threatened pursuant to subsection (2) of section 23F of the WC Act were recorded, nor were there any Priority flora species recorded. A total of 27 introduced species were recorded.

Vegetation within the survey area was represented by three broad units:

- Jarrah/Marri forest on lateritic slopes;
- Flooded Gum on lower slopes and along drainage line features; and
- Regrowth and introduced weeds associated with severely disturbed sites.

Vegetation of the study area was generally rated as either degraded or completely degraded due to historical disturbance from clearing, excavation and mineral exploration as well as the introduction of weed species.

Bridgetown RWSS Pipelines Millstream Dam to Greenbushes Link Biological Survey (AECOM Australia Pty Ltd 2010)

A biological survey was undertaken in the Greenbushes area as part of a plan to construct a regional pipeline to supply water from Millstream Dam to seven south-west towns. A field survey was undertaken during the spring of 2009 along Route 1, extending from Millstream Dam to the Greenbushes link. The survey included a flora and fauna assessment as well as a tree habitat survey.

A total of 86 flora species were identified during the survey from 70 genera and 37 families. The most species rich families were Poaceae (11 taxa), Myrtaceae (8 taxa) and Papilionaceae (7 taxa). A total of 29 introduced species were recorded within the study area. There were no Threatened or Priority flora recorded during the survey.

A total of 19 vegetation associations were described along Route 1 consisting of four major vegetation types: Woodland to Low Open Forest, Shrubland, Remnant Vegetation and Completely Degraded Areas. The vegetation types are briefly described below:

1. Low Woodlands to Low Open Forests: Typically consisting of *Eucalyptus marginata* and *Corymbia calophylla* with *Banksia grandis* in sand areas, *Taxandria parviceps* and *Melaleuca preissiana* in drainage areas, *Eucalyptus rudis* on creek banks and various understory species. There were eight vegetation associations within this vegetation type;
2. Shrubland: A Tall Open Shrubland of *Taxandria parviceps* and *Astartea fascicularis* with sedgeland of *Meeboldina* (now *Leptocarpus*) *roycei* and Herbland of *Typha orientalis*. There was a single vegetation association within this vegetation type;
3. Remnant Vegetation: Consists mostly of **Pinus radiata* over a Closed Grassland over **Phalaris canariensis* and Herbland of **Allium triquetrum*, **Fumaria capreolata* and **Raphanus raphanistrum* over Low Open Heath of **Rubus ulmifolius* on clayey soils. There was one vegetation association within the vegetation type.
4. Completely Degraded Areas: This vegetation type included all other mapped areas that were considered completely degraded, including Parkland, Tasmanian Blue Gum (**Eucalyptus globulus*) plantation, cleared land, Pine Plantation (**Pinus* spp.), cleared pine plantation, residential areas and gardens, vineyards and water bodies.

The majority of the area surveyed was considered to be completely degraded with only 1.5 percent of the area surveyed rated as very good to good.

Flora and Vegetation Survey Greenbushes Mining Leases (Onshore Environmental 2012)

A single season Level 2 (now referred to as detailed) flora and vegetation survey of ten mining leases (M01/2 to M01/11) that surround the existing Greenbushes mining operation (10,059.82 ha) was completed by three botanists from Onshore Environmental between the 13th and 21st October 2011. The survey area encompassed the current active mine site as well as large areas surrounding the mine which incorporate a combination of state forest, privately owned farmland, plantation timber, and the Greenbushes townsite. The field survey involved systematic sampling using quadrats (referred to as study sites) and transects which generally linked the quadrats. A total of 26 quadrats were formally assessed.

A total number of 368 plant taxa (including varieties and subspecies) from 73 families and 208 genera were recorded during the spring 2011 survey. Species representation was greatest among the Fabaceae, Poaceae, Myrtaceae, Malvaceae, Asteraceae, Orchidaceae, Cyperaceae, Proteaceae and Stylidiaceae families. The most speciose genus was *Acacia* (18 taxa), followed by *Stylidium* (10 taxa), *Caladenia* (7 taxa), *Lepidosperma* (6 taxa), *Lomandra* (6 taxa) and *Hakea* (6 taxa).

One plant taxon gazetted as Threatened pursuant to subsection (2) of section 23F of the WC Act and listed as Vulnerable under the EPBC Act, was recorded; *Caladenia harringtoniae. Caladenia harringtoniae* was recorded as 26 plants from an unincised drainage line / dampland in the south-west sector of the area surveyed. One Priority 3 flora taxon was also recorded; *Tetratheca parvifolia. Tetratheca parvifolia* was recorded from two locations within the north-west sector of the area.

A total of 86 introduced species were recorded during the survey, of which three taxa are Declared Plants under the *Agriculture and Related Resources Act 1976*; **Asparagus asparagoides* (Bridal Creeper), **Galium aparine* (Goosegrass) and **Rubus ulmifolius* (Blackberry).

A total of eight vegetation associations, classified into four broad floristic formations according to dominant vegetation strata, were described and mapped from the area. The field assessment confirmed there were no TECs or PECs represented within the area. The vegetation types are briefly described below:

1. *Eucalyptus* Dense Forest: Typically consisting of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* dense forest over *Banksia grandis* or *Bossiaea ornate* scrub in brown sandy loam on hill slopes and plateau;
2. *Eucalyptus* Forest: Consists mostly of *Eucalyptus marginata* subsp. m*arginata* or *E. rudis*, and *Corymbia calophylla* forest over *Banksia* spp. over *Leucopogon capitellatus* and *Bossiaea ornata* scrub in loamy sand on upper hill slopes and plateau, or along drainage lines and flats;
3. *Leptospermum* Scrub: described as *Leptospermum erubescens* scrub over *L. erubescens*, *Bossiaea aquifolium*, *Allocasuarina humilis* heath over *Hypocalymma angustifolium*, *Babingtonia camphorosmae* and *Thomasia foliosa* low heath in brown loamy sand on granite outcrops and sheets; and
4. **Typha orientalis* Dense Tall Sedges.

Greenbushes Mining Operations – Detailed Flora and Vegetation Survey (Onshore Environmental 2018)

To support environmental approvals for the proposed expansion of lithium mining at Talison Lithium's Greenbushes operation, a two season detailed flora and vegetation survey of the proposed expanded development envelope was completed by two Principal Botanists and one Senior Botanist from Onshore Environmental. Field work

occurred over a four day period from the 27th February to the 2nd March 2018, with a second season assessment completed over five spring days; 26th September, 4th and 16th - 18th October 2018.

A total number of 363 plant taxa (including varieties and subspecies) from 62 families and 197 genera were recorded, with species representation greatest among the Fabaceae, Asteraceae, Orchidaceae, Cyperaceae, Poaceae, Asparagaceae, Myrtaceae and Proteaceae families. The most speciose genus was *Acacia* (18 taxa), followed by *Stylidium* (12 taxa), *Lomandra* (8 taxa), *Caladenia, Drosera* and *Leucopogon* (7 taxa each).

None of the plant taxa recorded from the study area were gazetted as Threatened Flora (T) under the WC Act, or listed under the EPBC Act. The Priority 4 flora taxon *Acacia semitrullata* was recorded as approximately 213 plants from two populations occurring in grey sand on lower hill slopes within the north-west and central southern sectors of the study area. None of the flora recorded from within the study area was identified as a range extension.

A total of 62 introduced species were recorded from the study area, of which three taxa were listed as Declared Plants under the BAM Act; **Asparagus asparagoides* (Bridal Creeper) - s22(2), **Rubus anglocandicans* (Blackberry) - s22(2) (C3 Exempt), and **Rumex acetosella* (Sorrell) - s12 (C1 Prohibited).

A total of nine vegetation types from three broad landforms were described and mapped from the study area. Extensive field assessment confirmed there were no TECs or PECs represented within the study area. Vegetation within the study area is well represented regionally, and well reserved.

Vegetation condition across the majority of the study area was rated as very good (472 ha or 59 percent) or good (223 ha or 28 percent) with the primary disturbances resulting from hardwood logging activities. Smaller areas supported degraded vegetation which included historical mine rehabilitation (55 ha or 7 percent), or were completely degraded (including cleared annual pasture on private farmland). Other disturbances noted were access tracks, historical mine exploration (excavation of costeans), powerline corridors, and feral pig activity on drainage flats.

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	Significant Flora	Introduced (Weed) Taxa
A Flora and Vegetation Survey of Part of the Greenbushes Leases	Trudgen and Morgan	1991	April 1991	None	**Briza maxima, *Eragrostis curvula, *Phalaris* spp., **Juncus microcephalus, *Rubus discolor, *Eriodium cicutarium, *Centaurium* sp. **Dittrichia graveolens, *Hypoclaeris glabra*
Flora and Vegetation Survey Greenbushes Mine Site: Vegetation surrounding south east corner of the TSF	Onshore Environmental Consultants	2006	13th April 2006	None	**Conyza bonariensis,*Dittrichia graveolens, *Hypochaeris glabra, *Sonchus oleraceus, *Hypericum perforatum, *Cyperus tenellus, *Centaurium tenuiflorum, *Erodium cicutarium, *Gladiolus undulates, *Romulea rosea, *Juncus microcephalus, *Acacia dealbata, *Acacia pycnantha, *Monadenia bracteata, *Orobanche minor, *Chamaecytisus palmensis, *Lotus angustissimus, *Lotus uliginosus, *Trifolium* sp., **Pinus pinaster, *Plantago lanceolata, *Aira caryophyllea, *Briza maxima, *Briza minima, *Eragrostis curvula, *Rumex crispus, *Rubus discolor*
Bridgetown RWSS Pipelines Millstream Dam to Greenbushes Link Biological Survey	AECOM Australia Pty Ltd	2010	2009	None	**Rubus ulmifolius, *Asparagus asparadoidies, *Acacia decurrens, *Acacia iteaphylla, *Acacia longifolia, Acacia podalyriifolia, *Acacia pycnantha, *Echium plantagineum*
Flora and Vegetation Survey Greenbushes Mining Leases	Onshore Environmental Consultants	2012	13-21 October 2011	*Caladenia harringtoniae* (T); *Tetratheca parvifolia* (P3)	86 introduced species recorded; three listed as Declared Plants; **Asparagus asparagoides, *Galium aparine, *Rubus ulmifolius*

Survey	Consultant	Year	Field Survey Date	Significant Flora	Introduced (Weed) Taxa
Greenbushes Mining Operations, Detailed Flora and Vegetation Survey	Onshore Environmental Consultants	2018	27 February - 2 March 2018, 26 September, 4, 16 - 18 October 2018	*Acacia semitrullata* (P4)	62 introduced species recorded; three listed as Declared Plants; **Asparagus asparagoides, *Rubus anglocandicans, *Rumex acetosella*

3.1.2 Threatened Flora listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken within a 20 km radius around the central point of the study area (DoEE 2018). The search identified three records of 'Vulnerable' plant taxa potentially occurring regionally: *Caladenia harringtoniae, Diuris micrantha* and *Eleocharis keigheryi*; and a further three records of 'Endangered' plant taxa: *Caladenia hoffmanii*, *Commersonia erythrogyna* and *Goodenia arthrotricha*.

There were no TECs listed from the Federal search occurring within or surrounding the study area.

3.1.3 Threatened Flora listed under the IUCN Red List

A search of the IUCN database (IUCN 2018) determined that no Threatened Flora taxon was likely to occur within the study area.

3.1.4 Threatened Flora listed under the WA Wildlife Conservation (Rare Flora) Notice

A search of the DBCA rare flora databases identified three Threatened Flora as having previously being recorded within a 50 km radius of the study area (DBCA 2018a); *Caladenia harringtoniae, Caladenia christineae* and *Diuris drummondii*.

Caladenia harringtoniae has previously been recorded as one population within state forest outside the southwest boundary of the study area (Onshore Environmental 2012).

3.1.5 Priority Flora Recognised by the DBCA

The DBCA rare flora database search (DBCA 2018a) and NatureMap search identified 22 Priority flora taxa as potentially occurring within a 50 km radius of the study area (Table 4). It was determined that four of these taxa were considered *likely* to occur within the study area, and it was considered *possible* that a further six taxa may occur within the study area (as per criteria set out in Table 1) (Table 4).

Table 4 Priority flora taxa previously recorded within a 50 km radius of the study area (DBCA 2018a), and the likelihood of these taxa occurring within the study area.

Taxon	Cons Code	Habitat Preference	Likelihood in the study area
Acacia parkerae	3	Loam soils.	Unlikely
Acacia tayloriana	4	Grey or yellow/orange sandy soils, lateritic gravel, clay loam.	Possible
Andersonia barbata	2	White sand. Swampy areas.	Possible
Aponogeton hexatepalus	4	Freshwater: ponds, rivers, claypans.	Unlikely
Caladenia uliginosa subsp. *patulens*	1	Clay loam and gravel. Well drained soils amongst dense shrubs.	Possible
Carex tereticaulis	3	Black peaty sand.	Unlikely
Chorizema carinatum	3	Sand, sandy clay.	Possible
Dampiera heteroptera	3	Sandy soils. Swampy areas.	Likely
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.	Unlikely
Gastrolobium formosum	3	Clay loam. Along river banks or in swamps.	Unlikely
Grevillea bronwenae	3	Grey sand over laterite, lateritic loam. Hillslopes.	Unlikely
Grevilla ripicola	4	Sandy clay, clay or gravelly loam. Swampy flats, granite outcrops, along watercourses.	Likely
Melaleuca viminalis	2	Drainage lines and flats.	Likely
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.	Possible
Tetraria sp. Blackwood River (A.R. Annels 3043)	3	Loam soil.	Possible
Tetraria sp. Nannup (P.A. Jurjevich 1133)	1	Laterite.	Unlikely
Tetratheca parvifolia	3	Loam soils.	Likely
Thysanotus formosus	1	Clayey sand, sandy loam. In situations often inundated in winter.	Unlikely
Thysanotus gageoides	3	Sand, clay, granite, sandstone, laterite.	Unlikely

3.1.6 TECs listed under State and Federal legislation

A search of the EPBC Act Protected Matters database (DoEE 2018) confirmed there were no Federal listed TECs previously recorded within, or adjacent to, the study area. Similarly, a search of DBCA ecological communities database (DBCA 2018b) confirmed there were no State listed TEC records within a 20 km radius of the study area.

3.1.7 PECs recognised by DBCA

A search of DBCA's ecological community database confirmed there were no PEC records within a 20 km radius of the study area.

3.1.8 Environmentally Sensitive Areas

There is one Environmentally Sensitive Area (ESA) identified to the south-west of the study area, approximately 560 m from the intersection of Huitson Road and Maranup Ford Road. The ESA incorporates the winter-wet dampland supporting the *Caladenia harringtoniae* population.

3.2 Flora Species

A total number of 280 plant taxa (including varieties and subspecies) from 60 families and 157 genera were recorded from the study area (Table 5, Appendix 6). Species representation was greatest among the Fabaceae, Orchidaceae, Asparagaceae, Myrtaceae, Asteraceae, Cyperaceae, Proteaceae and Poaceae families. The most speciose genus was *Acacia* (17 taxa), followed by *Caladenia* (11 taxa), *Lomandra* (10 taxa), *Stylidium* (8 taxa), *Hibbertia* (7 taxa each), *Drosera* and *Pterostylis* (6 taxa each).

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

Parameter	No. Taxa
No. Families	60
No. Genera	157
No. Species (incl. subspecies & varieties)	280
No. Native Species (incl. subsp. & var.)	235
No. Threatened Flora	0
No. Priority Flora	2
No. Range Extensions	1
No. Introduced Species	45
Speciose Families	
Fabaceae	40
Orchidaceae	28
Asparagaceae	20
Myrtaceae	18
Asteraceae	14
Cyperaceae	11
Proteaceae	10
Poaceae	10
Dilleniaceae	8
Ericaceae	8

Speciose Genera	
Acacia	17
Lomandra	9
Stylidium	9
Caladenia	8
Hibbertia	7
Drosera	6
Pterostylis	6
Gompholobium	5
Eucalyptus	5
Lepidosperma	5

3.3 Conservation Significant Flora Species

3.3.1 Threatened Flora listed under the WC Act and EPBC Act

None of the plant taxa recorded from the study area were gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the WC Act, or listed under the EPBC Act.

3.3.2 Priority Flora

One Priority 4 flora taxon was recorded from the study area; *Acacia semitrullata. Acacia semitrullata* is a slender, erect shrub to 0.7 m in height (Plate 1). It is known to occur from white/grey sands on sandplains or swampy areas, from the Jarrah Forest, Swan Coastal Plan and Warren bioregions (WAH 2018). It has been widely recorded between Pinjarra in the north, Cape Leeuwin in the south, and Collie and Nannup in the east, with one outlying record from Walpole on the south coast (Atlas of Living Australia 2018).

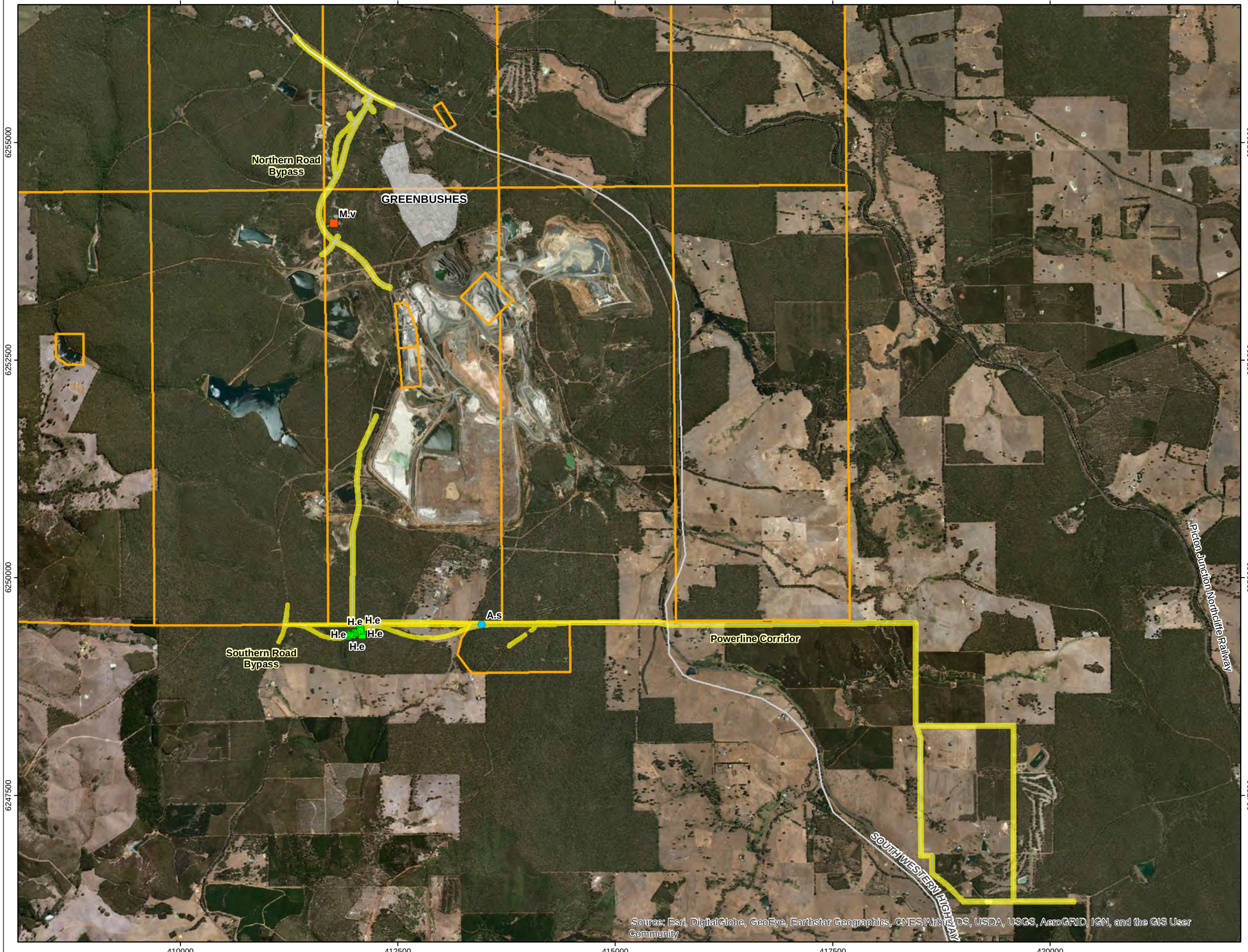
Acacia semitrullata was recorded as four plants from a single point location in state forest situated adjacent to Forest Park Avenue along the proposed powerline corridor (Figure 6). It occurred on brown loamy sand on a mid hill slope. Vegetation was described as 'Forest of *Eucalyptus marginata* and *Corymbia calophylla* over Scrub of *Eucalyptus marginata* and *Corymbia calophylla* (regrowth) over Dwarf Scrub D of *Leucopogon capitellatus, Bossiaea ornata, Hypocalymma angustifolium* and *Hakea lissocarpha* (with scattered *Xanthorrhoea preissii*)'.

The Priority 2 flora taxon *Melaleuca viminalis* was recorded approximately 70 metres east (outside) of the proposed northern bypass road. Three plants up to four metres in height (Plate 2) were recorded in riparian vegetation adjacent to the Greenbushes "swimming pool", a popular recreation site. The close proximity of this location to the ablution block and other exotic plantings suggests the individuals may have been introduced to the site.

Melaleuca viminalis occurs extensively in Queensland and New South Wales, where the majority of collections have been made east of the Great Dividing Range. It is also know from South Australia and the Northern Territory. In Western Australia it has been collected in the creekline of sandstone gorges in the Kimberley region of Western Australia. There are other scattered records around the Perth metrolopitan area, with other localised records from Boddington, Waroona, Greenbushes and Denmark.

Plate 1 ***Acacia semitrullata*** **(Priority 4) from within the study area.**

Plate 2 ***Melaleuca viminalis*** **(Priority 2) from adjacent to the study area.**



ONSHORE ENVIRONMENTAL

TALISON

Bypass and Powerline Corridors

Significant Flora Locations

Legend

- Study Areas
- Talison Tenure
- Railway

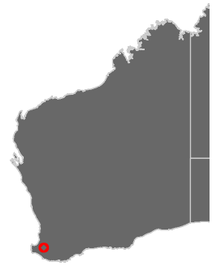
Significant Flora

Opportunistic

- Acacia semitrullata (A.s) - P4
- Hybanthus epacroides (H.e) - Range Extension

Targeted Search

- Hybanthus epacroides (H.e) - Range Extension
- Melaleuca viminalis (M.v) - P2



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Requested by:	DB

GRIFFIN SPATIAL & MAPPING

3.3.3 Range Extensions

One taxon recorded from within the study area was considered to occur outside of the previously recognised range, and as such has been identified as a significant range extension; *Hybanthus epacroides* (Plate 3). This taxon occurs along the south coast between Bremer Bay and Cape Arid National Park, extending north to Fraser Range, Coolgardie and Mount Manning Range Nature Reserve, and west to Wongan Hills, Gnowangerup and east of the Stirling Range National Park. The nearest known record to the study area is approximately 180 km to the east at Gnowangerup.

Hybanthus epacroides is known to occur in white or yellow sand in association with laterite. Within the study area it was recorded on orange sands weathered and deposited from laterite positioned higher in the landscape. This habitat type was specific and localised.

Plate 3 *Hybanthus epacroides* (range extension) from within the study area.

3.4 Introduced Flora

A total of 45 introduced species were recorded from within the study area (Table 6), of which two taxa were listed as Declared Plants under the *Biosecurity and Agriculture Management Act 2007* (Department of Agriculture and Food 2018):

- **Asparagus asparagoides* (Bridal Creeper) - s22(2); and
- **Rubus anglocandicans* (Blackberry) - s22(2) (C3 Exempt).

The diversity of weeds within the study area is relatively high and reflects the long mining history of the Greenbushes area and close proximity of remnant native vegetation to surrounding agricultural land. Many of the weed species recorded are likely to have been introduced during early exploration and mining, becoming

established on disturbed ground and volunteering into adjacent areas. High moisture habitats are particularly vulnerable to colonisation by weeds, however infestations recorded in 2018 were generally localised.

Farmland in the southern sector of the study area was another source of introduced species, with 'edge effects' typically evident around the boundary of cleared annual pasture areas. The annual pasture and verge species are represented within intact native vegetation as a minor component of the understorey. Disturbed areas such as tracks and historical rehabilitation are more susceptible to invasion by these introduced taxa, which are generally not vigorous and typically do not impact on native vegetation structure.

Table 6 Introduced species recorded from the study area.

Species	Common Name	Category
**Acacia baileyana*	Cootamundra wattle	Permitted - s11
**Acacia dealbata*	Silver Wattle	Permitted - s11
**Acacia iteaphylla*	Flinders Ranges wattle	Permitted - s11
**Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle	Permitted - s11
**Acacia pycnantha*	Golden Wattle	Permitted - s11
**Acaena echinata*	Sheep's Burr	Permitted - s11
**Aira caryophyllea*	Silvery Hairgrass	Permitted - s11
**Anthoxanthum odoratum*	Sweet Veral Grass	Permitted - s11
**Arctotheca calendula*	Cape Weed	Permitted - s11
**Asparagus asparagoides*	Bridal Creeper	s22(2)
**Asparagus declinatus*	Bridal Veil	Permitted - s11
**Briza maxima*	Blowfly Grass	Permitted - s11
**Briza minor*	Shivery Grass	Permitted - s11
**Bromus diandrus*	Great Brome	Permitted - s11
**Callistemon comboynensis*	Cliff Bottlebrush	Permitted - s11
**Carduus pycnocephalus*	Slender Thistle	Permitted - s11
**Centaurium erythraea*	Common Centaury	Permitted - s11
**Chamaecytisus palmensis*	Tagasaste	Permitted - s11
**Chasmanthe floribunda*	African Cornflag	Permitted - s11
**Conyza bonariensis*	Flaxleaf Fleabane	Permitted - s11
**Corymbia maculata*	Spotted Gum	Permitted - s11
**Cynodon dactylon*	Couch Grass	Permitted - s11
**Ehrharta calycina*	Perennial Veld Grass	Permitted - s11
**Eucalyptus resinifera*	Red Mahogany	Permitted - s11
**Freesia alba × leichtlinii*	Freesia	Permitted - s11
**Hypochaeris glabra*	Smooth Catsear	Permitted - s11
**Juncus microcephalus*	Rush	Permitted - s11
**Lavandula stoechas*	Italian Lavender	Permitted - s11
**Lobularia maritima*	Sea Alyssum	Permitted - s11
**Lolium rigidum*	Wimmera Ryegrass	Permitted - s11
**Lysimachia arvensis*	Pimpernel	Permitted - s11
**Narcissus pseudonarcissus*	Wild Daffodi	Permitted - s11
**Osteospermum ecklonis*	White Daisybush	Permitted - s11
**Ornithopus pinnatus*	Slender Serradella	Permitted - s11
**Oxalis corniculata*	Yellow Wood Sorrel	Permitted - s11
**Oxalis glabra*	Finger-leaf	Permitted - s11
**Oxalis pes-caprae*	Soursob	Permitted - s11
**Oxalis purpurea*	Largeflower Wood Sorrel	Permitted - s11
**Petrorhagia dubia*	Hairy Pink	Permitted - s11

Species	Common Name	Category
**Pinus pinaster*	Pinaster Pine	Permitted - s11
**Plantago lanceolata*	Ribwort Plantain	Permitted - s11
**Psoralea pinnata*	Taylorina	Permitted - s11
**Ricinus communis*	Castor Oil Plant	Permitted - s11
**Romulea rosea*	Guildford Grass	Permitted - s11
**Rubus anglocandicans*	Blackberry	s22(2) (C3 Exempt)
**Solanum nigrum*	Deadly Nightshade	Permitted - s11
**Sonchus oleraceus*	Common Sowthistle	Permitted - s11
**Sparaxis bulbifera*	Harlequin Flower	Permitted - s11
**Trifolium repens*	White Clover	Permitted - s11
**Ursinia anthemoides*	Ursinia	Permitted - s11

3.5 Vegetation

A total of ten vegetation types from four broad landforms were described and mapped from within the corridor study area (Figures 7-9). The vegetation types were classified into six broad floristic formations according to dominant vegetation strata (Table 7). Raw data for each of the 22 formal quadrats assessed is provided in Appendix 7.

In order to provide context for environmental impact assessment, as per the requirement for 'linear corridor surveys' (EPA 2016a), vegetation mapping was extended to a minimum distance of 500 metres either side of the study area corridor. It was then merged with adjacent vegetation mapping recently completed within the Mine Development Envelope (Onshore Environmental 2018) to provide additional local context. This resulted in a consolidated vegetation map with 16 vegetation types classified into eleven broad floristic formations and occurring on five broad landforms (Appendix 8).

Table 7 Vegetation types mapped within the study area (shaded grey) and surrounding buffer.

Broad Floristic Formation	Vegetation Code	Vegetation Association Description	Quadrats	Additional Taxa / Strata
Allocasuarina Forest	HC Af	Forest of *Allocasuarina fraseriana, Corymbia calophylla* and *Eucalyptus marginata* over Low Woodland A of *Corymbia calophylla, Eucalyptus marginata* and *Allocasuarina fraseriana* over Open Dwarf Scrub D of *Bossiaea ornata (Astroloma pallidum)* over Very Open Low Sedges of *Tetraria* sp. Jarrah Forest (R. Davis 7391) on brown loamy sand on hill crests and upper hill slopes with outcropping laterite	C-6	
Corymbia Forest	HS Bg	Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Woodland A of *Banksia grandis, Persoonia longifolia, Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Open Low Scrub A of *Bossiaea linophylla, Pteridium esculentum* and/or *Macrozamia riedlei* over Low Heath D of *Bossiaea ornata* and/or *Leucopogon capitellatus* on brown sandy loam on upper hillslopes	C-2, C-14, C-15, C-21, GR-02, GR-10, GR-15, GR-20, GR-41	*Bossiaea linophylla, Hibbertia hypericoides, Xanthorrhoea gracilis, Leucopogon verticillatus, Phyllanthus calycinus, Tetraria* sp. Jarrah Forest (R. Davis 7391), *Lepidosperma leptostachyum*
Eucalyptus Forest	HS Bo	Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Heath D of *Bossiaea ornata* and *Leucopogon capitellatus* on grey/brown loamy sand on hillslopes	C-1, C-9, C-11, C-12, C-20, C-23, GR-03, GR-04, GR-06, GR-08, GR-09, GR-12, GR-14, GR-18, GR-19, GR-21, GR-28, GR-31, GR-33, GR-35, GR-36	*Banksia grandis, Persoonia longifolia, Banksia dallanneyi, Hibbertia hypericoides, Xanthorrhoea preissii, Xanthorrhoea gracilis, Leucopogon verticillatus, Hypocalymma angustifolium, Hakea lissocarpha, Tetraria* sp. Jarrah Forest (R. Davis 7391)
Podocarpus Heath A	HS Pd TpBl	Heath A of *Podocarpus drouynianus (Pultenaea ocheata)* with Woodland (to Forest) of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Scrub of *Taxandria parviceps (Bossiaea linophylla)* over Dwarf Scrub C/D of *Dasypogon bromeliifolius, Adenanthos obovatus* and *Leucopogon oxycedrus* on grey sand on lower hillslopes	C-22, C-24, C-25, C-A23, GR-01, GR-07, GR-13, GR-25	*Corymbia calophylla, Eucalyptus marginata, Persoonia longifolia, Xanthorrhoea preissii, Macrozamia riedlei, Billarderia heterophylla, Leucopogon capitellatus, Hibbertia diamesogenos, Hypolaena exsulca, Desmocladus fascicularis*

Broad Floristic Formation	Vegetation Code	Vegetation Association Description	Quadrats	Additional Taxa / Strata
Corymbia Forest	HS Xp	Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Scrub of *Xanthorrhoea preissii (Bossiaea linophylla)* over Dwarf Scrub C of *Xanthorrhoea gracilis* and *Phyllanthus calycinus* on brown sandy loam on hillslopes	C-3, C-8, GR-11, GR-17, GR-23	*Banksia grandis, Macrozamia riedlei, Hypocalymma angustifolium, Bossiaea ornata, Hibbertia hypericoides, Leucopogon capitellatus, Banksia dallanneyii, Thomasia grandiflora*
Allocasuarina Heath A	HS AhLe	Heath A of *Allocasuarina humilis* and *Leptospermum erubescens* over Low Heath D of *Thomasia grandiflora, Andersonia caerulescens* and *Banksia dallanneyi* with Low Open Scrub B of *Xanthorrhoea preissii* on brown clay loam on lower hill slopes	C-4	Very Open Low Sedges of *Tetraria* sp. Jarrah Forest (R. Davis 7391) and *Desmocladus fasciculatus*
Eucalyptus Forest	DF Ep Mp Hp	Forest of *Eucalyptus patens, Corymbia calophylla* and **Pinus radiata* over Scrub of *Hakea prostrata, *Acacia pycnantha* and *Taxandria linearifolia* over Low Scrub B of *Astartea scoparia* and *Bossiaea linophylla* over Open Dwarf Scrub D of *Hypocalymma angustifolium* over Very Open Low Sedges of *Tetraria* sp. Jarrah Forest (R. Davis 7391) on brown sandy clay loam on drainage flats	C-10	
Melaleuca Forest	DF MpEp AsTl	Forest of *Melaleuca preissiana* and *Eucalyptus patens* over Scrub of *Astartea scoparia* and *Taxandria linearifolia* over Low Scrub B of *Aotus gracillima* and *Pteridium esculentum* over Open Low Grass of **Anthoxanthum odoratum* and **Vulpia* sp. indet over Very Open Tall Sedges of *Isolepis cyperoides* and *Juncus pallidus* on black sandy clay loam on seasonally wet drainage flats	C-16, GR-05	
Eucalyptus Forest	DL Er	Forest of *Eucalyptus rudis* subsp. *rudis* (sometimes mixed species) over Scrub of *Trymalium odoratissimum* subsp. *odoratissimum, Taxandria linearifolia* and/or *Hakea prostrata* over Open Tall Sedges of *Lepidosperma tetraquetrum* or *Chorizandra enodis* on brown sandy clay loam on minor drainage lines	C-5, C-13, GR-16, GR-24, GR-34, GR-37, GR-39, GR-40	*Corymbia calophylla, Eucalyptus patens, Callistachys lanceolata, Melaleuca preissiana, Pteridium esculentum, Billardiera heterophylla, Lepidosperma tetraquetrum*
Eucalyptus Forest	HR Er	Forest of *Eucalyptus resinifera* over Very Open Herbs of **Chasmanthe floribunda* and **Oxalis glabra* on brown loamy sand on post mining rehabilitation landform	C-7	

ONSHORE ENVIRONMENTAL

TALISON LITHIUM

Northern Bypass

Vegetation Types

Figure 7

Legend

- Mine Development
- Study

N

0 100 200 300

Meters

1:12,500

Datum: GDA94

Projection: MGA Zone 50

Date:	13/09/2018
Status:	Final
Figure:	7
Sheet Size:	A3
Internal Reference:	TL_Nth_bypass
Drawn by:	GSM
Requested by:	DB

GRIFFIN SPATIAL & MAPPING

411000
412000
413000
414000
6250000
6249000

MARANUP FORD RD
PERRYS RD
WOLJENUP CREEK
FOREST PARK AV
DANIELS RD

HS Bo
Road
Rehab
HS Pd TpBl
Cleared Pasture
HS Bg

TALISON LITHIUM

Southern Bypass

Vegetation Types

Figure 8

Legend

- Mine Development Area
- Study Area

N

0 100 200 300

Meters
1:10,000
Datum: GDA94
Projection: MGA Zone 50

Date:	13/09/2018
Status:	Final
Figure:	8
Sheet Size:	A3
Internal Reference:	TL_Sth_bypass
Drawn by:	GSM
Requested by:	DB

412000 413000 414000 415000 416000 417000 418000 419000 420000

6252000 6251000 6250000 6249000 6248000 6247000 6246000

MARANUP FORD RD
Mine Clearing
HS Bg
Road
HS Bg
Road
Rehab
Water
Rehab
Mine Clearing
Rehab
Water
Rehab
HS Bo
Road
Rehab
Rehab
HS Bo
PERRYS RD
SOUTH WESTERN HWY
HESTER BROOK
FULLERTON RD
HAINES RD
HESTER CASCADES RD
HS Pd TpBl
HS Pd TpBl
Road
HS Bo
FOREST PARK AV
HS Bo
HS Bo
Blue Gum Plantation
Road
Road
HS Pd TpBl
Road
Cleared Pasture
HS Bo
HS Bg
Cleared Pasture
Road
HS Bo
Cleared Pasture
HALLS RD
DL Er
Blue Gum Plantation
HESTER HALL RD
DANIELS RD
Pine Plantation
Cleared Pasture
Blue Gum Plantation
Cleared
WOLJENUP CREEK
DL Er
HS Bo
Cleared Pasture
BILL BALDOCK DR
BLACKWOOD PARK RD
Cleared Pasture
WAGEBADENUP RDGE
Cleared Pasture
HS Bg
HS Bg
Pine Plantation
HS Bg
HS Bg
Cleared Pasture
HS Bg
Road
HS Bg
HESTER RD
HS Bg
Cleared Pasture
HS Bg
Cleared Pasture
Pine Plantation
TROTTS RD

412000 413000 414000 415000 416000 417000 418000 419000 420000

TALISON LITHIUM

Powerline

Vegetation Types

Figure 9

Legend

- Mine Development Area
- Study Area

N

0 250 500 750

Meters
1:25,000
Datum: GDA94
Projection: MGA Zone 50

Date:	17/09/2018
Status:	Final
Figure:	9
Sheet Size:	A3
Internal Reference:	TL_Powerline
Drawn by:	GSM
Requested by:	DB

Legend

Mine Development

Study

Vegetation Types

Hill Crest

HC Af	Forest of Allocasuarina fraseriana, Corymbia calophylla and Eucalyptus marginata over Low Woodland A of Corymbia calophylla, Eucalyptus marginata and Allocasuarina fraseriana over Open Dwarf Scrub D of Bossiaea ornata and (Astroloma pallidum) over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) on brown loamy sand on hill crests and upper hill slopes with outcropping laterite

Hill Slope

HS Bg	Forest of Corymbia calophylla and Eucalyptus marginata subsp. marginata over Low Woodland A of Banksia grandis , Persoonia longifolia, Corymbia calophylla and Eucalyptus marginata subsp. marginata over Open Low Scrub A of Pteridium esculentum and Macrozamia riedlei over Low Heath D of Bossiaea ornata and/or Leucopogon capitellatus on brown sandy loam on upper hillslopes
HS Bo	Forest of Eucalyptus marginata subsp. marginata and Corymbia calophylla over Low Heath D of Bossiaea ornata and Leucopogon capitellatus on grey/brown loamy sand on
HS Pd TpBl	Heath A of Podocarpus drouynianus (Pultenaea ocheata) with Woodland (to Forest) of Eucalyptus marginata subsp. marginata and Corymbia calophylla over Scrub of Taxandria parviceps (Bossiaea linophylla) over Dwarf Scrub C/D of Dasypogon bromeliifolius, Adenanthos obovatus and Leucopogon oxycedrus on grey sand on lower hillslopes
HS Xp	Forest of Corymbia calophylla and Eucalyptus marginata subsp. marginata over Scrub of Xanthorrhoea preissii (Bossiaea linophylla) over Dwarf Scrub C of Xanthorrhoea gracilis and Phyllanthus calycinus on brown sandy loam on

Drainage Flats

DF Ep Mp Hp	Forest of Eucalyptus patens, Corymbia calophylla and *Pinus radiata over Scrub of Hakea prostrata, *Acacia pycnantha and Taxandria linearifolia over Low Scrub B of Astartea scoparia and Bossiaea linophylla over Open Dwarf Scrub D of Hypocalymma angustifolium over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) on brown sandy clay loam on drainage flats
DF MpEp	Forest of Melaleuca preissiana and Eucalyptus patens over Scrub of Astartea scoparia and Taxandria linearifolia over Low Scrub B of Aotus gracillima and Pteridium esculentum over Open Low Grass of *Anthoxanthum odoratum and *Vulpia sp. indet over Very Open Tall Sedges of Isolepis cyperoides and Juncus pallidus on black sandy clay loam on seasonally wet drainage flats

Drainage Line

DL Er	Forest of Eucalyptus rudis subsp. rudis (sometimes mixed species) over Scrub of Trymalium odoratissimum subsp. odoratissimum, Taxandria linearifolia and/or Hakea prostrata over Open Tall Sedges of Lepidosperma tetraquetrum or Chorizandra enodis on brown sandy clay loam on minor drainage lines

Other

Cleared

Cleared Pasture

Mine Clearing

Plantation

Rehabilitation

Road

Water

[redacted]

TALISON LITHIUM

Vegetation Types

Legend

Figures 7-9

Date:	13/09/2018
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Figure:	7-9
Sheet Size:	A3
Internal Reference:	TL_Veg_types
Drawn by:	GSM
Requested by:	DB

[redacted]

Broad Floristic Formation	*Allocasuarina* Forest
Vegetation Association	HC Af - Forest of *Allocasuarina fraseriana, Corymbia calophylla* and *Eucalyptus marginata* over Low Woodland A of *Corymbia calophylla, Eucalyptus marginata* and *Allocasuarina fraseriana* over Open Dwarf Scrub D of *Bossiaea ornata (Astroloma pallidum)* over Very Open Low Sedges of *Tetraria* sp. Jarrah Forest (R. Davis 7391) on brown loamy sand on hill crests and upper hill slopes with outcropping laterite

Area Mapped	0.61 ha
Quadrats Sampled	C-06
Soils	Brown loamy sand
Land Form	Upper Hill Slopes
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	None
Vegetation Condition	Good
Disturbances	Access track, logging
Average Fire Age	Moderate (3-5yrs)
Vegetation Structure & Floristics	
Trees 10-30 m	*Allocasuarina fraseriana, Corymbia calophylla, Eucalyptus marginata*
Tall Shrubs >2 m	*Persoonia longifolia*
Low Shrubs >0.5 m	*Bossiaea ornata, Astroloma pallidum*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391), *Desmocladus fasciculatus*

Broad Floristic Formation	*Corymbia* Forest
Vegetation Association	HS Bg - Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Woodland A of *Banksia grandis*, *Persoonia longifolia*, *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Open Low Scrub A of *Bossiaea linophylla, Pteridium esculentum* and/or *Macrozamia riedlei* over Low Heath D of *Bossiaea ornata* and/or *Leucopogon capitellatus* on brown sandy loam on upper hillslopes

Area Mapped	7.94 ha
Quadrats Sampled	C-2, C-14, C-15, C-21, GR-02, GR-10, GR-15, GR-20, GR-41
Soils	Sandy loam
Land Form	Upper Hillslope
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Acacia dealbata, *Acacia iteaphylla, *Acacia longifolia* subsp. *longifolia, *Asparagus asparagoides, *Bicinis communis, *Briza maxima, *Chamaecytisus palmensis, *Chasmanthe floribunda, *Cynodon dactylon, *Ehrharta calycina, *Hypochaeris glabra, *Juncus microcephalus, *Lobularia maritima, *Oxalis corniculata, *Oxalis pes-caprae, *Pinus pinaster, *Plantago lanceolata, *Romulea rosea, *Rubus anglocandicans, *Solanum nigrum, *Sonchus oleraceus *Sparaxis bulbifera*
Vegetation Condition	Very Good
Disturbances	Weed invasion, logging, road/access track
Average Fire Age	Moderate (3 to 5yrs) to Old (6+ years)
Vegetation Structure & Floristics	
Trees >15 m	*Corymbia calophylla, Eucalyptus marginata* subsp. *marginata*
Trees <15 m	*Banksia grandis, Persoonia longifolia, Corymbia calophylla, Eucalyptus marginata* subsp. *marginata*
Shrubs >1.5 m	*Bossiaea linophylla, Pteridium esculentum, Macrozamia riedlei, Xanthorrhoea gracilis, Leucopogon verticillatus*
Shrubs <0.5 m	*Bossiaea ornata, Leucopogon capitellatus, Banksia dallanneyi, Hibbertia hypericoides, Phyllanthus calycinus, Labichea punctata*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391), *Lepidosperma leptostachyum, Tetraria octandra*

Broad Floristic Formation	*Eucalyptus* Forest
Vegetation Association	HS Bo - Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Heath D of *Bossiaea ornata* and *Leucopogon capitellatus* on grey/brown loamy sand on hillslopes

Area Mapped	24.88 ha
Quadrats Sampled	C-1, C-9, C-11, C-12, C-20, C-23, GR-03, GR-04, GR-06, GR-08, GR-09, GR-12, GR-14, GR-18, GR-19, GR-21, GR-28, GR-31, GR-33, GR-35, GR-36
Soils	Loamy sand
Land Form	Hillslope
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Acacia pycnantha, *Briza maxima, *Chasmanthe floribunda, *Hypochaeris glabra, *Oxalis corniculata*
Vegetation Condition	Very Good
Disturbances	Weeds, road/ access tracks, logging, cattle grazing, dieback, mining exploration, ground disturbance
Average Fire Age	Moderate (3 to 5yrs) to Old (6+ years)
Vegetation Structure & Floristics	
Trees >15 m	*Eucalyptus marginata* subsp. *marginata, Corymbia calophylla*
Shrubs >2 m	*Persoonia longifolia, Banksia grandis, Xanthorrhoea preissii*
Shrubs 0.5-1 m	*Xanthorrhoea gracilis, Leuocopogon propinquus, Hypocalymma angustifolium, Macrozamia riedlei, Leuocopogon verticillatus*
Shrubs <0.5 m	*Bossiaea ornata, Leucopogon capitellatus, Hibbertia diamesogenos, Hibbertia hypericoides, Banksia dallanneyi, Hibbertia amplexicaulis, Hibbertia commutata, Hypocalymma angustifolium, Hakea lissocarpha, Phyllanthus calycinus*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391), *Lepidosperma leptostachyum*

Broad Floristic Formation	*Podocarpus* Heath A
Vegetation Association	HS Pd TpBl - Heath A of *Podocarpus drouynianus* (*Pultenaea ochreata*) with Woodland (to Forest) of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Scrub of *Taxandria parviceps* (*Bossiaea linophylla*) over Dwarf Scrub C/D of *Dasypogon bromeliifolius*, *Adenanthos obovatus* and *Leucopogon oxycedrus* on grey sand on lower hillslopes

Area Mapped	2.60 ha
Quadrats Sampled	C-22, C-25, C-A23, GR-01, GR-07, GR-13, GR-25
Soils	Sand
Land Form	Lower hillslopes
Priority Ecological Community	No
Conservation Significant Flora	*Acacia semitrullata*
Introduced Species	**Briza maxima, *Hypochaeris glabra*
Vegetation Condition	Very Good
Disturbances	Logging, road/access tracks, pigs
Average Fire Age	Moderate (3 to 5 yr)
Vegetation Structure & Floristics	
Trees >15 m	*Eucalyptus marginata* subsp. *marginata, Corymbia calophylla*
Shrubs >2 m	*Taxandria parviceps, Bossiaea linophylla*
Shrubs 1.5-2 m	*Podocarpus drouynianus, Pultenaea ochreata, Macrozamia riedlei*
Shrubs <1 m	*Dasypogon bromeliifolius, Adenanthos obovatus, Leucopogon oxycedrus, Hypocalymma angustifolium, Leucopogon capitellatus, Melaleuca thymoides*
Sedges <0.5 m	*Lyginea imberbis, Hypolaena exsulca*

Broad Floristic Formation	*Corymbia* Forest
Vegetation Association	HS Xp - Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Scrub of *Xanthorrhoea preissii* (*Bossiaea linophylla*) over Dwarf Scrub C of *Xanthorrhoea gracilis* and *Phyllanthus calycinus* on brown sandy loam on hillslopes

Area Mapped	2.02 ha
Quadrats Sampled	C-3, C-8, GR-11, GR-17, GR-23
Soils	Sandy loam
Land Form	Hillslope
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Acacia pycnantha, *Briza maxima, *Chasmanthe floribunda, *Conyza bonariensis, *Hypochaeris glabra, *Lavendula stoechus, *Oxalis corniculata*
Vegetation Condition	Good
Disturbances	Cattle grazing, road/access track, weeds, logging, dieback, farmland
Average Fire Age	Old (6+yr)
Vegetation Structure & Floristics	
Trees >15 m	*Corymbia calophylla, Eucalyptus marginata* subsp. *marginata*
Shrubs >2 m	*Xanthorrhoea preissii, Bossiaea linophylla*
Shrubs <1 m	*Xanthorrhoea gracilis, Macrozamia riedlei, Phyllanthus calycinus, Leucopogon propinquus, Leucopogon capitellatus, Hakea lissocarpha, Banksia dallanneyi, Hypocalymma angustifolium, Bossiaea ornata, Hibbertia hypericoides*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391), *Lepidosperma leptostachyum*

Broad Floristic Formation	*Allocasuarina* Heath A
Vegetation Association	HS AhLe - Heath A of *Allocasuarina humilis* and *Leptospermum erubescens* over Low Heath D of *Thomasia grandiflora, Andersonia caerulescens* and *Banksia dallanneyi* with Low Open Scrub B of *Xanthorrhoea preissii* on brown clay loam on lower hill slopes

Area Mapped	0 ha (fringing the corridor)
Quadrats Sampled	C-04
Soils	Brown clay loam
Land Form	Footslopes
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Hypochaeris glabra, *Lavendula stoechis, *Oxalis glabra, *Oxalis purpurea*
Vegetation Condition	Good
Disturbances	Access track
Average Fire Age	Moderate (3-5yrs)
Vegetation Structure & Floristics	
Trees 10-30 m	*Allocasuarina humilis, Leptospermum erubescens*
Mid Shrubs 1-1.5 m	*Xanthorrhoea preissii*
Low Shrubs >0.5 m	*Thomasia grandiflora, Andersonia caerulea, Banksia dallaneyi*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391), *Desmocladus fasciculatus*

Broad Floristic Formation	*Eucalyptus* Forest
Vegetation Association	DF Ep Mp Hp - Forest of *Eucalyptus patens, Corymbia calophylla* and **Pinus radiata* over Scrub of *Hakea prostrata, *Acacia pycnantha* and *Taxandria linearifolia* over Low Scrub B of *Astartea scoparia* and *Bossiaea linophylla* over Open Dwarf Scrub D of *Hypocalymma angustifolium* over Very Open Low Sedges of *Tetraria* sp. Jarrah Forest (R. Davis 7391) on brown sand y clay loam on drainage flats

Area Mapped	1.57 ha
Quadrats Sampled	C-10
Soils	Brown sandy clay loam
Land Form	Wetland
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Acacia pycnantha, *Oxalis glabra, *Pinus radiata*
Vegetation Condition	Good
Disturbances	Access track, weeds, logging
Average Fire Age	Old (6+ yrs)
Vegetation Structure & Floristics	
Trees 10-30 m	*Eucalyptus patens, Corymbia calophylla, *Pinus radiata*
Tall Shrubs >2 m	*Hakea prostrata, Taxandria linearifolia, *Acacia pycnantha*
Mid Shrubs 1-1.5 m	*Astartea scoparia, Bossiaea linophylla*
Low Shrubs <0.5 m	*Hypocalymma angustifolium*
Sedges <0.5 m	*Tetraria* sp. Jarrah Forest (R. Davis 7391)

Broad Floristic Formation	*Melaleuca* Forest
Vegetation Association	DF MpEp AsTl - Forest of *Melaleuca preissiana* and *Eucalyptus patens* over Scrub of *Astartea scoparia* and *Taxandria linearifolia* over Low Scrub B of *Aotus gracillima* and *Pteridium esculentum* over Open Low Grass of **Anthoxanthum odoratum* and **Vulpia* sp. indet over Very Open Tall Sedges of *Isolepis cyperoides* and *Juncus pallidus* on black sandy clay loam on seasonally wet drainage flats

Area Mapped	0.60 ha
Quadrats Sampled	C-16, GR-05
Soils	Sandy clay loam
Land Form	Drainage flates
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Asparagus asparagoides, *Chasmanthe floribunda, *Eucalyptus resinifera, *Hypochaeris glabra, *Juncus microcephalus, *Lobularia maritima, *Pinus pinaster, *Plantago lanceolata, *Ricinus communis, *Rubus anglocandicans*
Vegetation Condition	Good
Disturbances	Mining exploration, road/access tracks, weeds, heavily disturbed
Average Fire Age	Old (6+yrs)
Vegetation Structure & Floristics	
Trees >15m	*Melaleuca preissiana, Eucalyptus patens, Corymbia calophylla*
Shrubs >2m	*Astartea scoparia, Taxandria linearifolia*
Shrubs <2m	*Aotus gracillima, Pteridium esculentum*
Grasses	**Anthoxanthum odoratum, *Vulpia* sp. indet
Sedges	*Isolepis cyperoides, Juncus pallidus, Leptocarpus roycei*

Broad Floristic Formation	*Eucalyptus* Forest
Vegetation Association	DL Er - Forest of *Eucalyptus rudis* subsp. *rudis* (sometimes mixed species) over Scrub of *Trymalium odoratissimum* subsp. *odoratissimum*, *Taxandria linearifolia* and/or *Hakea prostrata* over Open Tall Sedges of *Lepidosperma tetraquetrum* or *Chorizandra enodis* on brown sandy clay loam on minor drainage lines

Area Mapped	1.87 ha
Quadrats Sampled	C-5, C-13, GR-16, GR-24, GR-34, GR-37, GR-39, GR-40
Soils	Sandy clay loam
Land Form	Drainage lines
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Acacia pycnantha, *Acaena echinata, *Asparagus asparagoides, *Chasmanthe floribunda, *Conyza bonariensis, *Cynodon dactylon, *Hypochaeris glabra, *Oxalis corniculata, *Romulea rosea, *Rubus anglocandicans*
Vegetation Condition	Good - Degraded
Disturbances	Mining exploration, road/access track, weeds, kangaroo grazing
Average Fire Age	Old (6+ yr)
Vegetation Structure & Floristics	
Trees <15 m	*Eucalyptus rudis* subsp. *rudis, Corymbia calophylla, Eucalyptus patens*
Shrubs >2 m	*Trymalium odoratissimum* subsp. *odoratissimum, Taxandria linearifolia, Hakea prostrata, Gastrolobium bilobum, Melaleuca viminea, Callistachys lanceolate, Melaleuca preissiana*
Shrubs 1-2 m	*Pteridium esculentum, Astartea scoparia, Billardiera heterophylla*
Sedges	*Lepidosperma tetraquetrum, Chorizandra enodis*

Broad Floristic Formation	*Eucalyptus* Forest
Vegetation Association	Forest of **Eucalyptus resinifera* over Very Open Herbs of **Chasmanthe floribunda* and **Oxalis glabra* on brown loamy sand on post mining rehabilitation landform

Area Mapped	11.24 ha
Quadrats Sampled	C-07
Soils	Brown sandy clay loam
Land Form	Post mining landform, hill slope
Priority Ecological Community	No
Conservation Significant Flora	None
Introduced Species	**Eucalyptus resinifera*, **Acacia pycnantha, *Chasmanthe floribunda, *Oxalis glabra*
Vegetation Condition	Good
Disturbances	Access track, weeds, mining
Average Fire Age	Recent (<2 yrs)
Vegetation Structure & Floristics	
Trees 10-30 m	**Eucalyptus resinifera*
Mid Shrubs 1-1.5 m	*Taxandria linearifolia, Taxandria parviceps, *Acacia pycnantha*
Low Shrubs >1 m	**Chasmanthe floribunda*
Herbs	**Oxalis glabra*

3.6 Vegetation Significance

3.6.1 Beard (1981) Vegetation Associations

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^2, of which 18,715 km^2 (70 percent) originally supported jarrah and jarrah-marri forest (Beard 1981).

The study area lies within the Bridgetown Vegetation System as recognised by Beard (1981). Within this system, there is one vegetation association that intersects the study area:

- Vegetation Association 3 - Medium Forest; Jarrah-Marri.

When determining representation and reservation of remaining vegetation, Vegetation Association 3 was determined to be well represented at all levels (statewide, bioregional [IBRA and IBRA sub-region], and local government authority), with more than 56% of the Pre-European extent remaining (Table 8).

Vegetation Association 3 was also determined to be well reserved, with more than 15% of the current extent protected for conservation within the Southern Jarrah Forest sub-region and within the Shire of Bridgetown-Greenbushes (Table 8).

3.6.2 Mattiske and Havel (1998) Vegetation Complexes

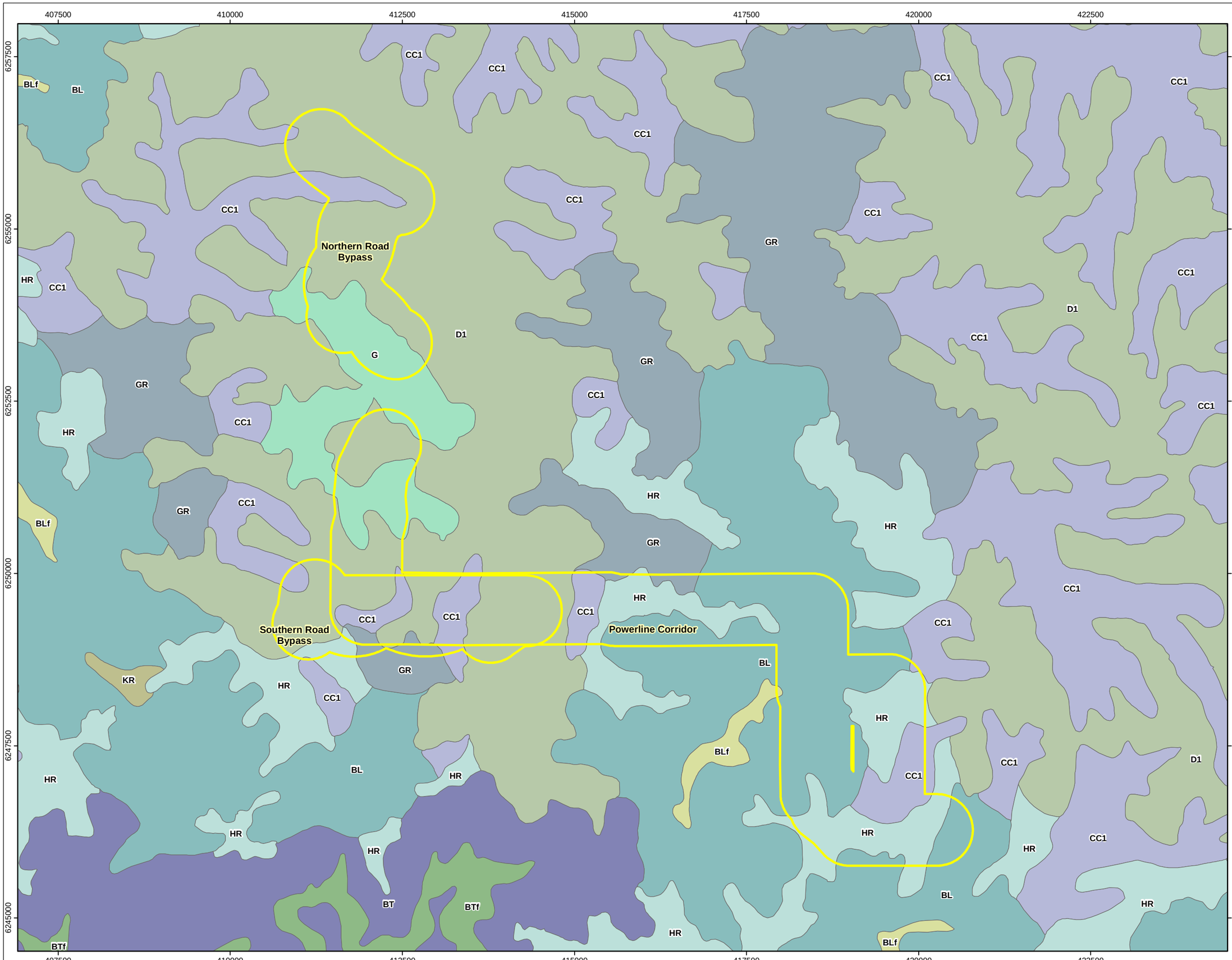
The pre-1750 distribution of vegetation complexes of the south west forest region of Western Australia has been mapped at 1:50,000 scale by Mattiske and Havel (1998) as part of the biodiversity assessment for the comprehensive regional assessment for the south west forest region. This database has been used to assess flora and vegetation values as part of the 1999 Regional Forest Agreement (RFA). Interrogation of this database confirmed there were five vegetation complexes (as described and mapped by Mattiske and Havel 1998) intersecting the study area (Figure 10):

- Balingup (BL) - Woodland of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes, and woodland of *Eucalyptus rudis* on valley floors in the humid zone;
- Catterick 1 (CC1) - Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* mixed with *Eucalyptus patens* on slopes, *Eucalyptus rudis* and *Banksia littoralis* on valley floors in the humid zone;
- Dwellingup 1 (D1) - Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones;
- Goonaping (G) – Mosaic of Open Forest of *Eucalyptus marginata* subsp. *marginata* (humid zones) and *Eucalyptus marginata* subsp. *thalassica* (semiarid to perarid zones) on the sandy gravels, low woodland of *Banksia attenuate* on the drier sandier sites (humid to perarid zones) with some *Banksia menziesii* (northern arid and perarid zones) and low open woodland of *Melaleuca preissiana-Banksia littoralis* on the moister sandy soils (humid to perarid zones); and
- Hester (HR) – Tall Open Forest to Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in perhumid and humid zones.

These five vegetation complexes currently have between 24% and 87% of the pre-European extent remaining within the South West Forest Region, and between 13% and 70% of the current extent formally protected for conservation. One vegetation complex, Balingup (BL), was determined to be poorly represented with less than 30% of the pre-European extent remaining (currently 23.9%). However, all five vegetation complexes are determined to be well reserved with >10% of the pre-European extent secured within formal reserves (Table 8).

Table 8 Pre-European extent of vegetation represented on the basis of identified datasets.

Vegetation System / Association	Pre-European Extent (ha)	Extent Remaining (ha)	% Extent of Pre-European	% Current Extent Protected (IUCN I - IV) for Conservation (proportion of Current Extent)
Beard Vegetation Association				
3 - Medium forest; jarrah-marri	2,661,404.62	1,806,035.91	67.86	26.87
Vegetation System				
Bridgetown 3.1	700,920.82	456,448.65	65.12	28.87
Jarrah Forest (JAF)				
Beard Vegetation Association 3	2,390,591.54	1,606,736.77	67.21	23.97
Bridgetown 3.1	695,903.60	451,804.22	64.92	18.55
Southern Jarrah Forest JAF02				
Beard Vegetation Association 3	1,482,491.85	883,557.83	59.60	31.03
Bridgetown 3.1	684,331.98	444,272.04	64.92	18.86
Shire of Bridgetown-Greenbushes				
Beard Vegetation Association 3	121,152.70	68,440.37	56.49	23.39
Bridgetown 3.1	120,148.72	67,456.61	56.14	23.73
Mattiske & Havel Complexes				
Balingup BL	59,460	14,225	23.92	16.2
Catterick Complex CC1	27,386	16,350	59.70	14.2
Dwellingup Complex D1	208,491	181,811	87.20	12.9
Goonaping Complex G	27,467	21,516	78.33	69.6
Hester Complex HR	32,250	23,474	72.79	18.7



TALISON

Bypass and Powerline Corridors

Mattiske and Havel (1998) Vegetation Complexes

Legend

- Study Areas

Mattiske and Havel (1998) Vegetation Complexes

- BL , Balingup
- BLf , Balingup
- BT , Bridgetown
- BTf , Bridgetown
- CC1 , Catterick
- D1 , Dwellingup
- G , Goonaping
- GR , Grimwade
- HR , Hester
- KR , Kirup

N

0 500 1,000 1,500

Meters
1:50,000
Datum: GDA94
Projection: MGA Zone 50

Date:	26/11/2018
Status:	Final
Figure:	10
Sheet Size:	A3
Internal Reference:	TL_Mat_Havel
Drawn by:	GSM
Requested by:	DB

3.7 Vegetation Condition

Vegetation condition across the majority of the study area was rated as *degraded* (44.5 ha or 41% of the study area) reflecting a high proportion of the area having been disturbed and rehabilitated as part of historical tin mining operations (Table 9, Figures 11-13).

Approximately 12.6 ha (11% of the study area) has been cleared for a mixture of annual pasture, existing road infrastructure, and as part of historical mining activities; these areas do not support any native vegetation cover. Blocks of vegetation rated as *completely degraded* totaled 19.9 ha (18% of the study area) and included a mix of pine and bluegum plantation, and historical rehabilitation.

Intact native vegetation was rated as *very good* (22.8 ha or 21% of the study area) or *good* (9.8 ha or 9% of the study area) with the primary disturbances resulting from hardwood logging activities or close proximity to disturbed ground, i.e. road verges.

Table 9 Area of vegetation condition classes within the study area.

Vegetation Association	Area (ha)	% of Study Area
Very Good	22.85	20.8
Good	9.75	8.9
Degraded	44.50	40.6
Completely Degraded	19.94	18.2
Cleared	12.55	11.4
Total	109.59	100.0

TALISON LITHIUM

Northern Bypass

Vegetation Condition

Figure 11

Legend

- Mine Development Area
- Study Area

Vegetation Condition

- Cleared
- Degraded
- Good
- Very Good

N

0 100 200 300

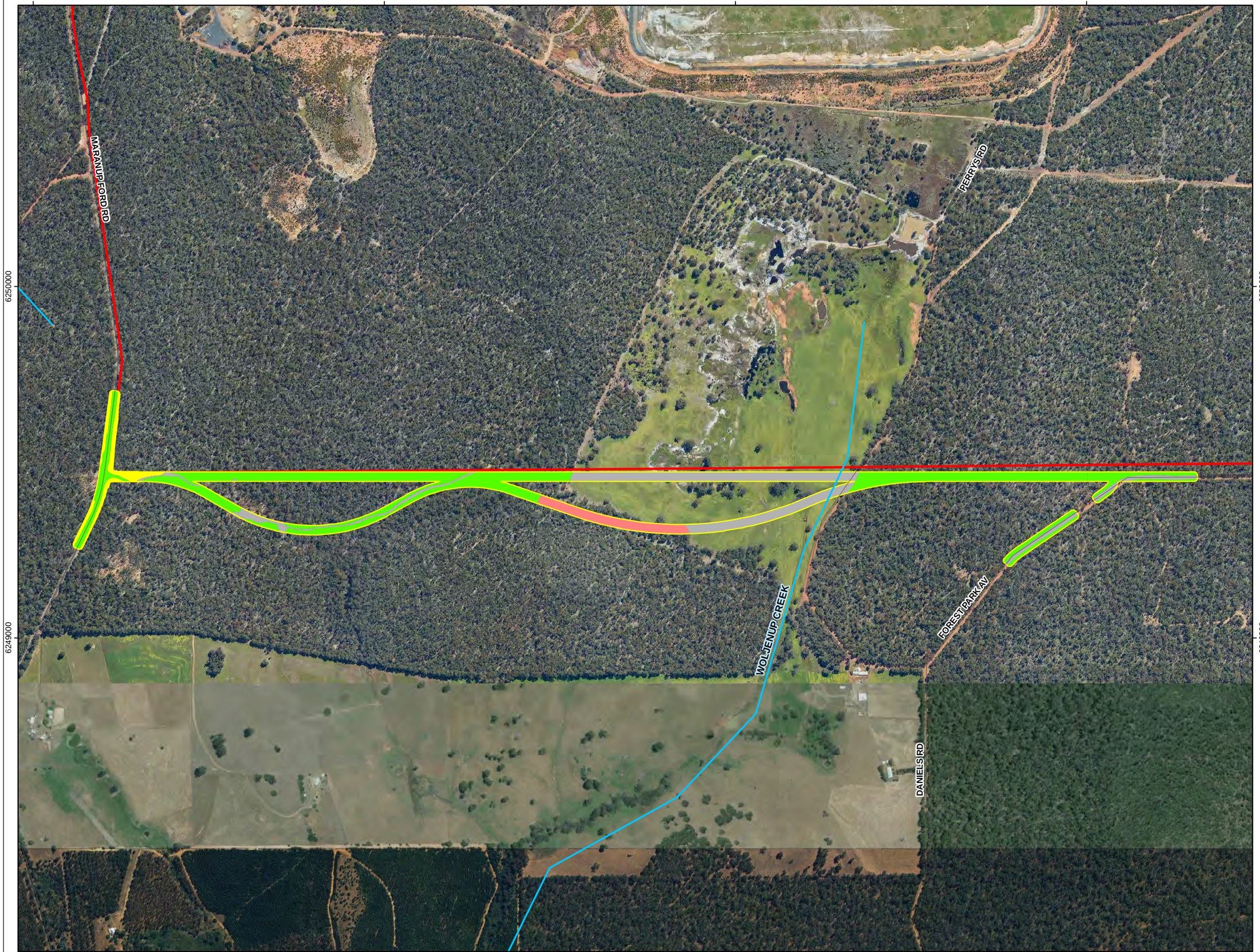
Meters

1:12,500

Datum: GDA94

Projection: MGA Zone 50

Date:	13/09/2018
Status:	Final
Figure:	11
Sheet Size:	A3
Internal Reference:	TL_Nth_bp_cond
Drawn by:	GSM
Requested by:	DB



TALISON LITHIUM

Southern Bypass

Vegetation Condition

Figure 12

Legend

- Mine Development Area
- Study Area

Vegetation Condition

- Cleared
- Degraded
- Good
- Very Good

N

0 100 200 300

Meters

1:10,000

Datum: GDA94

Projection: MGA Zone 50

Date:	13/09/2018
Status:	Draft
Figure:	12
Sheet Size:	A3
Internal Reference:	TL_Sth_bypass
Drawn by:	GSM
Requested by:	DB

412000 413000 414000 415000 416000 417000 418000 419000 420000

6252000 6251000 6250000 6249000 6248000 6247000 6246000

MARANUP FORD RD
PERRYS RD
SOUTH WESTERN HWY
HESTER BROOK
FULLERTON RD
HAINES RD
HESTER CASCADES RD
FOREST PARK AV
HALLS RD
DANIELS RD
HESTER HALL RD
WOLJENUP CREEK
BLACKWOOD PARK RD
WAGEBADENUP RDGE
HESTER RD
BILL BALDOCK DR
TROTTS RD

TALISON LITHIUM

Powerline

Vegetation Condition

Figure 13

Legend

- Mine Development Area
- Study Area

Vegetation Condition

- Cleared
- Completely Degraded
- Degraded
- Good
- Very Good

N

0 250 500 750

Meters
1:25,000
Datum: GDA94
Projection: MGA Zone 50

Date:	17/09/2018
Status:	Final
Figure:	13
Sheet Size:	A3
Internal Reference:	TL_Powerline
Drawn by:	GSM
Requested by:	DB

4.0 SUMMARY

Onshore Environmental completed a two season detailed flora and vegetation survey of remnant native vegetation occurring within three proposed infrastructure corridors surrounding the mine site. The field survey was completed by two Principal Botanists and one Senior Botanist working over six days in July and August 2018, with a second season assessment completed over six days in September and October 2018.

A total number of 280 plant taxa (including varieties and subspecies) from 60 families and 157 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Orchidaceae, Asparagaceae, Myrtaceae, Asteraceae, Cyperaceae, Proteaceae and Poaceae families. The most speciose genus was *Acacia* (17 taxa), followed by *Caladenia* (11 taxa), *Lomandra* (10 taxa), *Stylidium* (8 taxa), *Hibbertia* (7 taxa each), *Drosera* and *Pterostylis* (6 taxa each).

None of the plant taxa recorded from the study area was gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the WC Act, or listed under the EPBC Act. One Priority 4 flora taxon was recorded from within the study area; *Acacia semitrullata. Acacia semitrullata* was recorded as four plants from a single point location in state forest along the proposed powerline corridor.

The Priority 2 flora taxon *Melaleuca viminalis* was recorded approximately 70 metres east (outside) of the proposed northern bypass road. Three plants occurred in riparian vegetation adjacent to the Greenbushes “swimming pool”, a popular recreation site. The close proximity of this location to the ablution block and other exotic plantings suggests the individuals may have been introduced to the site.

One taxon recorded from within the study area was identified to represent a significant range extension; *Hybanthus epacroides.* The nearest known record is from Gnowangerup approximately 180 km east of the study area. *Hybanthus epacroides* is known to occur in white or yellow sand in association with laterite. Within the study area it was recorded on orange sands weathered and deposited from laterite positioned higher in the landscape. This habitat type was specific and localised.

A total of 45 introduced species were recorded from the study area, of which two taxa were listed as Declared Plants under the BAM Act:

- **Asparagus asparagoides* (Bridal Creeper) - s22(2); and
- **Rubus anglocandicans* (Blackberry) - s22(2) (C3 Exempt).

A total of ten vegetation types from four broad landforms were described and mapped from within the corridor study area. Extensive field assessment confirmed there were no TECs or PECs represented within the study area. Furthermore, vegetation was generally well represented regionally and locally, and well reserved.

Vegetation condition across the majority of the study area was rated as *degraded* (44.5 ha or 41% of the study area) reflecting a high proportion of the area having been disturbed and rehabilitated as part of historical tin mining operations. Approximately 12.6 ha (11% of the study area) had been cleared for a mixture of annual pasture, existing road infrastructure, and as part of historical mining activities; these areas do not support any native vegetation cover. Blocks of vegetation rated as *completely degraded* totaled 19.9 ha (18% of the study area) and included a mix of pine and bluegum plantation, and historical rehabilitation. Intact native vegetation

was rated as *very good* (22.8 ha or 21% of the study area) or *good* (9.8 ha or 9% of the study area) with the primary disturbances resulting from hardwood logging activities or close proximity to disturbed ground, i.e. road verges.

5.0 STUDY TEAM

The two season detailed 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
pf 08 9756 6206 m 0427 339 842
Email: info@onshoreenvironmental.com.au

Project Staff

Dr Darren Brearley	PhD	Project Manager and Principal Botanist
Dr Jerome Bull	PhD	Principal Botanist
Ms Jessica Waters	BSc	Senior Botanist
Ms Breanne Menezies	BSc	Senior Environmental Advisor
Mrs Kerry Keenan		Data Analyst
Mr Todd Griffin	BSc	GIS and Mapping Specialist

Licences

The field survey was conducted under the authorisation of the following licences issued by DBCA:

- Darren Brearley, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL012077;
- Darren Brearley, Onshore Environmental Consultants 'Regulation 4 Written Notice of Lawful Authority' Licence No. CE005699;
- Jerome Bull, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL012079; and
- Jessica Waters, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL012078.

6.0 REFERENCES

AECOM (2010) *Bridgetown RWSS Pipelines Millstream Dam to Greenbushes Link.* Report prepared for Water Corporation.

Aplin T.E.H. (1979) The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). Environment and Science. University of Western Australia Press.

Atlas of Living Australia (2018) Atlas of Living Australia website at http://www.ala.org.au. Accessed 29 April 2018.

Beard, J.S. (1981) Vegetation Survey of Western Australia – Swan, 1:1000 000 Vegetation Series. UWA Press, Perth, WA, Australia.

Beard, J.S. (1990) Plant Life of Western Australia. Kangaroo Press Pty Ltd, Kenthurst, NSW, Australia.

Belbin, L. (2003) PATN - A Revised User's Guide. Blatant Fabrications Pty Ltd.

Bureau of Meteorology (2018) *Climate Data Online.* Available from: http://www.bom.gov.au/climate/data/

CALM (1999) Environmental Weed Strategy for Western Australia. Environmental Protection Branch, Western Australia.

Churchward, H.M. and McArthur, W.M. (1980). *Landform and Soils of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia.* Department of Conservation and Environment, Perth, Western Australia.

Conservation Commission of Western Australia (2003) Forest Management Plan for the Southwest Forest Region. Conservation Commission of Western Australia, Perth.

CSIRO (2015) Australian Soil Resource Information System (ASRIS), Available from: http://www.asris.csiro.au/index.html

Department of Agriculture and Food Western Australia (2018) A list of Declared Pests for Western Australia at March 2018.

Department of Biodiversity, Conservation and Attractions (2018a) Threatened and Priority Flora Database Search. Request for Threatened and Priority Flora Information, letter from Threatened Flora Database Officer, dated 20 February 2018.

Department of Biodiversity, Conservation and Attractions (2018b) List of Threatened Ecological Communities on the Department of Parks and Wildlife's Threatened Ecological Community (TEC) Database endorsed by the Minister for the Environment. WA Threatened Species and Communities Unit, Department of Parks and Wildlife. Email received from TEC Ecologist of the Species and Communities Branch of DBCA, dated 2 March 2018.

Department of Biodiversity Conservation and Attractions (DBCA) (2018c) NatureMap: Mapping Western Australia's biodiversity. https://naturemap.dpaw.wa.gov.au/

Department of the Environment and Energy (2018) Protected Matters Search Tool, accessed March 2018, http://www.environment.gov.au/epbc/pmst/

Environmental Protection Authority (EPA) (2000) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No. 2. EPA, Perth, Western Australia.

Environmental Protection Authority (2016a) Statement of Environmental Principles, Factors and Objectives, EPA, Perth.

Environmental Protection Authority (2016b) Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment, EPA, Perth.

Environmental Protection Authority (2016c) Environmental Factor Guideline Flora and Vegetation, EPA, Perth.

Gardner, C.A. (1942) The vegetation of Western Australia. J. Roy. Soc. W. Aust. 28, 11-37.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994) A Floristic Survey of the Southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission. Prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Government of Western Australia. (2018) 2017 South West Vegetation Complex Statistics. Current as of October 2017. WA Department of Biodiversity, Conservation and Attractions, Perth. https://catalogue.data.wa.gov.au/dataset/dbca

Havel, J.J. (2000) Ecology of forests of south western Australia in relation to climate and landforms. PhD Thesis, Murdoch University, Western Australia.

Havel, J.J. and Mattiske Consulting (2002) Review of management options for poorly reserved vegetation complexes. Prepared for the Conservation Commission of Western Australia, Perth.

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, pg 382-403, Jarrah Forest 2 (JF2 - Southern Jarrah Forest subregion).

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980) Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Hill, A.L., Semeniuk, C.A., Semeniuk, V., and Del Marco, A. (1996) Wetlands of the Swan Coastal Plain, Volume 2b: Wetland Mapping, Classification and Evaluation, Wetland Atlas. Department of Environmental Protection and the Water Authority of Western Australia, Perth.

International Union for Conservation of Nature (IUCN) (2018) *Interactive Environmental Database Reporting Tool Search*, performed March 2018. www.iucn.org

Keighery, B.J. (1994) *Bushland Plant Survey: a Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.), Nedlands, Western Australia.

Mattiske, E.M. and Havel, J.J. (1998) Vegetation Complexes of the Southwest Forest Region of Western Australia. Prepared as part of the Regional Forest Agreement, Western Australia. Department of Conservation and Land Management & Environment Australia.

McArthur, W.M. and Clifton, A.L. (1975) Forestry and agriculture in relation to soils in the Pemberton area of Western Australia. Soils and Land Use Series No. 54. CSIRO Australian Division of Soils.

McCune, B. and Grace, J.B. (2002) Analysis of Ecological Communities. MJM Software Design, Gleneden Beach, Oregon.

McCune, B. and Metford, M.J. (1999) PC-ORD. Multivariate Analysis of Ecological Data, Version 4. MjM Software Design, Gleneden Beach, Oregon, USA.

Muir, B.G. (1977) Biological Survey of the Western Australian Wheatbelt. Records Western Australian Museum, Supplement No. 3.

Onshore Environmental Consultants (2006) *Flora and Vegetation Survey Greenbushes Mine Site: Vegetation surrounding south east corner of the TSF.* Confidential report prepared for Sons of Gwalia Ltd.

Onshore Environmental Consultants (2012) *Flora and Vegetation Survey Greenbushes Mining Leases.* Confidential report prepared for Talison Minerals.

Onshore Environmental Consultants (2018) *Greenbushes Mining Operations, Detailed Flora and Vegetation Survey.* Confidential report prepared for Talison Minerals.

Shepherd, D., Beeston, G and Hopkins, A. (2002) Native Vegetation in Western Australia. Extent, Type and Status. *Resource Management Technical Report 249*. Department of Agriculture, South Perth.

Smith, F.G. (1972) Vegetation Survey of Western Australia, 1:250 000 Series, Pemberton and Irwin Inlet. Department of Agriculture, Perth.

Specht R.L. (1970) Vegetation. In The Australian Environment. 4th edn (Ed. G.W. Leeper). Melbourne.

Thackway and Cresswell (1995) An Interim Biogeographic Regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperative Program Version 4. Australian Nature Conservation Agency, Canberra.

Tille, P.J. (1996) Wellington-Blackwood Land Resources Survey: Land Resources Series No 14. ISSN 1033-1670. Natural Resources Assessment Group, Agriculture Western Australia.

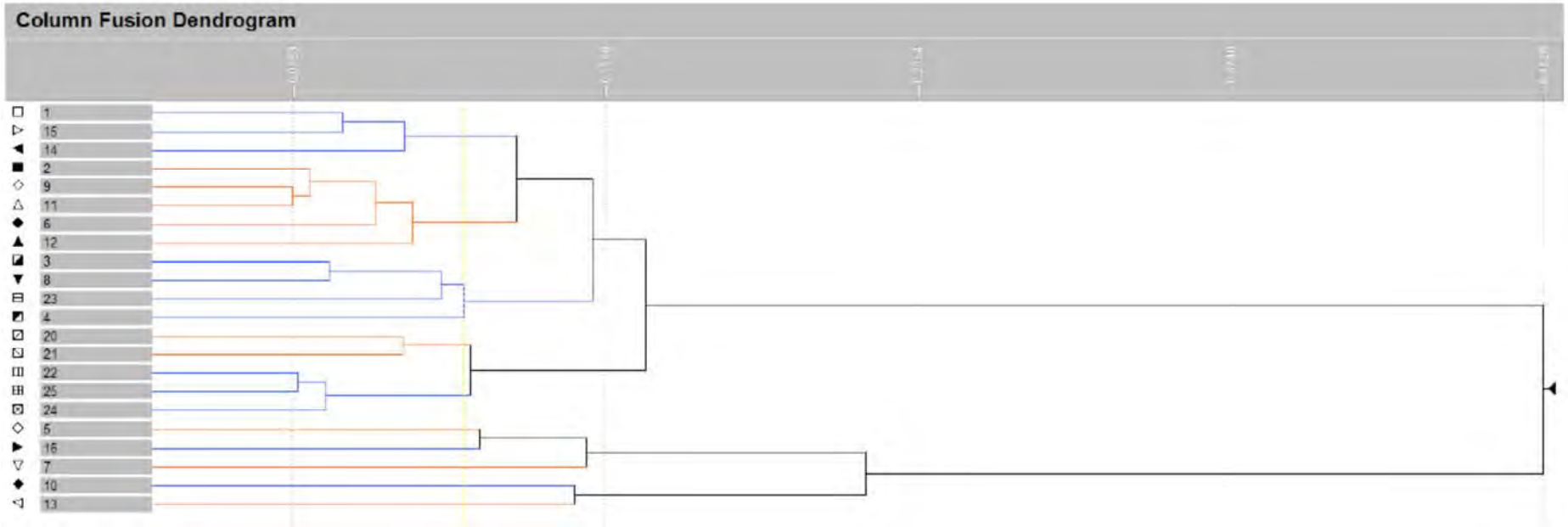
Tille, P.J. (2006) *Soil-landscapes of Western Australia's rangelands and arid interior*. Resource management technical report 313. Department of Agriculture and Food WA.

Trudgen and Morgan (1991) *A Flora and Vegetation Survey of part of the Greenbushes Leases.* Report prepared for Greenbushes Ltd.

Western Australian Herbarium (2018) *Florabase - Information on the Western Australian flora.* Department of Biodiversity Conservation and Attractions. Online: https://florabase.dpaw.wa.gov.au/search

APPENDIX 1

Dendrogram of floristic quadrat groups produced by the flexible UPGMA classification


Column Fusion Dendrogram
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APPENDIX 2

Vegetation Classifications following Muir (1997)

LIFE FORM / HEIGHT CLASS	Canopy Cover DENSE 70 % - 100%	MID DENSE 30% - 70%	SPARSE 10% - 30%	VERY SPARSE 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 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	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

APPENDIX 3

Vegetation condition scale
(as developed by Keighery 1994)

Condition	Scale	Description
Pristine	1	Pristine or nearly so, no obvious signs of disturbance.
Excellent	2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	3	Vegetation structure altered; obvious signs of disturbance.
Good	4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
Degraded	5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching Very Good condition without intensive management.
Completely Degraded	6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

APPENDIX 4

Conservation categories for flora described under the EPBC Act.

Category	Description
Extinct	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	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 Endangered	The species is facing an extremely high risk of extinction in the wild and in the immediate future.
Endangered	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	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 Dependent	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.

APPENDIX 5

Conservation Codes for Western Australian Flora

Threatened Species

Listed as Specially Protected under the Wildlife Conservation Act 1950, published under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

- Flora that are extant and considered likely to become extinct, or rare and therefore in need of special protection, are declared to be rare flora.

Species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.
The assessment of the conservation status of these species is based on their national extent.

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 flora or fauna. 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 One - Poorly Known Taxa

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 immediate threat from known threatening processes. Such species are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

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 Three - Poorly Known Taxa

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 Four - Rare, Near Threatened and other taxa 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

APPENDIX 6

Total flora list from the study area

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Amaranthaceae	*Ptilotus*	*manglesii*			No	Native
Amaryllidaceae	*Narcissus*	*pseudonarcissus*			No	Introduced
Apiaceae	*Daucus*	*glochidiatus*			No	Native
Apiaceae	*Pentapeltis*	*silvatica*			No	Native
Apiaceae	*Platysace*	*tenuissima*			No	Native
Apiaceae	*Xanthosia*	*candida*			No	Native
Apiaceae	*Xanthosia*	*huegelii*			No	Native
Apiaceae	*Xanthosia*	*tasmanica*			No	Native
Araliaceae	*Hydrocotyle*	*callicarpa*			No	Native
Araliaceae	*Trachymene*	*pilosa*			No	Native
Asparagaceae	*Asparagus*	*asparagoides*			No	Introduced
Asparagaceae	*Asparagus*	*declinatus*			No	Introduced
Asparagaceae	*Chamaescilla*	*corymbosa*			No	Native
Asparagaceae	*Dichopogon*	*capillipes*			No	Native
Asparagaceae	*Laxmannia*	*squarrosa*			No	Native
Asparagaceae	*Lomandra*	*brittanii*			No	Native
Asparagaceae	*Lomandra*	*caespitosa*			No	Native
Asparagaceae	*Lomandra*	*drummondii*			No	Native
Asparagaceae	*Lomandra*	*hermaphrodita*			No	Native
Asparagaceae	*Lomandra*	*integra*			No	Native
Asparagaceae	*Lomandra*	*nigricans*			No	Native
Asparagaceae	*Lomandra*	*pauciflora*			No	Native
Asparagaceae	*Lomandra*	*preissii*			No	Native
Asparagaceae	*Lomandra*	*sericea*			No	Native
Asparagaceae	*Lomandra*	*sonderi*			No	Native
Asparagaceae	*Sowerbaea*	*laxiflora*			No	Native
Asparagaceae	*Thysanotus*	*manglesianus*			No	Native
Asparagaceae	*Thysanotus*	*multiflorus*			No	Native
Asparagaceae	*Thysanotus*	*patersonii*			No	Native
Asparagaceae	*Thysanotus*	*tenellus*			No	Native
Asteraceae	*Carduus*	*pycnocephalus*			No	Introduced
Asteraceae	*Conyza*	*bonariensis*			No	Introduced
Asteraceae	*Craspedia*	*variabilis*			No	Native
Asteraceae	*Hypochaeris*	*glabra*			No	Introduced

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Asteraceae	*Lagenophora*	*huegelii*			No	Native
Asteraceae	*Millotia*	*tenuifolia*	var.	*tenuifolia*	No	Native
Asteraceae	*Olearia*	*paucidentata*			No	Native
Asteraceae	*Osteospermum*	*ecklonis*			No	Introduced
Asteraceae	*Senecio*	*diaschides*			No	Native
Asteraceae	*Senecio*	*hispidulus*			No	Native
Asteraceae	*Sonchus*	*oleraceus*			No	Introduced
Asteraceae	*Trichocline*	*spathulata*			No	Native
Asteraceae	*Ursinia*	*anthemoides*			No	Introduced
Asteraceae	*Waitzia*	*suaveolens*			No	Native
Brassicaceae	*Lobularia*	*maritima*			No	Introduced
Campanulaceae	*Lobelia*	*anceps*			No	Native
Caryophyllaceae	*Petrorhagia*	*dubia*			No	Introduced
Casuarinaceae	*Allocasuarina*	*fraseriana*			No	Native
Casuarinaceae	*Allocasuarina*	*humilis*			No	Native
Celastraceae	*Stackhousia*	*huegelii*			No	Native
Colchicaceae	*Burchardia*	*congesta*			No	Native
Cyperaceae	*Baumea*	*preissii*			No	Native
Cyperaceae	*Chorizandra*	*enodis*			No	Native
Cyperaceae	*Cyathochaeta*	*avenacea*			No	Native
Cyperaceae	*Lepidosperma*	*leptostachyum*			No	Native
Cyperaceae	*Lepidosperma*	*pubisquameum*			No	Native
Cyperaceae	*Lepidosperma*	*squamatum*			No	Native
Cyperaceae	*Lepidosperma*	*tenue*			No	Native
Cyperaceae	*Lepidosperma*	*tetraquetrum*			No	Native
Cyperaceae	*Schoenus*	*odontocarpus*			No	Native
Cyperaceae	*Tetraria*	*octandra*			No	Native
Cyperaceae	*Tetraria*		sp.	Jarrah Forest (R. Davis 7391)	No	Native
Dasypogonaceae	*Dasypogon*	*bromeliifolius*			No	Native
Dennstaedtiaceae	*Pteridium*	*esculentum*			No	Native
Dilleniaceae	*Hibbertia*	*amplexicaulis*			No	Native
Dilleniaceae	*Hibbertia*	*commutata*			No	Native
Dilleniaceae	*Hibbertia*	*cuneiformis*			No	Native
Dilleniaceae	*Hibbertia*	*diamesogenos*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Dilleniaceae	*Hibbertia*	*ferruginea*			No	Native
Dilleniaceae	*Hibbertia*	*glomerata*	subsp.	*glomerata*	No	Native
Dilleniaceae	*Hibbertia*	*hypericoides*			No	Native
Droseraceae	*Drosera*	*erythrorhiza*			No	Native
Droseraceae	*Drosera*	*glanduligera*			No	Native
Droseraceae	*Drosera*	*macrantha*			No	Native
Droseraceae	*Drosera*	*modesta*			No	Native
Droseraceae	*Drosera*	*pallida*			No	Native
Droseraceae	*Drosera*	*stolonifera*			No	Native
Elaeocarpaceae	*Tetratheca*	*affinis*			No	Native
Elaeocarpaceae	*Tetratheca*	*hirsuta*	subsp.	*viminea*	No	Native
Elaeocarpaceae	*Tremandra*	*diffusa*			No	Native
Ericaceae	*Andersonia*	*caerulea*			No	Native
Ericaceae	*Astroloma*	*ciliatum*			No	Native
Ericaceae	*Astroloma*	*drummondii*			No	Native
Ericaceae	*Astroloma*	*pallidum*			No	Native
Ericaceae	*Leucopogon*	*australis*			No	Native
Ericaceae	*Leucopogon*	*capitellatus*			No	Native
Ericaceae	*Leucopogon*	*propinquus*			No	Native
Ericaceae	*Leucopogon*	*verticillatus*			No	Native
Euphorbiaceae	*Amperea*	*simulans*			No	Native
Euphorbiaceae	*Monotaxis*	*occidentalis*			No	Native
Euphorbiaceae	*Ricinus*	*communis*			No	Introduced
Fabaceae	*Acacia*	*baileyana*			No	Introduced
Fabaceae	*Acacia*	*celastrifolia*			No	Native
Fabaceae	*Acacia*	*dealbata*			No	Introduced
Fabaceae	*Acacia*	*dentifera*			No	Native
Fabaceae	*Acacia*	*drummondii*			No	Native
Fabaceae	*Acacia*	*extensa*			No	Native
Fabaceae	*Acacia*	*insolita*	subsp.	*insolita*	No	Native
Fabaceae	*Acacia*	*iteaphylla*			No	Introduced
Fabaceae	*Acacia*	*latericola*			No	Native
Fabaceae	*Acacia*	*longifolia*	subsp.	*longifolia*	No	Introduced
Fabaceae	*Acacia*	*nervosa*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Fabaceae	*Acacia*	*obovata*			No	Native
Fabaceae	*Acacia*	*pulchella*			No	Native
Fabaceae	*Acacia*	*pycnantha*			No	Introduced
Fabaceae	*Acacia*	*saligna*			No	Native
Fabaceae	*Acacia*	*semitrullata*			Yes	Native
Fabaceae	*Acacia*	*stenoptera*			No	Native
Fabaceae	*Bossiaea*	*aquifolium*			No	Native
Fabaceae	*Bossiaea*	*linophylla*			No	Native
Fabaceae	*Bossiaea*	*ornata*			No	Native
Fabaceae	*Callistachys*	*lanceolata*			No	Native
Fabaceae	*Chamaecytisus*	*palmensis*			No	Introduced
Fabaceae	*Chorizema*	*nanum*			No	Native
Fabaceae	*Daviesia*	*decurrens*			No	Native
Fabaceae	*Daviesia*	*physodes*			No	Native
Fabaceae	*Daviesia*	*preissii*			No	Native
Fabaceae	*Gompholobium*	*capitatum*			No	Native
Fabaceae	*Gompholobium*	*knightianum*			No	Native
Fabaceae	*Gompholobium*	*marginatum*			No	Native
Fabaceae	*Gompholobium*	*preissii*			No	Native
Fabaceae	*Gompholobium*	*tomentosum*			No	Native
Fabaceae	*Hovea*	*chorizemifolia*			No	Native
Fabaceae	*Hovea*	*trisperma*			No	Native
Fabaceae	*Isotropis*	*cuneifolia*			No	Native
Fabaceae	*Kennedia*	*coccinea*			No	Native
Fabaceae	*Kennedia*	*prostrata*			No	Native
Fabaceae	*Labichea*	*punctata*			No	Native
Fabaceae	*Psoralea*	*pinnata*			No	Introduced
Fabaceae	*Sphaerolobium*	*medium*			No	Native
Fabaceae	*Trifolium*	*campestre*			No	Introduced
Gentianaceae	*Centaurium*	*tenuiflorum*			No	Introduced
Geraniaceae	*Geranium*	*solanderi*			No	Native
Goodeniaceae	*Dampiera*	*linearis*			No	Native
Goodeniaceae	*Lechenaultia*	*biloba*			No	Native
Goodeniaceae	*Scaevola*	*calliptera*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Haemodoraceae	*Conostylis*	*aculeata*	subsp.	*aculeata*	No	Native
Haemodoraceae	*Conostylis*	*laxiflora*			No	Native
Haemodoraceae	*Conostylis*	*serrulata*			No	Native
Haemodoraceae	*Conostylis*	*setigera*			No	Native
Haemodoraceae	*Haemodorum*	*laxum*			No	Native
Haloragaceae	*Glischrocaryon*	*aureum*			No	Native
Haloragaceae	*Gonocarpus*	*benthamii*			No	Native
Hemerocallidaceae	*Agrostocrinum*	*hirsutum*			No	Native
Hemerocallidaceae	*Agrostocrinum*	*scabrum*			No	Native
Hemerocallidaceae	*Caesia*	*micrantha*			No	Native
Hemerocallidaceae	*Dianella*	*revoluta*			No	Native
Hemerocallidaceae	*Johnsonia*	*lupulina*			No	Native
Hemerocallidaceae	*Stypandra*	*glauca*			No	Native
Hemerocallidaceae	*Tricoryne*	*elatior*			No	Native
Hemerocallidaceae	*Tricoryne*	*humilis*			No	Native
Hypoxidaceae	*Pauridia*	*occidentalis*	var.	*quadriloba*	No	Native
Iridaceae	*Chasmanthe*	*floribunda*			No	Introduced
Iridaceae	*Freesia*	*alba × leichtlinii*			No	Introduced
Iridaceae	*Patersonia*	*babianoides*			No	Native
Iridaceae	*Patersonia*	*occidentalis*			No	Native
Iridaceae	*Patersonia*	*pygmaea*			No	Native
Iridaceae	*Romulea*	*rosea*			No	Introduced
Iridaceae	*Sparaxis*	*bulbifera*			No	Introduced
Juncaceae	*Juncus*	*microcephalus*			No	Introduced
Juncaceae	*Juncus*	*pallidus*			No	Native
Juncaceae	*Luzula*	*meridionalis*			No	Native
Lamiaceae	*Lavendula*	*stoechus*			No	Introduced
Lauraceae	*Cassytha*	*racemosa*	forma	*racemosa*	No	Native
Loganiaceae	*Orianthera*	*serpyllifolia*	subsp.	*serpyllifolia*	No	Native
Malvaceae	*Thomasia*	*grandiflora*			No	Native
Menyanthaceae	*Ornduffia*	*parnassifolia*			No	Native
Myrtaceae	*Astartea*	*scoparia*			No	Native
Myrtaceae	*Callistemon*	*comboynensis*			No	Introduced
Myrtaceae	*Corymbia*	*calophylla*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Myrtaceae	*Corymbia*	*maculata*			No	Introduced
Myrtaceae	*Eucalyptus*	*cornuta*			No	Native
Myrtaceae	*Eucalyptus*	*marginata*	subsp.	*marginata*	No	Native
Myrtaceae	*Eucalyptus*	*patens*			No	Native
Myrtaceae	*Eucalyptus*	*resinifera*			No	Introduced
Myrtaceae	*Eucalyptus*	*rudis*	subsp.	*rudis*	No	Native
Myrtaceae	*Hypocalymma*	*angustifolium*			No	Native
Myrtaceae	*Kunzea*	*glabrescens*			No	Native
Myrtaceae	*Leptospermum*	*erubescens*			No	Native
Myrtaceae	*Melaleuca*	*preissiana*			No	Native
Myrtaceae	*Melaleuca*	*viminalis*			Yes	Native
Myrtaceae	*Melaleuca*	*viminea*			No	Native
Myrtaceae	*Pericalymma*	*ellipticum*			No	Native
Myrtaceae	*Taxandria*	*linearifolia*			No	Native
Myrtaceae	*Taxandria*	*parviceps*			No	Native
Orchidaceae	*Caladenia*	*arrecta*			No	Native
Orchidaceae	*Caladenia*	*attingens*	subsp.	*attingens*	No	Native
Orchidaceae	*Caladenia*	*cairnsiana*			No	Native
Orchidaceae	*Caladenia*	*emarginata*			No	Native
Orchidaceae	*Caladenia*	*ferruginea*			No	Native
Orchidaceae	*Caladenia*	*flava*	subsp.	*sylvestris*	No	Native
Orchidaceae	*Caladenia*	*flava*			No	Native
Orchidaceae	*Caladenia*	*longiclavata*			No	Native
Orchidaceae	*Caladenia*	*macrostylis*			No	Native
Orchidaceae	*Caladenia*	*magniclavata*			No	Native
Orchidaceae	*Caladenia*	*reptans*	subsp.	*reptans*	No	Native
Orchidaceae	*Cryptostylis*	*ovata*			No	Native
Orchidaceae	*Cyanicula*	*sericea*			No	Native
Orchidaceae	*Cyrtostylis*	*huegelii*			No	Native
Orchidaceae	*Diuris*	*longifolia*			No	Native
Orchidaceae	*Elythranthera*	*brunonis*			No	Native
Orchidaceae	*Eriochilus*	*dilatatus*			No	Native
Orchidaceae	*Lyperanthus*	*serratus*			No	Native
Orchidaceae	*Pterostylis*	*pyramidalis*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Orchidaceae	*Pterostylis*	*recurva*			No	Native
Orchidaceae	*Pterostylis*	*sigmoidea*			No	Native
Orchidaceae	*Pterostylis*	*vittata*			No	Native
Orchidaceae	*Pterostylis*		sp.	aff. *nana*	No	Native
Orchidaceae	*Pterostylis*		sp.	indet	No	Native
Orchidaceae	*Pyrorchis*	*forrestii*			No	Native
Orchidaceae	*Pyrorchis*	*nigricans*			No	Native
Orchidaceae	*Thelymitra*	*graminea*			No	Native
Orchidaceae	*Thelymitra*		sp.	indet	No	Native
Oxalidaceae	*Oxalis*	*corniculata*			No	Introduced
Oxalidaceae	*Oxalis*	*glabra*			No	Introduced
Oxalidaceae	*Oxalis*	*pes-caprae*			No	Introduced
Oxalidaceae	*Oxalis*	*purpurea*			No	Introduced
Phyllanthaceae	*Phyllanthus*	*calycinus*			No	Native
Phyllanthaceae	*Poranthera*	*huegelii*			No	Native
Pinaceae	*Pinus*	*pinaster*			No	Introduced
Pittosporaceae	*Billardiera*	*heterophylla*			No	Native
Pittosporaceae	*Billardiera*	*laxiflora*			No	Native
Pittosporaceae	*Billardiera*	*variifolia*			No	Native
Plantaginaceae	*Plantago*	*lanceolata*			No	Introduced
Poaceae	*Aira*	*caryophyllea*			No	Introduced
Poaceae	*Amphipogon*	*amphipogonoides*			No	Native
Poaceae	*Austrostipa*	*campylachne*			No	Native
Poaceae	*Austrostipa*	*mollis*			No	Native
Poaceae	*Briza*	*maxima*			No	Introduced
Poaceae	*Cynodon*	*dactylon*			No	Introduced
Poaceae	*Ehrharta*	*calycina*			No	Introduced
Poaceae	*Lolium*	*rigidum*			No	Introduced
Poaceae	*Neurachne*	*alopecuroidea*			No	Native
Poaceae	*Tetrarrhena*	*laevis*			No	Native
Podocarpaceae	*Podocarpus*	*drouynianus*			No	Native
Polygalaceae	*Comesperma*	*calymega*			No	Native
Primulaceae	*Lysimachia*	*arvensis*			No	Introduced
Proteaceae	*Banksia*	*dallanneyi*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Proteaceae	*Banksia*	*grandis*			No	Native
Proteaceae	*Grevillea*	*centristigma*			No	Native
Proteaceae	*Grevillea*	*trifida*			No	Native
Proteaceae	*Hakea*	*amplexicaulis*			No	Native
Proteaceae	*Hakea*	*lissocarpha*			No	Native
Proteaceae	*Hakea*	*prostrata*			No	Native
Proteaceae	*Hakea*	*ruscifolia*			No	Native
Proteaceae	*Persoonia*	*longifolia*			No	Native
Proteaceae	*Synaphea*	*obtusata*			No	Native
Ranunculaceae	*Clematis*	*pubescens*			No	Native
Ranunculaceae	*Ranunculus*	*colonorum*			No	Native
Restionaceae	*Desmocladus*	*fasciculatus*			No	Native
Restionaceae	*Hypolaena*	*exsulca*			No	Native
Restionaceae	*Leptocarpus*	*depilatus*			No	Native
Restionaceae	*Loxocarya*	*cinerea*			No	Native
Rhamnaceae	*Cryptandra*	*arbutiflora*	subsp.	*tubulosa*	No	Native
Rosaceae	*Acaena*	*echinata*			No	Introduced
Rosaceae	*Rubus*	*anglocandicans*			No	Introduced
Rubiaceae	*Opercularia*	*apiciflora*			No	Native
Rubiaceae	*Opercularia*	*hispidula*			No	Native
Rubiaceae	*Opercularia*	*vaginata*			No	Native
Rutaceae	*Philotheca*	*spicata*			No	Native
Santalaceae	*Leptomeria*	*cunninghamii*			No	Native
Solanaceae	*Solanum*	*nigrum*			No	Introduced
Stylidiaceae	*Levenhookia*	*dubia*			No	Native
Stylidiaceae	*Stylidium*	*adnatum*			No	Native
Stylidiaceae	*Stylidium*	*amoenum*			No	Native
Stylidiaceae	*Stylidium*	*crassifolium*			No	Native
Stylidiaceae	*Stylidium*	*piliferum*			No	Native
Stylidiaceae	*Stylidium*	*schoenoides*			No	Native
Stylidiaceae	*Stylidium*	*spathulatum*			No	Native
Stylidiaceae	*Stylidium*	*tenue*			No	Native
Stylidiaceae	*Stylidium*	*uniflorum*	subsp.	*uniflorum*	No	Native
Thymelaeaceae	*Pimelea*	*angustifolia*			No	Native

Family	Genus	Species	Infra Rank	Infra Name	Significant	Introduced/Native
Thymelaeaceae	*Pimelea*	*ciliata*	subsp.	*ciliata*	No	Native
Thymelaeaceae	*Pimelea*	*cracens*			No	Native
Violaceae	*Hybanthus*	*debilissimus*			No	Native
Violaceae	*Hybanthus*	*epacroides*			Yes	Native
Violaceae	*Hybanthus*	*floribundus*	subsp.	*floribundus*	No	Native
Xanthorrhoeaceae	*Xanthorrhoea*	*gracilis*			No	Native
Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*			No	Native
Zamiaceae	*Macrozamia*	*riedlei*			No	Native

APPENDIX 7

Raw data for 22 quadrats formally assessed within the study area

Site	GBC-01	Location	50K 411466 E	6256195 N
Date	1st Season: 30/07/18 2nd Season: 26/09/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Low Heath D of Bosssiaea ornata, Leucopogon capitellatus and Banksia dallanneyi over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391)			

Condition	Very Good
Disturbance	Logging, road / access track, weeds
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South East
Soil Type	Loamy Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia				
Acacia	insolita	subsp.	insolita		
Astroloma	pallidum			<1	0.3
Banksia	dallanneyi			7	0.2
Banksia	grandis				
Billarderia	laxiflora			<1	Cl
Bossiaea	ornata			5	0.5
Briza	maxima			<1	0.3
Caesia	micrantha			<1	0.1
Clematis	pubescens			1	Cl
Conostylis	aculeata	subsp.	aculeata	2	0.4
Corymbia	calophylla			25	10-30
Dampiera	linearis			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Daviesia	preissii			<1	0.3
Desmocladus	fasciculatus			<1	
Drosera	glanduligera				
Drosera	pallida			<1	Cl
Drosera	stolonifera			<1	0.1
Eriochilus	dilatatus			<1	0.1
Eucalyptus	marginata	subsp.	marginata	40	10-30
Grevillea	trifida				
Haemodorum	laxum				
Hakea	ruscifolia				
Hibbertia	amplexicaulis			1	0.2
Hibbertia	commutata			0.5	0.2
Hibbertia	hypericoides				
Hovea	chorizemifolia				
Hypochaeris	glabra				
Lagenophora	huegelii			<1	0.1
Lechenaultia	biloba			<1	0.1
Lepidosperma	leptostachyum			<1	0.5
Leucopogon	capitellatus			8	0.5
Leucopogon	verticillatus			<1	1.5
Lomandra	nigricans			<1	0.3
Lomandra	sericea			<1	0.3
Macrozamia	riedlei			0.5	1.5
Oxalis	corniculata			<1	0.1
Patersonia	pygmaea				
Pentapeltis	silvatica			<1	0.1
Persoonia	longifolia			0.5	2.5
Phyllanthus	calycinus			<1	0.1
Synaphea	obtusata				
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.8
Tetrarrhena	laevis			<1	0.1
Tetratheca	affinis			<1	0.4
Tetratheca	hirsuta	subsp.	viminea	<1	0.3
Thysanotus	patersonii				
Tremandra	diffusa				
Xanthorrhoea	gracilis			<1	0.5
Xanthosia	candida				

Site	GBC-02	Location	50K 411608 E	6256113 N
Date	1st Season: 30/07/18 2nd Season: 26/09/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Low Woodland B of Banksia grandis and Persoonia longifolia over Dwarf Scrub D of Bossiaea ornata, Hibbertia hypericoides and Leucopogon capitellatus with Open Low Scrub B of Macrozamia riedlei and Xanthorrhoea gracilis			

Condition	Very Good
Disturbance	Logging
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South West
Soil Type	Loamy Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	extensa				
Acacia	pulchella			<1	1
Acacia	stenoptera				
Allocasuarina	fraseriana			<1	6
Astroloma	drummondii			<1	0.3
Astroloma	pallidum			<1	0.2
Banksia	dallanneyi			<1	0.2
Banksia	grandis			25	<5
Billarderia	variifolia			<1	Cl
Billarderia	variifolia			1	0.3
Bossiaea	ornata			5	0.4
Caesia	micrantha			<1	0.1
Caladenia	flava			<1	0.2
Clematis	pubescens			<1	Cl

Genus	Species	Rank	Name	Cover	Height
Comesperma	calymega			<1	0.1
Conostylis	aculeata	subsp.	aculeata	<1	0.3
Conostylis	serrulata			<1	0.2
Corymbia	calophylla			20	10-30
Craspedia	variabilis			<1	0.2
Dampiera	linearis			<1	0.1
Daviesia	preissii			<1	0.5
Desmocladus	fasciculatus			<1	0.1
Dichopogon	capillipes			<1	0.4
Drosera	erythrorhiza			<1	0.1
Drosera	pallida			<1	Cl
Eriochilus	dilatatus			<1	0.1
Eucalyptus	marginata	subsp.	marginata	40	10-30
Glischrocaryon	aureum			<1	0.5
Haemodorum	laxum			<1	0.5
Hakea	amplexicaulis			<1	1.2
Hakea	lissocarpha				
Hibbertia	amplexicaulis			0.5	0.4
Hibbertia	commutata			<1	
Hibbertia	hypericoides			10	0.4
Hovea	chorizemifolia			<1	0.2
Labichea	punctata			<1	0.1
Lagenophora	huegelii			<1	0.1
Lechenaultia	biloba			<1	0.2
Leucopogon	capitellatus			3	0.4
Leucopogon	propinquus				
Lomandra	hermaphrodita			<1	0.2
Lomandra	nigricans			<1	0.5
Lomandra	preissii			<1	0.4
Lomandra	sericea			<1	0.4
Loxocarya	cinerea			<1	0.5
Macrozamia	riedlei			1	2
Neurachne	alopecuroidea			<1	0.1
Opercularia	hispidula			<1	0.1
Patersonia	babianoides			<1	0.1
Patersonia	pygmaea			<1	0.2
Patersonia	pygmaea			<1	0.1
Pentapeltis	silvatica			<1	0.05
Persoonia	longifolia			5	3.5
Philotheca	spicata			<1	0.5
Podocarpus	drouynianus				
Pterostylis	sigmoidea				
Pterostylis	vittata			<1	0.6
Pterostylis	vittata			<1	0.8
Ptilotus	manglesii				
Scaevola	calliptera			<1	0.1
Stylidium	amoenum			<1	0.1
Synaphea	obtusata			<1	0.3
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	2	0.8
Tetrarrhena	laevis			<1	0.3
Tetratheca	affinis			<1	0.5
Tetratheca	hirsuta	subsp.	viminea	<1	0.3
Thysanotus	patersonii			<1	Cl
Xanthorrhoea	gracilis			1.5	4

Site	GBC-03	Location	50K 411782 E	6255877 N
Date	1st Season: 30/07/18 2nd Season: 26/09/18			
Landform	Hillslope			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla and Eucalyptus marginata over Low Scrub B of Xanthorrhoea preissii over Dwarf Scrub D of (Hypocalymma angustifolium), Bossiaea ornata, Hibbertia hypericoides and Leucopogon capitellatus with Open Low Woodland B of Banksia grandis over Open Dwarf Scrub C of Macrozamia riedlei and Xanthorrhoea gracilis			

Condition	Very Good
Disturbance	Logging, road / access track, weeds
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South East
Soil Type	Loamy Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia				
Acacia	extensa			<1	1
Acacia	nervosa			<1	0.3
Acacia	pulchella			<1	1
Acacia	pycnantha				
Acaena	echinata			0.5	0.1
Allocasuarina	humilis				
Andersonia	caerulea				
Astroloma	drummondii			<1	0.2
Astroloma	pallidum			<1	0.2
Banksia	grandis			2	4
Billarderia	variifolia			<1	Cr

Genus	Species	Rank	Name	Cover	Height
Bossiaea	ornata			4	0.5
Caesia	micrantha			<1	
Caladenia	flava			<1	0.1
Chasmanthe	floribunda			<1	1
Clematis	pubescens				
Conostylis	aculeata	subsp.	aculeata	<1	0.2
Conostylis	setigera			<1	0.2
Corymbia	calophylla			45	30
Craspedia	variabilis			<1	0.1
Cryptandra	arbutiflora	subsp.	tubulosa		
Dampiera	linearis			<1	0.2
Daviesia	preissii			<1	0.5
Desmocladus	fasciculatus			<1	0.1
Dichopogon	capillipes			<1	0.1
Drosera	macrantha				
Eriochilus	dilatatus			<1	0.15
Eucalyptus	marginata	subsp.	marginata	15	30
Grevillea	trifida			<1	0.4
Haemodorum	laxum			<1	0.5
Hakea	lissocarpha			0.5	0.5
Hibbertia	diamesogenos				
Hibbertia	hypericoides			5	0.3
Hovea	chorizemifolia			<1	0.1
Hybanthus	floribundus	subsp.	floribundus		
Hypocalymma	angustifolium			1	0.3
Hypochaeris	glabra			<1	0.1
Isotropis	cuneifolia				
Kennedia	prostrata				
Kunzea	glabrescens				
Kunzea	glabrescens				
Labichea	punctata				
Labichea	punctata			<1	0.2
Lagenophora	huegelii			<1	0.1
Lavendula	stoechus			<1	0.5
Leptospermum	erubescens				
Leucopogon	capitellatus			6	0.3
Lobelia	anceps			<1	0.3
Lomandra	nigricans			0.5	0.3
Lomandra	preissii			<1	0.4
Lomandra	sericea			<1	0.5
Loxocarya	cinerea			2	0.5
Macrozamia	riedlei			1	1.2
Opercularia	hispidula			<1	0.2
Oxalis	corniculata			0.5	0.1
Persoonia	longifolia			0.5	2
Philotheca	spicata			<1	0.1
Pimelea	ciliata	subsp.	ciliata		
Pterostylis		sp.	indet	<1	0.1
Scaevola	calliptera				
Stylidium	tenue				
Tetraria	octandra				
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.5
Tetrarrhena	laevis			<1	0.2

Genus	Species	Rank	Name	Cover	Height
Tetratheca	hirsuta	subsp.	viminea	<1	0.2
Thomasia	grandiflora				
Thysanotus	manglesianus			<1	Cl
Tricoryne	humilis				
Xanthorrhoea	gracilis			1	<1
Xanthorrhoea	preissii			10	1.5
Xanthosia	candida			<1	0.1

Site	GBC-04	Location	50K 411871 E	6255833 N
Date	1st Season: 30/07/18 2nd Season: 29/09/18			
Landform	Footslope			
BFF	Allocasuarina Heath A			
Vegetation Description	Heath A of Allocasuarina humilis and Leptospermum erubescens over Low Heath D of Thomasia grandiflora, Andersonia caerulescens and Banksia dallanneyi with Low Open Scrub B of Xanthorrhoea preissii over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) and Desmocladus fasciculatus			

Condition	Good
Disturbance	Road / access track, powerline
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South
Soil Type	Clay Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	nervosa			<1	0.3
Acacia	pulchella			<1	0.3
Acacia	pycnantha			0.5	3.5
Allocasuarina	humilis			15	0.5-2
Andersonia	caerulea			4	0.3
Astroloma	pallidum			<1	0.2
Banksia	dallanneyi			6	0.2
Bossiaea	ornata			<1	0.4
Caladenia	cairnsiana			<1	0.15
Chamaescilla	corymbosa			<1	0.05
Conostylis	setigera			<1	0.05

Genus	Species	Rank	Name	Cover	Height
Corymbia	calophylla			1	4
Craspedia	variabilis			<1	0.1
Cryptandra	arbutiflora	subsp.	tubulosa	<1	0.6
Cyanicula	sericea				
Dampiera	linearis			<1	0.1
Daviesia	preissii			<1	0.3
Desmocladus	fasciculatus			0.5	0.1
Drosera	erythrorhiza			<1	0.05
Drosera	macrantha			<1	Cl
Eriochilus	dilatatus			<1	0.1
Eucalyptus	marginata	subsp.	marginata	1	6
Gompholobium	marginatum				
Haemodorum	laxum			<1	0.5
Hibbertia	hypericoides			0.5	0.4
Hypocalymma	angustifolium			<1	0.4
Hypochaeris	glabra			<1	0.1
Kunzea	glabrescens			2	2
Lavendula	stoechus			<1	0.1
Laxmannia	squarrosa			<1	0.05
Lepidosperma	leptostachyum			<1	0.7
Lepidosperma	pubisquameum			<1	0.5
Leptospermum	erubescens			1	2.5
Lomandra	nigricans			<1	0.4
Lomandra	sericea			<1	0.3
Macrozamia	riedlei			0.5	1
Oxalis	glabra			1	0.05
Oxalis	purpurea			<1	0.1
Pentapeltis	silvatica			<1	0.05
Stylidium	tenue			<1	0.05
Tetraria	octandra			<1	0.3
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	4	0.6
Thomasia	grandiflora			5	0.5
Thysanotus	patersonii			<1	Cl
Ursinia	anthemoides				
Xanthorrhoea	preissii			3	1.5

Site	GBC-05	Location	50K 412091 E	6255696 N
Date	1st Season: 30/07/18 2nd Season: 27/09/18			
Landform	Minor Drainage Line			
BFF	Taxandria Thicket			
Vegetation Description	Thicket of Taxandria linearifolia and Astartea scoparia over Low Heath D of *Chasmanthe floribunda with Tall Woodland of Eucalyptus rudis over Low Woodland A of Callistachys lanceolata and Melaleuca preissiana			

Condition	Degraded
Disturbance	Road / access track, weeds
Fire age	Old (>6 yrs)
Slope	Low
Aspect	South
Soil Type	Clayey Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	pulchella			<1	0.3
Acacia	pycnantha			0.5	2.5
Agrostocrinum	scabrum			<1	0.5
Asparagus	asparagoides				
Astartea	scoparia			2	2.5
Baumea	preissii				
Callistachys	lanceolata			20	8
Chasmanthe	floribunda			45	0.5
Conostylis	aculeata	subsp.	aculeata	<1	0.2
Corymbia	calophylla				
Cynodon	dactylon			<1	0.1
Drosera	glanduligera			<1	0.01
Eucalyptus	rudis	subsp.	rudis	0.5	2

Genus	Species	Rank	Name	Cover	Height
Hypochaeris	glabra			<1	0.1
Juncus	microcephalus			<1	0.5
Juncus	pallidus				
Leptocarpus	depilatus			1	1.2
Lysimachia	arvensis			<1	0.1
Melaleuca	preissiana			2	5
Ornduffia	parnassifolia				
Oxalis	purpurea			<1	0.1
Romulea	rosea			<1	0.1
Stypandra	glauca				
Taxandria	linearifolia			30	3

Site	GBC-06	Location	50K 411567 E	6255953 N
Date	1st Season: 30/07/18 2nd Season: 27/09/18			
Landform	Hillcrest / Upper Hill Slope			
BFF	Allocasuarina Forest			
Vegetation Description	Forest of Allocasuarina fraseriana, Corymbia calophylla and Eucalyptus marginata over Low Woodland A of Corymbia calophylla, Eucalyptus marginata and Allocasuarina fraseriana over Open Dwarf Scrub D of Bossiaea ornata and (Astroloma pallidum) over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391)			

Condition	Good
Disturbance	Road / access track, weeds, logging
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South
Soil Type	Loamy Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia				
Acacia	extensa			<1	0.4
Allocasuarina	fraseriana			30	5-20
Astroloma	pallidum			<1	0.2
Billarderia	variifolia			<1	CL
Bossiaea	ornata			2	0.5
Caesia	micrantha			<1	0.3
Chamaescilla	corymbosa			<1	0.1
Conostylis	setigera			<1	0.1
Corymbia	calophylla			20	10-30
Cyrtostylis	huegelii				

Genus	Species	Rank	Name	Cover	Height
Dampiera	linearis			<1	0.05
Dichopogon	capillipes			<1	0.1
Drosera	erythrorhiza			<1	0.05
Drosera	pallida			<1	Cl
Eucalyptus	marginata	subsp.	marginata	5	10-30
Hibbertia	amplexicaulis			<1	0.1
Hibbertia	commutata			<1	0.2
Hovea	chorizemifolia			0.5	0.2
Lagenophora	huegelii			<1	0.05
Lechenaultia	biloba			<1	0.2
Leucopogon	capitellatus			<1	0.1
Leucopogon	propinquus			<1	0.5
Lomandra	hermaphrodita			<1	0.3
Lomandra	nigricans			<1	0.2
Lomandra	sericea			<1	0.5
Opercularia	vaginata			<1	0.3
Patersonia	babianoides			<1	0.1
Patersonia	pygmaea			<1	0.2
Persoonia	longifolia			0.5	1.5
Philotheca	spicata			<1	0.2
Pterostylis	vittata			<1	0.5
Pyrorchis	nigricans			<1	0.5
Scaevola	calliptera			<1	0.05
Stylidium	amoenum			<1	0.05
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.5
Tetrarrhena	laevis			<1	0.2
Tetratheca	hirsuta	subsp.	viminea	<1	0.1
Thysanotus	manglesianus			<1	Cl

Site	GBC-07	Location	50K 412110 E	6255392 N
Date	1st Season: 31/07/18 2nd Season: 27/09/18			
Landform	Footslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of *Eucalyptus resinifera over Very Open Herbs of *Chasmanthe floribunda and *Oxalis glabra			

Condition	Completely Degraded
Disturbance	Road / access track, weeds, post-mining rehabilitation
Fire age	Recent (0 to 2 yr)
Slope	Flat
Aspect	Flat
Soil Type	Loamy Sand
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia				
Acacia	drummondii				
Acacia	latericola				
Acacia	pulchella				
Acacia	pycnantha			<1	1.2
Acacia	saligna				
Asparagus	asparagoides				
Astartea	scoparia				
Billarderia	heterophylla			<1	0.2
Chamaecytisus	palmensis			<1	0.2
Chamaescilla	corymbosa			<1	0.05
Chasmanthe	floribunda			0.5	0.7
Corymbia	maculata				
Cynodon	dactylon			<1	0.5

Genus	Species	Rank	Name	Cover	Height
Eucalyptus	patens			<1	0.5
Eucalyptus	resinifera			60	30
Eucalyptus	rudis	subsp.	rudis		
Hypocalymma	angustifolium			<1	0.2
Hypochaeris	glabra			<1	0.1
Lavendula	stoechus				
Leptocarpus	depilatus			<1	1
Melaleuca	preissiana				
Oxalis	corniculata			2	0.1
Patersonia	pygmaea			<1	0.2
Pericalymma	ellipticum				
Pinus	pinaster				
Plantago	lanceolata			<1	0.1
Rubus	anglocandicans				
Taxandria	linearifolia			1	1.5
Taxandria	parviceps			0.5	1.5
Tetrarrhena	laevis			<1	0.1

Site	GBC-08	Location	50K 411974 E	6255197 N
Date	1st Season: 31/07/18 2nd Season: 27/09/18			
Landform	Hillslope			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla and Eucalyptus marginata over Dwarf Scrub D of Banksia dallaneyi, Phyllanthus calycinus, Hibbertia hypericoides and Thomasia grandiflora with Open Low Scrub B of Xanthorrhoea preissii, Macrozamia riedlei and Xanthorrhoea gracilis			

Condition	Good
Disturbance	Road / access track, weeds, logging
Fire age	Recent (0 to 2 yr)
Slope	Low
Aspect	North
Soil Type	Sandy Loam
Soil Colour	Black

Genus	Species	Rank	Name	Cover	Height
Acacia	dentifera			<1	0.3
Acacia	nervosa			<1	0.1
Acacia	pycnantha			<1	0.2
Astroloma	pallidum			<1	0.1
Banksia	dallanneyi			6	0.3
Bossiaea	ornata			<1	0.2
Briza	maxima			<1	0.3
Caladenia	flava			<1	0.05
Chamaescilla	corymbosa			0.5	0.05
Chasmanthe	floribunda			<1	0.5
Conostylis	aculeata	subsp.	aculeata	<1	0.2
Conostylis	setigera			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Conyza	bonariensis				
Corymbia	calophylla			20	10-30
Craspedia	variabilis			<1	0.2
Dampiera	linearis			<1	0.1
Desmocladus	fasciculatus			2	0.1
Dianella	revoluta				
Drosera	erythrorhiza			<1	0.05
Drosera	macrantha			<1	Cl
Eriochilus	dilatatus			<1	0.2
Eucalyptus	marginata	subsp.	marginata	25	5-25
Eucalyptus	patens			<1	6
Gompholobium	knightianum			<1	0.1
Grevillea	trifida			0.5	0.4
Haemodorum	laxum			<1	0.4
Hakea	amplexicaulis				
Hakea	lissocarpha				
Hibbertia	hypericoides			3	0.3
Hovea	chorizemifolia			0.5	0.2
Isotropis	cuneifolia			<1	0.5
Kennedia	coccinea			<1	0.1
Kennedia	prostrata			<1	0.1
Labichea	punctata			<1	0.1
Lagenophora	huegelii			<1	0.05
Lechenaultia	biloba			<1	0.2
Leucopogon	capitellatus			<1	0.1
Lomandra	nigricans			<1	0.1
Lomandra	sericea			<1	0.3
Macrozamia	riedlei			1	1
Patersonia	pygmaea			<1	0.3
Persoonia	longifolia			2	2.5
Philotheca	spicata			0.5	0.3
Phyllanthus	calycinus			4	0.3
Pimelea	ciliata	subsp.	ciliata	<1	0.2
Scaevola	calliptera			<1	0.1
Stylidium	piliferum			<1	0.05
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	<1	0.5
Tetratheca	hirsuta	subsp.	viminea	<1	0.2
Thomasia	grandiflora			4	0.3
Thysanotus	manglesianus			<1	Cl
Xanthorrhoea	gracilis			1	1
Xanthorrhoea	preissii			8	1.3

Site	GBC-09	Location	50K 411858 E	6255053 N
Date	1st Season: 31/07/18 2nd Season: 27/09/18			
Landform	Hillslope			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla and Eucalyptus marginata over Dwarf Scrub D of Bossiaea ornata and Hibbertia hypericoides with Open Dwarf Scrub C of Macrozamia riedlei and Hibbertia hypericoides			

Condition	Very Good
Disturbance	Road / access track
Fire age	Old (>6 yr)
Slope	Low
Aspect	North West
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	extensa			0.5	2.5
Acacia	insolita	subsp.	insolita	<1	0.3
Acacia	pulchella			<1	0.8
Acacia	pycnantha			0.5	3
Billarderia	variifolia			<1	Cl
Bossiaea	ornata			15	0.5
Burchardia	congesta			<1	0.3
Caesia	micrantha			<1	0.2
Chamaescilla	corymbosa			<1	0.1
Conostylis	setigera			<1	0.2
Corymbia	calophylla			30	10-30
Dampiera	linearis			<1	0.1
Daviesia	preissii			<1	0.5

Genus	Species	Rank	Name	Cover	Height
Drosera	erythrorhiza			<1	0.05
Drosera	pallida			<1	Cl
Eucalyptus	marginata	subsp.	marginata	20	10-30
Gompholobium	knightianum			<1	0.1
Grevillea	trifida			<1	0.2
Haemodorum	laxum			<1	0.1
Hakea	amplexicaulis			0.5	1.2
Hibbertia	amplexicaulis			<1	0.2
Hibbertia	commutata			<1	0.3
Hibbertia	hypericoides			10	0.4
Hovea	chorizemifolia			0.5	0.3
Kennedia	coccinea			<1	0.1
Lagenophora	huegelii			<1	0.2
Lechenaultia	biloba			<1	0.2
Leucopogon	verticillatus			0.5	1
Lomandra	nigricans			<1	0.2
Lomandra	preissii			<1	0.5
Lomandra	sericea			<1	0.3
Lomandra	sonderi			<1	0.5
Macrozamia	riedlei			0.5	1
Opercularia	hispidula			<1	0.1
Orianthera	serpyllifolia	subsp.	serpyllifolia	<1	0.1
Patersonia	babianoides			<1	0.1
Pentapeltis	silvatica			<1	0.1
Persoonia	longifolia			1	4
Philotheca	spicata			0.5	0.2
Podocarpus	drouynianus			1	2
Pterostylis	vittata			<1	0.5
Scaevola	calliptera			<1	0.5
Stylidium	amoenum			<1	0.05
Taxandria	parviceps			<1	1.5
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	<1	0.5
Tetrarrhena	laevis			<1	0.3
Tetratheca	affinis			<1	0.3
Tetratheca	hirsuta	subsp.	viminea	<1	0.4
Tremandra	diffusa			<1	0.3
Xanthorrhoea	gracilis			2	1
Xanthosia	huegelii			<1	0.1

Site	GBC-10	Location	50K 411718 E	6254031 N
Date	1st Season: 31/07/18 2nd Season: 03/10/18			
Landform	Wetland			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus patens, Corymbia calophylla and *Pinus radiata over Scrub of Hakea prostrata, *Acacia pycnantha and Taxandria linearifolia over Low Scrub B of Astartea scoparia and Bossiaea linophylla over Open Dwarf Scrub D of Hypocalymma angustifolium over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391)			

Condition	Good
Disturbance	Road / access track, rubbish, weeds, logging
Fire age	Old (>6 yr)
Slope	Flat
Aspect	Flat
Soil Type	Sandy Clay Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	extensa			0.5	1
Acacia	pulchella			0.5	1.5
Acacia	pycnantha			8	2-8
Astartea	scoparia			10	2
Astroloma	ciliatum				
Austrostipa	mollis			<1	0.4
Billarderia	heterophylla			<1	1.5
Bossiaea	linophylla			6	1-2
Caladenia	ferruginea				
Caladenia	ferruginea				
Caladenia	flava				

Genus	Species	Rank	Name	Cover	Height
Chamaescilla	corymbosa				
Conostylis	aculeata	subsp.	aculeata	<1	0.4
Corymbia	calophylla			5	30
Diuris	longifolia			<1	0.4
Eriochilus	dilatatus			<1	0.3
Eucalyptus	patens			40	30
Grevillea	centristigma				
Hakea	prostrata			10	2-3
Hibbertia	glomerata	subsp.	glomerata		
Hypocalymma	angustifolium			8	0.5
Juncus	pallidus				
Laxmannia	squarrosa				
Lepidosperma	squamatum				
Leptocarpus	depilatus			<1	1.5
Leucopogon	capitellatus				
Leucopogon	verticillatus			<1	0.5
Lomandra	integra			<1	0.3
Melaleuca	viminea				
Neurachne	alopecuroidea			<1	0.1
Oxalis	glabra				
Patersonia	occidentalis			<1	0.3
Philotheca	spicata				
Pimelea	angustifolia				
Pinus	pinaster			10	30
Pterostylis	vittata			<1	0.4
Pterostylis	vittata			<1	0.4
Stylidium	uniflorum	subsp.	uniflorum		
Taxandria	linearifolia			2	3
Taxandria	parviceps			<1	2
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.5
Tetrarrhena	laevis			<1	0.3
Thysanotus	patersonii			<1	Cl
Xanthosia	huegelii			<1	0.1
Acacia	extensa			0.5	1
Acacia	pulchella			0.5	1.5
Acacia	pycnantha			8	2-8
Astartea	scoparia			10	2
Astroloma	ciliatum				
Austrostipa	mollis			<1	0.4
Billarderia	heterophylla			<1	1.5
Bossiaea	linophylla			6	1-2
Caladenia	ferruginea				
Caladenia	ferruginea				

Site	GBC-11	Location	50K 411609 E	6254364 N
Date	1st Season: 31/07/18 2nd Season: 03/10/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Dwarf Scrub D of Bossiaea ornata, Hibbertia hypericoides and Leucopogon capitellatus with Open Dwarf Scrub C of Xanthorrhoea preissii and Macrozamia riedlei			

Condition	Very Good
Disturbance	Road / access track, weeds
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South East
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia			<1	1.4
Acacia	pulchella			0.5	1
Acacia	pycnantha			<1	6
Amphipogon	amphipogonoides			<1	0.2
Banksia	dallanneyi			2	0.3
Billarderia	variifolia			<1	Cl
Bossiaea	aquifolium				
Bossiaea	ornata			10	0.5
Burchardia	congesta			<1	0.4
Caesia	micrantha			<1	0.3
Cassytha	racemosa	forma	racemosa	<1	Cl
Chamaescilla	corymbosa			0.5	0.1
Chasmanthe	floribunda			<1	0.8

Genus	Species	Rank	Name	Cover	Height
Clematis	pubescens				
Corymbia	calophylla			35	20-30
Dampiera	linearis			<1	0.1
Desmocladus	fasciculatus			0.5	0.1
Drosera	erythrorhiza			<1	0.05
Drosera	macrantha			<1	Cl
Eucalyptus	marginata	subsp.	marginata	25	20-30
Grevillea	trifida			<1	0.5
Haemodorum	laxum				
Hakea	amplexicaulis			<1	1.7
Hibbertia	amplexicaulis			<1	0.1
Hibbertia	commutata			<1	0.2
Hibbertia	hypericoides			15	0.5
Hovea	chorizemifolia			1	0.3
Lagenophora	huegelii			<1	0.05
Lechenaultia	biloba			<1	0.2
Lepidosperma	leptostachyum			<1	0.7
Leucopogon	capitellatus			2	0.3
Lobelia	anceps			<1	0.1
Lomandra	integra			<1	0.2
Lomandra	sericea			<1	0.2
Macrozamia	riedlei			0.5	1.2
Neurachna	alopecuroidea			<1	0.1
Opercularia	apiciflora			<1	0.1
Patersonia	babianoides			<1	0.15
Patersonia	pygmaea				
Pentapeltis	silvatica			<1	0.05
Philotheca	spicata			1	0.3
Pterostylis	vittata			<1	0.4
Pterostylis	vittata			<1	0.3
Stylidium	amoenum			<1	0.05
Synaphea	obtusata			<1	0.4
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	1	0.5
Tetrarrhena	laevis			<1	0.3
Tetratheca	hirsuta	subsp.	viminea	<1	0.3
Xanthorrhoea	gracilis			2	1.2
Xanthorrhoea	preissii			1	1.5

Site	GBC-12	Location	50K 411900 E	6254900 N
Date	1st Season: 31/07/18 2nd Season: 03/10/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Open Low Woodland A of Banksia grandis and Persoonia longifolia over Open Dwarf Scrub C of Xanthorrhoea gracilis and Leucopogon verticillatus			

Condition	Good
Disturbance	Logging, weeds
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	North West
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	pulchella			<1	0.5
Acacia	pycnantha			2	2.5
Agrostocrinum	hirsutum			<1	0.6
Amphipogon	amphipogonoides			<1	0.1
Austrostipa	campylachne			<1	0.1
Banksia	grandis			3	5
Billarderia	variifolia			<1	0.2
Bossiaea	ornata			1	0.3
Briza	maxima			<1	0.1
Burchardia	congesta				
Caladenia	arrecta			<1	0.2
Caladenia	arrecta			<1	0.1
Caladenia	flava			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Caladenia	macrostylis				
Chamaescilla	corymbosa			<1	0.05
Clematis	pubescens			<1	Cl
Corymbia	calophylla			15	20
Daviesia	preissii			<1	0.6
Diuris	longifolia			<1	0.2
Drosera	erythrorhiza			<1	0.05
Drosera	macrantha			<1	Cl
Eriochilus	dilatatus				
Eucalyptus	marginata	subsp.	marginata	20	10-25
Grevillea	trifida			<1	0.1
Hibbertia	amplexicaulis			<1	0.3
Hibbertia	commutata			<1	0.4
Hibbertia	hypericoides			4	0.4
Hovea	chorizemifolia			<1	0.5
Hypochaeris	glabra			<1	0.05
Kennedia	coccinea			<1	0.1
Labichea	punctata			<1	0.2
Lagenophora	huegelii			<1	0.1
Lechenaultia	biloba				
Leucopogon	capitellatus			0.5	0.3
Leucopogon	verticillatus			1.5	1
Lobelia	anceps			<1	0.1
Lomandra	drummondii				
Lomandra	hermaphrodita			<1	0.2
Lomandra	integra			<1	0.2
Lomandra	preissii			<1	0.1
Lomandra	sericea			<1	0.2
Macrozamia	riedlei			<1	1
Neurachne	alopecuroidea			<1	0.1
Opercularia	hispidula			<1	0.4
Patersonia	babianoides			<1	0.1
Pentapeltis	silvatica			<1	0.05
Pericalymma	ellipticum			<1	0.4
Philotheca	spicata				
Pterostylis	sigmoidea				
Pterostylis	vittata			<1	0.3
Pterostylis		sp.	aff. nana		
Scaevola	calliptera			<1	0.05
Senecio	diaschides				
Stylidium	amoenum			<1	0.05
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	2	0.5
Tetrarrhena	laevis			<1	0.2
Tetratheca	affinis				
Tetratheca	hirsuta	subsp.	viminea	<1	0.3
Thysanotus	tenellus			<1	0.2
Xanthorrhoea	gracilis			3	0.5-1
Xanthosia	atkinsoniana			<1	0.1

Site	GBC-13	Location	50K 411885 E	6249071 N
Date	1st Season: 06/08/18 2nd Season: 03/10/18			
Landform	Wetland			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla, Eucalyptus marginata and (Eucalyptus rudis) over Low Scrub A of Lepidosperma tetraquetrum with Open Low Woodland B of Callistachys lanceolata over Open Scrub of Taxandria linearifolia over Open Low Scrub B of Pteridium esculentum, *Rubus ulmifolius and Billardiera heterophylla			

Condition	Very Good
Disturbance	Road / access track, weeds
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South
Soil Type	Sandy Clay Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acaena	echinata			<1	0.1
Amperea	simulans				
Amphipogon	amphipogonoides			<1	0.5
Asparagus	asparagoides			<1	Cl
Billarderia	heterophylla			2	1.5
Bossiaea	ornata			<1	0.1
Caesia	micrantha				
Caladenia	flava	subsp.	sylvestris	<1	0.1
Caladenia	reptans	subsp.	reptans		
Callistachys	lanceolata			4	8
Carduus	pycnocephalus			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Clematis	pubescens			<1	Cl
Conyza	bonariensis			<1	0.15
Corymbia	calophylla			25	30
Cryptostylis	ovata				
Cynodon	dactylon			0.5	0.1
Cyrtostylis	huegelii			<1	Pr
Daucus	glochidiatus			<1	0.1
Drosera	modesta			<1	0.1
Drosera	stolonifera				
Eucalyptus	marginata	subsp.	marginata	15	30
Eucalyptus	patens			5	35
Geranium	solanderi			<1	0.1
Gonocarpus	benthamii				
Hibbertia	amplexicaulis			<1	0.5
Hibbertia	commutata			<1	0.2
Hibbertia	cuneiformis			<1	0.4
Hovea	trisperma			<1	0.3
Hybanthus	debilissimus				
Hypochaeris	glabra			1	0.05
Isotropis	cuneifolia			<1	0.1
Lagenophora	huegelii			<1	0.4
Lepidosperma	tetraquetrum			15	1-2
Leucopogon	capitellatus			<1	0.5
Leucopogon	verticillatus			<1	0.1
Lolium	rigidum			<1	0.2
Lomandra	pauciflora			<1	0.3
Luzula	meridionalis				
Macrozamia	riedlei			<1	0.1
Neurachne	alopecuroidea			<1	0.05
Olearia	paucidentata				
Opercularia	hispidula			<1	0.3
Oxalis	corniculata			<1	0.2
Patersonia	occidentalis			0.5	0.5
Pelargonium	littorale			3	0.05
Phyllanthus	calycinus			<1	0.4
Pteridium	esculentum			5	1-2
Pterostylis	pyramidalis			<1	0.1
Ranunculus	colonorum			<1	0.1
Rubus	anglocandicans			2	2
Senecio	hispidulus			<1	0.2
Sowerbaea	laxiflora				
Stylidium	adnatum			<1	0.2
Taxandria	linearifolia			4	3
Tetrarrhena	laevis			<1	0.1
Thysanotus	patersonii			<1	Cl
Tremandra	diffusa			<1	0.1

Site	GBC-14	Location	50K 418907 E	6246400 N
Date	1st Season: 06/08/18 2nd Season: 03/10/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Open Low Woodland B of Banksia grandis over Open Dwarf Scrub C of Macrozamia riedlei and Petridium esculentum over Open Dwarf Scrub D of Leucopogon capitellatus and Leucopogon verticillatus over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) and Tetraria octandra			

Condition	Degraded
Disturbance	Road / access track, rubbish, weeds, logging
Fire age	Moderate (3 to 5 yr)
Slope	Low
Aspect	South
Soil Type	Sandy Loam
Soil Colour	Black

Genus	Species	Rank	Name	Cover	Height
Acacia	longifolia	subsp.	longifolia		
Acacia	pulchella			<1	0.3
Agrostocrinum	scabrum			<1	0.5
Austrostipa	campylachne			<1	0.4
Banksia	dallanneyi				
Banksia	grandis			5	1-4
Billarderia	heterophylla				
Bossiaea	ornata			0.5	0.3
Briza	maxima			2	0.2
Burchardia	congesta			<1	0.5
Caesia	micrantha			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Chamaecytisus	palmensis				
Chasmanthe	floribunda				
Clematis	pubescens			2	Cl
Conostylis	laxiflora			<1	0.1
Corymbia	calophylla			25	10-30
Dampiera	linearis			<1	0.1
Daucus	glochidiatus			<1	0.1
Desmocladus	fasciculatus			<1	0.1
Dianella	revoluta				
Drosera	erythrorhiza			<1	0.03
Drosera	macrantha			<1	Cl
Ehrharta	calycina				
Eucalyptus	marginata	subsp.	marginata	35	10-30
Hakea	amplexicaulis				
Hibbertia	hypericoides				
Hypochaeris	glabra			0.5	0.05
Kennedia	coccinea			1	0.5
Labichea	punctata				
Labichea	punctata				
Lagenophora	huegelii			<1	0.1
Leucopogon	capitellatus			0.5	0.4
Leucopogon	verticillatus			0.5	0.5
Lomandra	nigricans			<1	0.2
Lomandra	sericea			<1	0.3
Luzula	meridionalis			<1	0.3
Macrozamia	riedlei			1	1
Opercularia	vaginata				
Oxalis	corniculata			<1	0.1
Patersonia	pygmaea			<1	0.15
Persoonia	longifolia			<1	0.8
Phyllanthus	calycinus			<1	0.2
Pteridium	esculentum			1	0.6
Scaevola	calliptera			<1	0.1
Solanum	nigrum			<1	0.8
Sonchus	oleraceus			<1	0.1
Sparaxis	bulbifera			<1	0.1
Tetraria	octandra			<1	0.3
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	0.5	0.5
Tetrarrhena	laevis			<1	0.2
Tetratheca	hirsuta	subsp.	viminea	<1	0.3
Thelymitra		sp.	indet		
Thysanotus	multiflorus			<1	0.1
Thysanotus	patersonii				
Xanthorrhoea	gracilis				
Xanthosia	candida			<1	0.05

Site	GBC-15	Location	50K 412428 E	6255505 N
Date	2nd Season: 27/09/18			
Landform	Hillslope			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla over Scrub of Bossiaea linophylla and Banksia grandis over Open Low Scrub B of Macrozamia riedlei and Acacia celastrifolia over Open Dwarf Scrub D of Phyllanthus calycinus, (Leucopogon capitellatus) and Labichea punctata over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391)			

Condition	Degraded
Disturbance	Mining exploration, road/ access track, weeds, powerline
Fire age	Old (>6 yr)
Slope	Low
Aspect	North
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia			5	1.5
Acaena	echinata			<1	0.1
Banksia	grandis			10	2-3
Bossiaea	linophylla			10	2-5
Bossiaea	ornata			<1	0.5
Briza	maxima			<1	0.2
Caesia	micrantha			<1	0.2
Chasmanthe	floribunda			7	1
Clematis	pubescens			<1	Cl
Conostylis	aculeata	subsp.	aculeata	<1	0.2
Corymbia	calophylla			60	15-30
Haemodorum	laxum			<1	0.3

Genus	Species	Rank	Name	Cover	Height
Hibbertia	commutata			0.5	0.3
Hovea	chorizemifolia			<1	0.2
Hypochaeris	glabra			<1	0.1
Labichea	punctata			2	0.2
Lagenophora	huegelii			0.5	0.1
Lechenaultia	biloba			<1	0.1
Leucopogon	capitellatus			1	0.5
Leucopogon	propinquus			<1	0.2
Leucopogon	verticillatus			<1	0.5
Lomandra	sericea			<1	0.3
Macrozamia	riedlei			1.5	1.2
Opercularia	hispidula			1	0.5
Oxalis	corniculata			<1	0.1
Oxalis	purpurea			1	0.1
Patersonia	pygmaea			<1	0.1
Persoonia	longifolia			<1	0.4
Philotheca	spicata			<1	0.5
Phyllanthus	calycinus			3	0.5
Scaevola	calliptera			<1	0.1
Stylidium	amoenum			<1	0.2
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.5
Tetrarrhena	laevis			<1	0.3
Tetratheca	hirsuta	subsp.	viminea	<1	0.2
Trichocline	spathulata			0.5	0.1
Xanthorrhoea	gracilis			<1	0.6

Site	GBC-16	Location	50K 411991 E	6255614 N
Date	2nd Season: 27/09/18			
Landform	Wetland			
BFF	Melaleuca Low Forest A			
Vegetation Description	Low Forest A of Melaleuca preissiana with Woodland of Eucalyptus patens and Corymbia calophylla over Open Dwarf Scrub C of *Rubis anglocandicans, *Chasmanthe floribunda			

Condition	Degraded
Disturbance	Mining exploration, road/ access track, weeds, rubbish, altered drainage
Fire age	Old (>6 yr)
Slope	Low
Aspect	North West
Soil Type	Clayey Sand
Soil Colour	Black

Genus	Species	Rank	Name	Cover	Height
Asparagus	asparagoides			0.5	0.5
Baumea	preissii			0.5	1
Chasmanthe	floribunda			2	1
Chorizandra	enodis			0.5	0.5
Corymbia	calophylla			5	20
Cynodon	dactylon			1	0.2
Eucalyptus	cornuta				
Eucalyptus	patens			15	25
Eucalyptus	resinifera				
Hypochaeris	glabra			<1	0.1
Juncus	microcephalus			<1	0.8
Kennedia	prostrata			<1	0.3
Leptocarpus	depilatus			2	1.5
Lobularia	maritima			<1	0.2

Genus	Species	Rank	Name	Cover	Height
Melaleuca	preissiana			60	14
Ornduffia	parnassifolia			<1	0.1
Pinus	pinaster			<1	1.8
Plantago	lanceolata			<1	0.3
Ricinus	communis				7
Rubus	anglocandicans			5	1
Taxandria	linearifolia			1	1.4
Tetrarrhena	laevis			<1	0.2
Xanthorrhoea	preissii				

Site	GBC-20	Location	50K 419644 E	6247500 N
Date	1st Season: 02/08/18 2nd Season: 18/10/18			
Landform	Hillcrest / Upper Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Open Low Sedges of Lepidosperma leptostachyum, Lomandra drummondii and Tetraria octandra with Open Low Woodland A of Corymbia calophylla over Open Dwarf Scrub D of Phyllanthus calycinus, Leucopogon capitellatus and Bossiaea ornata over Open Hummock Grass of *Briza maxima			

Condition	Good
Disturbance	Road/ Access Track; Rubbish; Weeds; Logging; Gold Course
Fire age	Old (>6 yr)
Slope	Low
Aspect	South
Soil Type	Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acaena	echinata			<1	0.1
Aira	caryophyllea			<1	0.1
Austrostipa	campylachne			<1	0.5
Bossiaea	ornata			0.5	0.3
Briza	maxima			5	0.2
Burchardia	congesta			<1	0.5
Caesia	micrantha			<1	0.2
Caesia	micrantha			<1	0.4
Caladenia	attingens	subsp.	attingens	<1	0.35
Caladenia	macrostylis				
Centaurium	tenuiflorum			<1	0.4

Genus	Species	Rank	Name	Cover	Height
Clematis	pubescens			1	Cl
Corymbia	calophylla			30	5-30
Craspedia	variabilis			<1	0.1
Dampiera	linearis			<1	0.1
Daucus	glochidiatus			<1	0.05
Desmocladus	fasciculatus			<1	0.2
Dichopogon	capillipes			<1	0.4
Diuris	longifolia			<1	0.4
Drosera	erythrorhiza			<1	0.1
Drosera	pallida			<1	Cl
Elythranthera	brunonis			<1	0.3
Eucalyptus	marginata	subsp.	marginata	30	5-30
Geranium	solanderi			<1	0.1
Hakea	amplexicaulis			<1	1
Hibbertia	amplexicaulis			<1	0.3
Hibbertia	commutata			<1	0.3
Hovea	chorizemifolia			<1	0.2
Hypochaeris	glabra			<1	0.1
Lagenophora	huegelii			0.25	0.1
Lepidosperma	leptostachyum			9	0.5
Leucopogon	capitellatus			2	0.4
Leucopogon	propinquus			<1	0.3
Leucopogon	verticillatus			<1	0.3
Lomandra	drummondii			1.5	0.5
Lomandra	pauciflora			<1	0.2
Lomandra	preissii			<1	0.5
Luzula	meridionalis			<1	0.3
Macrozamia	riedlei			<1	0.7
Neurachne	alopecuroidea			0.5	0.1
Opercularia	apiciflora			<1	0.3
Opercularia	hispidula			<1	0.2
Orianthera	serpyllifolia	subsp.	serpyllifolia	<1	0.1
Oxalis	corniculata			1.5	0.1
Persoonia	longifolia			<1	0.5
Petrorhagia	dubia			<1	0.2
Phyllanthus	calycinus			4.5	0.4
Ptilotus	manglesii				
Pyrorchis	forrestii			<1	0.15
Scaevola	calliptera			<1	0.1
Tetraria	octandra			0.5	0.5
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	1	0.4
Tetrarrhena	laevis			0.5	0.3
Thelymitra	graminea				
Thelymitra		sp.	indet	<1	0.3
Thysanotus	patersonii			<1	Cl
Trachymene	pilosa			<1	0.05
Trifolium	campestre			<1	0.1
Xanthorrhoea	gracilis			1	0.5-1

Site	GBC-21	Location	50K 419656 E	6246886 N
Date	1st Season: 02/08/18 2nd Season: 04/10/18			
Landform	Hillslope			
BFF	Corymbia Low Forest A			
Vegetation Description	Low Forest A of Corymbia calophylla and Banksia grandis over Heath A of Pteridium esculentum and Bossiaea linophylla with Forest of Corymbia calophylla, Open Low Woodland of Banksia grandis, Open Dwarf Scrub D of Phyllanthus calycinus and Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) and Lepidosperma leptostachyum			

Condition	Good
Disturbance	Road/ Access Track; Rubbish; Weeds; Logging; Gold Course
Fire age	Old (>6 yr)
Slope	Low
Aspect	South
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	dealbata			0.5	2-10
Acacia	iteaphylla			2	4
Acacia	pulchella			<1	1
Asparagus	declinatus			<1	0.2
Banksia	grandis			3	2-5
Bossiaea	linophylla			2	1-3
Briza	maxima			<1	0.1
Chamaescilla	corymbosa			<1	0.05
Corymbia	calophylla			55	10-20
Drosera	pallida			<1	Cl
Freesia	alba × leichtlinii			1	0.3

Genus	Species	Rank	Name	Cover	Height
Haemodorum	laxum			<1	0.3
Hibbertia	amplexicaulis			<1	0.4
Hibbertia	commutata			0.5	0.3
Hypochaeris	glabra			<1	0.1
Kennedia	coccinea			<1	Cr
Lepidosperma	leptostachyum			3	0.5
Leucopogon	capitellatus			0.5	0.3
Leucopogon	propinquus			<1	0.3
Levenhookia	dubia			<1	0.1
Macrozamia	riedlei			1	0.5-1
Neurachne	alopecuroidea			<1	0.05
Opercularia	hispidula			<1	0.2
Oxalis	pes-caprae			5	0.3
Phyllanthus	calycinus			2	0.4
Psoralea	pinnata				
Pteridium	esculentum			30	1-2
Ptilotus	manglesii			<1	0.1
Romulea	rosea			<1	0.2
Scaevola	calliptera			<1	0.1
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	5	0.4
Tetrarrhena	laevis			<1	0.2

Site	GBC-22	Location	50K 412027 E	6249348 N
Date	1st Season: 02/08/18 2nd Season: 04/10/18			
Landform	Hillslope			
BFF	Corymbia Forest			
Vegetation Description	Forest of Corymbia calophylla and Eucalyptus marginata over Heath B of Podocarpus drouynianus, Macrozamia riedlei and Billarderia heterophylla (Dasypogon bromeliifolius) with Low Scrub A of Taxandria parviceps and (Bossiaea linophylla), Open Dwarf Scrub D of Leucopogon capitellatus and Hibbertia diamesogenos, and Very Open Low Sedges of Hypolaena exsulca and Desmocladus fascicularis			

Condition	Very Good
Disturbance	Road/ Access Track; Weeds
Fire age	Old (>6 yr)
Slope	Low
Aspect	South
Soil Type	Sandy
Soil Colour	Grey

Genus	Species	Rank	Name	Cover	Height
Acacia	extensa			<1	1
Astroloma	pallidum				
Austrostipa	campylachne				
Banksia	dallanneyi				
Billarderia	heterophylla			1	1.5
Billarderia	variifolia				
Bossiaea	linophylla			0.5	1.5
Bossiaea	ornata				
Briza	maxima				
Burchardia	congesta				

Genus	Species	Rank	Name	Cover	Height
Caesia	micrantha				
Caladenia	flava				
Caladenia	magniclavata				
Chamaescilla	corymbosa				
Conostylis	aculeata	subsp.	aculeata	<1	0.3
Conostylis	serrulata			<1	0.2
Corymbia	calophylla			35	20-30
Cyathochaeta	avenacea				
Cyrtostylis	huegelii			<1	0.05
Dampiera	linearis			<1	0.1
Dasypogon	bromeliifolius			3	1.2
Daucus	glochidiatus			<1	0.1
Desmocladus	fasciculatus			1	0.1
Drosera	erythrorhiza			<1	0.05
Drosera	pallida			<1	Cl
Eucalyptus	marginata	subsp.	marginata	20	20-30
Gompholobium	capitatum			<1	0.1
Gompholobium	tomentosum			0.5	0.2
Hibbertia	amplexicaulis			<1	0.3
Hibbertia	commutata				
Hibbertia	diamesogenos			0.5	0.2
Hibbertia	ferruginea			<1	0.2
Hovea	chorizemifolia			<1	0.2
Hovea	trisperma				
Hypocalymma	angustifolium			<1	0.3
Hypochaeris	glabra			<1	0.1
Hypolaena	exsulca			5	0.3
Isotropis	cuneifolia			<1	0.1
Johnsonia	lupulina			<1	0.5
Lagenophora	huegelii			1	0.05
Leptomeria	cunninghamii				
Leucopogon	australis			1	1.2
Leucopogon	capitellatus			4	0.2
Leucopogon	propinquus				
Lomandra	brittanii			<1	0.1
Lomandra	caespitosa				
Lomandra	nigricans			<1	0.3
Lomandra	preissii				
Lomandra	sericea				
Macrozamia	riedlei			1.5	1.2
Millotia	tenuifolia	var.	tenuifolia	<1	0.1
Monotaxis	occidentalis			<1	0.2
Neurachne	alopecuroidea				
Opercularia	apiciflora				
Opercularia	hispidula				
Opercularia	vaginata			<1	0.3
Orianthera	serpyllifolia	subsp.	serpyllifolia	<1	0.15
Patersonia	occidentalis				
Pentapeltis	silvatica				
Pentapeltis	silvatica				
Persoonia	longifolia			1	4
Philotheca	spicata			<1	0.3
Platysace	tenuissima				

Genus	Species	Rank	Name	Cover	Height
Podocarpus	drouynianus			45	1.2
Pterostylis	vittata			<1	0.3
Pyrorchis	nigricans			<1	0.05
Scaevola	calliptera				
Stylidium	amoenum			<1	0.1
Taxandria	parviceps			1	1.5
Tetraria	octandra			<1	0.2
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	<1	0.3
Tetrarrhena	laevis			<1	0.2
Thysanotus	patersonii			<1	0.1
Trachymene	pilosa			<1	0.05
Tremandra	diffusa			<1	0.2
Xanthorrhoea	preissii			0.5	1.2
Xanthosia	huegelii			<1	0.1
Xanthosia	tasmanica				

Site	GBC-23	Location	50K 411971 E	6250104 N
Date	1st Season: 02/08/18 2nd Season: 04/10/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Low Heath D of Hibbertia hypericoides, Hypocalymma angustifolium, Leucopogon capitellatus and Hakea lissocarpha with Open Low Woodland B of Persoonia longifolia			

Condition	Very Good
Disturbance	Logging, mining exploration
Fire age	Old (>6 yr)
Slope	Low
Aspect	North
Soil Type	Sandy Loam
Soil Colour	Brown

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia			1	1-2.5
Acacia	insolita	subsp.	insolita	<1	0.4
Acacia	latericola			<1	1
Acacia	obovata			<1	0.3
Astroloma	ciliatum			<1	0.1
Astroloma	drummondii			<1	0.2
Astroloma	pallidum			<1	0.2
Banksia	dallanneyi			5	0.3
Banksia	grandis				
Billarderia	variifolia			<1	0.1
Bossiaea	ornata			6	0.5
Caladenia	flava			<1	0.1
Chamaescilla	corymbosa			<1	0.05

Genus	Species	Rank	Name	Cover	Height
Conostylis	serrulata			<1	0.25
Corymbia	calophylla			25	10-30
Cyanicula	sericea			<1	0.2
Dampiera	linearis			<1	0.1
Daviesia	decurrens			<1	0.7
Daviesia	physodes			<1	0.6
Daviesia	preissii			0.5	0.6
Desmocladus	fasciculatus			1	0.2
Drosera	erythrorhiza			<1	0.05
Drosera	pallida			<1	Cl
Drosera	stolonifera			<1	0.1
Elythranthera	brunonis			<1	0.3
Eucalyptus	marginata	subsp.	marginata	25	10-30
Gompholobium	preissii			<1	0.1
Grevillea	trifida			<1	0.2
Hakea	lissocarpha			3	0.75
Hibbertia	amplexicaulis			<1	0.2
Hibbertia	commutata			2	0.25
Hibbertia	commutata			<1	0.15
Hibbertia	diamesogenos			<1	0.1
Hibbertia	hypericoides			60	0.5
Hovea	chorizemifolia			<1	0.15
Hypocalymma	angustifolium			4	0.6
Labichea	punctata			<1	0.1
Lagenophora	huegelii			<1	0.1
Leucopogon	capitellatus			3	0.4
Leucopogon	propinquus			<1	0.3
Lomandra	caespitosa			<1	0.15
Lomandra	nigricans			<1	0.4
Lomandra	preissii			<1	0.3
Macrozamia	riedlei			<1	0.3
Patersonia	babianoides			<1	0.1
Patersonia	occidentalis			<1	0.3
Patersonia	pygmaea			<1	0.1
Persoonia	longifolia			3	1.5-4
Philotheca	spicata			<1	0.4
Pimelea	cracens			<1	0.9
Pterostylis	pyramidalis			<1	0.1
Pterostylis	vittata			1	0.2
Scaevola	calliptera			<1	0.1
Scaevola	calliptera			<1	0.1
Sphaerolobium	medium			<1	0.1
Stylidium	amoenum			<1	0.3
Stylidium	amoenum			<1	0.1
Stylidium	piliferum			<1	0.01
Tetraria	octandra			<1	0.3
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	1	0.4
Tetratheca	hirsuta	subsp.	viminea	1	0.35
Thomasia	grandiflora			0.5	0.3
Trichocline	spathulata			<1	0.2

Site	GBC-24	Location	50K 411776 E	6249323 N
Date	1st Season: 03/08/18 2nd Season: 18/10/18			
Landform	Hillslope			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata and Corymbia calophylla over Low Woodland A of Banksia grandis and Persoonia longifolia over Low Scrub A of Podocarpus drouynianus over Dwarf Scrub D of Desmocladus fasciculatus			

Condition	Very Good
Disturbance	Road / Access Tracks, Weeds, Logging
Fire age	Old (>6 yr)
Slope	Low
Aspect	South East
Soil Type	Loamy Sand
Soil Colour	Grey

Genus	Species	Rank	Name	Cover	Height
Acacia	extensa			1	1.5
Acacia	pulchella			<1	0.1
Aira	caryophyllea			<1	0.1
Banksia	dallanneyi			<1	0.2
Banksia	grandis			20	6
Bossiaea	linophylla			2	2
Bossiaea	ornata			<1	0.3
Briza	maxima			2	0.2
Burchardia	congesta			<1	0.5
Caesia	micrantha			<1	0.3
Caladenia	emarginata				
Caladenia	flava			<1	0.2
Chamaescilla	corymbosa			<1	0.1

Genus	Species	Rank	Name	Cover	Height
Conostylis	aculeata	subsp.	aculeata	<1	0.2
Corymbia	calophylla			15	30
Craspedia	variabilis			0.5	0.4
Cyathochaeta	avenacea			0.5	0.5
Dampiera	linearis			<1	0.1
Daucus	glochidiatus			<1	0.1
Desmocladus	fasciculatus			18	0.1
Drosera	erythrorhiza			<1	0.05
Drosera	pallida			<1	Cl
Drosera	stolonifera			<1	0.1
Eriochilus	dilatatus			<1	0.1
Eucalyptus	marginata	subsp.	marginata	45	30
Gompholobium	tomentosum			<1	0.2
Hibbertia	amplexicaulis			<1	0.3
Hibbertia	commutata			<1	0.3
Hibbertia	diamesogenos			0.2	0.1
Hydrocotyle	callicarpa			<1	0.1
Hypocalymma	angustifolium			<1	0.5
Hypochaeris	glabra			<1	0.1
Hypolaena	exsulca			4	0.2
Johnsonia	lupulina			<1	0.3
Kennedia	coccinea			<1	0.2
Kennedia	prostrata			<1	0.1
Lagenophora	huegelii			<1	0.05
Leucopogon	capitellatus			<1	0.2
Leucopogon	propinquus			1	0.8
Levenhookia	dubia			<1	0.2
Lomandra	caespitosa			<1	0.2
Lomandra	hermaphrodita			<1	0.2
Lomandra	nigricans			<1	0.2
Lomandra	sericea			<1	0.3
Macrozamia	riedlei			3	1.2
Monotaxis	occidentalis			<1	0.1
Opercularia	apiciflora			<1	0.2
Opercularia	hispidula			0.5	0.3
Orianthera	serpyllifolia	subsp.	serpyllifolia	1	0.1
Patersonia	occidentalis			0.5	0.5
Persoonia	longifolia			2	2
Philotheca	spicata			<1	0.3
Podocarpus	drouynianus			20	2
Pteridium	esculentum			3	1-2
Pterostylis	vittata			<1	0.2
Ptilotus	manglesii			<1	0.1
Scaevola	calliptera			<1	0.1
Schoenus	odontocarpus			<1	0.1
Stylidium	amoenum			<1	0.1
Stylidium	schoenoides			<1	0.1
Tetraria	octandra			3	0.5
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	<1	0.4
Tetrarrhena	laevis			<1	0.2
Tetratheca	hirsuta	subsp.	viminea	0.5	0.2
Thelymitra		sp.	indet	<1	0.5
Thysanotus	patersonii			<1	Cl

Genus	Species	Rank	Name	Cover	Height
Trachymene	pilosa			<1	0.1
Tricoryne	humilis			<1	0.2
Waitzia	suaveolens			<1	0.1
Xanthosia	candida			<1	0.1
Xanthosia	huegelii			<1	0.1

Site	GBC-25	Location	50K 412505 E	6249495 N
Date	1st Season: 03/08/18 2nd Season: 18/10/18			
Landform	Stony Plain			
BFF	Eucalyptus Forest			
Vegetation Description	Forest of Eucalyptus marginata over Heath A of Taxandria parviceps and Bossiaea linophylla with Open Scrub of Xanthorrhoea preissii, Persoonia longifolia and Bossiaea linophylla over Low Scrub B of Macrozamia riedlei and Taxandria parviceps			

Condition	Very Good
Disturbance	Road / access track, logging
Fire age	Old (>6 yr)
Slope	Low
Aspect	South East
Soil Type	Sand
Soil Colour	Grey

Genus	Species	Rank	Name	Cover	Height
Acacia	celastrifolia			<1	1-2
Acacia	extensa			1	2
Acacia	pulchella			<1	0.5
Banksia	dallanneyi				
Billarderia	variifolia			<1	Cl
Bossiaea	linophylla			3	2.-3
Caesia	micrantha				
Caladenia	flava			<1	0.1
Caladenia	longiclavata			<1	0.35
Caladenia	longiclavata				
Chorizema	nanum				
Corymbia	calophylla			25	10-30

Genus	Species	Rank	Name	Cover	Height
Cyanicula	sericea				
Cyathochaeta	avenacea			1.5	0.3
Dampiera	linearis			<1	0.1
Dasypogon	bromeliifolius			1.5	0.6
Desmocladus	fasciculatus			2.5	0.1
Dianella	revoluta			<1	0.4
Drosera	pallida			<1	Cl
Eriochilus	dilatatus			<1	0.1
Eucalyptus	marginata	subsp.	marginata	25	10-30
Hibbertia	amplexicaulis			1	0.2
Hibbertia	commutata			<1	0.5
Hovea	trisperma			<1	0.15
Hypocalymma	angustifolium			3.5	0.5
Hypolaena	exsulca			1	0.3
Kennedia	prostrata				
Lagenophora	huegelii			<1	0.1
Leucopogon	australis			1	0.6
Leucopogon	capitellatus			1	0.4
Leucopogon	propinquus			0.5	0.4
Lomandra	caespitosa			<1	0.2
Lomandra	nigricans			<1	0.2
Lomandra	pauciflora			<1	0.2
Luzula	meridionalis			<1	0.2
Macrozamia	riedlei			3	1-1.5
Monotaxis	occidentalis			<1	0.1
Opercularia	apiciflora			0.5	0.3
Opercularia	hispidula			1	0.2
Pauridia	occidentalis	var.	quadriloba	<1	0.1
Persoonia	longifolia			1	3
Philotheca	spicata			2	0.3
Podocarpus	drouynianus			1	1.5
Pterostylis	recurva			<1	0.1
Pterostylis	vittata				0.6
Scaevola	calliptera			<1	0.1
Stackhousia	huegelii				
Stylidium	crassifolium				
Stylidium	spathulatum			<1	0.1
Taxandria	parviceps			35	1-2.5
Tetraria	octandra			0.5	0.3
Tetraria		sp.	Jarrah Forest (R. Davis 7391)	1	0.3
Tetrarrhena	laevis			1	0.4
Tetratheca	affinis				
Thysanotus	patersonii			<1	Cl
Tremandra	diffusa			0.5	0.1
Xanthorrhoea	preissii			2.5	3-4

APPENDIX 8

Consolidated vegetation mapping for a 500 metre radius either side of the study area corridor, along with adjacent vegetation mapping recently completed within the Mine Development Envelope.

409000 410000 411000 412000 413000 414000

6257000 6256000 6255000 6254000 6253000

DUMPLING GULLY

SPRING CREEK

SALT WATER GULLY

Cleared Pasture
Cleared
HS Bg
HS Bo
HC Af
Rehab
HS Xp
HS AhLe
Road
DF MpEp AsTl
DL Er
Water
Mine Clearing

TALISON LITHIUM

Northern Bypass 500m Inferred Boundary

Vegetation Types

Appendix 8a

Legend

- Mine Development
- Study Area

N

0 250 500

Meters

1:17,500

Datum: GDA94

Projection: MGA Zone 50

Date:	22/11/2018
Status:	Final
Figure:	A8a
Sheet Size:	A3
Internal Reference:	TL_Nth_bypass
Drawn by:	GSM
Requested by:	DB

GRIFFIN SPATIAL & MAPPING

ONSHORE ENVIRONMENTAL

TALISON LITHIUM

Southern Bypass 500m Inferred Boundary

Vegetation Types

Appendix 8b

Legend

Study

N

0 250 500

Meters

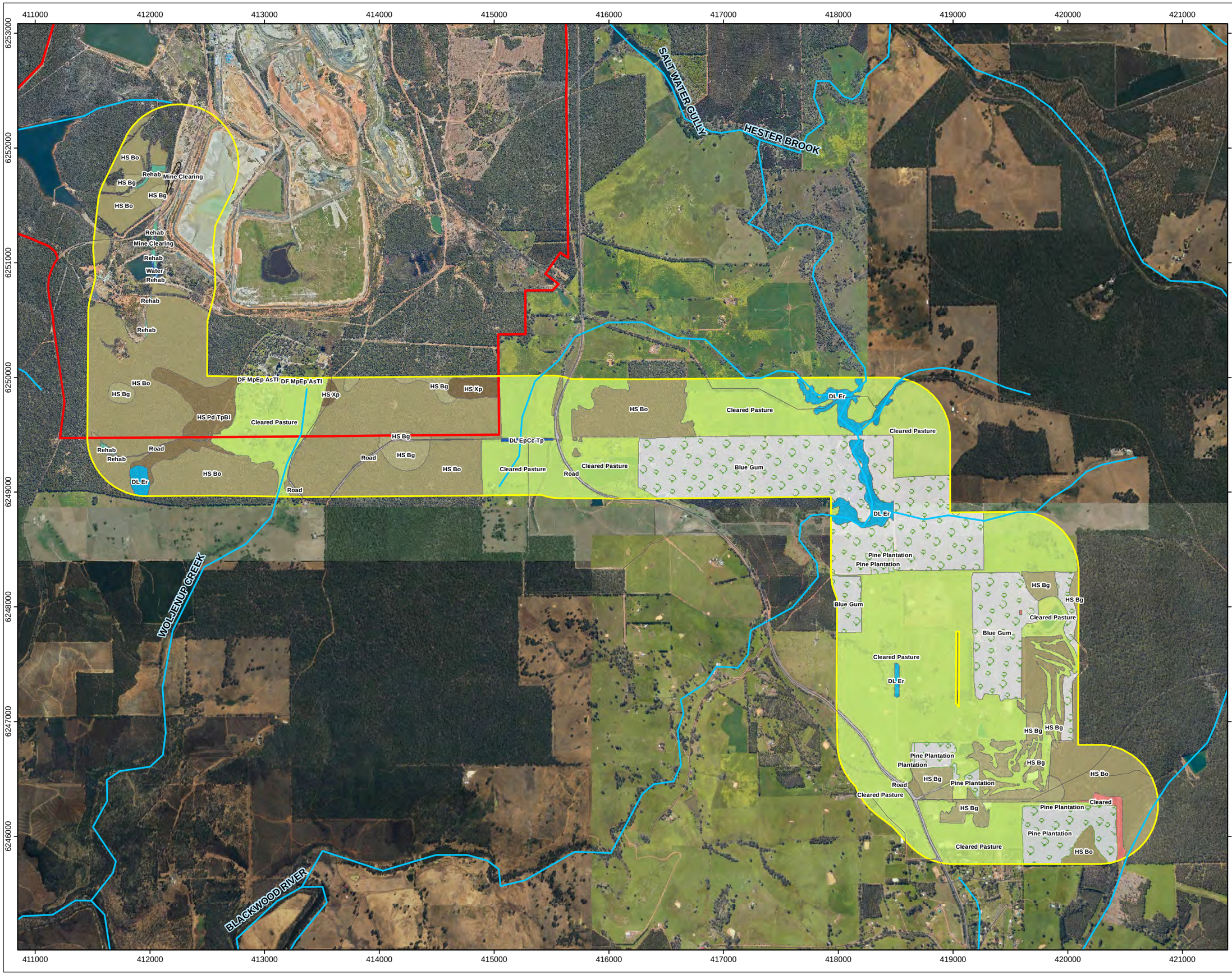
1:15,000

Datum: GDA94

Projection: MGA Zone 50

Date:	22/11/2018
Status:	Final
Figure:	A8b
Sheet Size:	A3
Internal Reference:	TL_Nth_bypass
Drawn by:	GSM
Requested by:	DB

GRIFFIN SPATIAL & MAPPING



TALISON LITHIUM

Powerline
500m Inferred Boundary

Vegetation Types

Appendix 8c

Legend

- Mine Development
- Study

N

0 250 500
Meters
1:30,000
Datum: GDA94
Projection: MGA Zone 50

Date:	22/11/2018
Status:	Final
Figure:	A8c
Sheet Size:	A3
Internal Reference:	TL_Nth_bypass
Drawn by:	GSM
Requested by:	DB

Legend

Study Area

Vegetation Types

Hill Crest

HC Af	Forest of Allocasuarina fraseriana, Corymbia calophylla and Eucalyptus marginata over Low Woodland A of Corymbia calophylla, Eucalyptus marginata and Allocasuarina fraseriana over Open Dwarf Scrub D of Bossiaea ornata and (Astroloma pallidum) over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) on brown loamy sand on hill crests and upper hill slopes with outcropping laterite

Hill Slope

HS AhLe	Heath A of Allocasuarina humilis and Leptospermum erubescens over Low Heath D of Thomasia grandiflora, Andersonia caerulescens and Banksia dallanneyi with Low Open Scrub B of Xanthorrhoea preissii on brown clay loam on lower hill slopes
HS Bg	Forest of Corymbia calophylla and Eucalyptus marginata subsp. marginata over Low Woodland A of Banksia grandis , Persoonia longifolia, Corymbia calophylla and Eucalyptus marginata subsp. marginata over Open Low Scrub A of Bossiaea linophylla, Pteridium esculentum and/or Macrozamia riedlei over Low Heath D of Bossiaea ornata and/or Leucopogon capitellatus on brown sandy loam on upper hillslopes
HS Bo	Forest of Eucalyptus marginata subsp. marginata and Corymbia calophylla over Low Heath D of Bossiaea ornata and Leucopogon capitellatus on grey/brown loamy sand on
HS Ew	Low Heath C of Hypocalymma angustifolium, Babingtonia camphorosmae and Banksia dallanneyi (Xanthorrhoea gracilis and Bossiaea ornata) with Low Woodland A of Eucalyptus wandoo (Corymbia calophylla) over Open Low Scrub B of Xanthorrhoea preissii, Acacia celastrifolia and Corymbia calophylla on grey clay loam soil on lower hillslopes
HS Pd TpBl	Heath A of Podocarpus drouynianus (Pultenaea ocheata) with Woodland (to Forest) of Eucalyptus marginata subsp. marginata and Corymbia calophylla over Scrub of Taxandria parviceps (Bossiaea linophylla) over Dwarf Scrub C/D of Dasypogon bromeliifolius, Adenanthos obovatus and Leucopogon oxycedrus on grey sand on lower hillslopes
HS Xp	Forest of Corymbia calophylla and Eucalyptus marginata subsp. marginata over Scrub of Xanthorrhoea preissii (Bossiaea linophylla) over Dwarf Scrub C of Xanthorrhoea gracilis and Phyllanthus calycinus on brown sandy loam on

Drainage Flats

DF Ep Mp Hp	Forest of Eucalyptus patens, Corymbia calophylla and *Pinus radiata over Scrub of Hakea prostrata, *Acacia pycnantha and Taxandria linearifolia over Low Scrub B of Astartea scoparia and Bossiaea linophylla over Open Dwarf Scrub D of Hypocalymma angustifolium over Very Open Low Sedges of Tetraria sp. Jarrah Forest (R. Davis 7391) on brown sandy clay loam on drainage flats
DF Pe	Dense Heath B of Pteridium esculentum on grey sand on seasonally wet drainage
DF MpEp AsTl	Forest of Melaleuca preissiana and Eucalyptus patens over Scrub of Astartea scoparia and Taxandria linearifolia over Low Scrub B of Aotus gracillima and Pteridium esculentum over Open Low Grass of *Anthoxanthum odoratum and *Vulpia sp. indet over Very Open Tall Sedges of Isolepis cyperoides and Juncus pallidus on black sandy clay loam on seasonally wet drainage flats

Drainage Line

DL Er	Forest of Eucalyptus rudis subsp. rudis (sometimes mixed species) over Scrub of Trymalium odoratissimum subsp. odoratissimum, Taxandria linearifolia and/or Hakea prostrata over Open Tall Sedges of Lepidosperma tetraquetrum or Chorizandra enodis on brown sandy clay loam on minor drainage
DL EpCc Tp	Woodland (to Forest) of Eucalyptus patens and Corymbia calophylla (sometimes with Banksia seminuda or Banksia littoralis) over Thicket of Taxandria parviceps (sometimes with Bossiaea linophylla, Acacia extensa and Pteridium esculentum) over Open Dwarf Scrub D of Dasypogon bromeliifolius and Conospermum capitatum on grey sand on drainage lines

Other

- Cleared
- Powerline
- Corridor
- Cleared Pasture
- Mine Clearing
- Plantation
- Rehabilitation
- Road
- Water

[redacted]

TALISON LITHIUM

Powerline
500m Inferred Boundary

Vegetation Types Legend

Appendix 8

Date:	22/11/2018
Status:	Final
Figure:	A8
Sheet Size:	A3
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