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CHANDALA EXPANSION AREAS

Flora and Vegetation Assessment

FINAL

October 2024

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Flora and Vegetation Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tronox Management Pty Ltd

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Report No.	R01
Date:	October 2024

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Executive Summary

Tronox Management Pty Ltd (Tronox) is investigating potential expansion of their Chandala mineral sands processing plant at Muchea (the Project), located approximately 50 kilometres (km) north-east of Perth (the Project). Umwelt were commissioned by Tronox to conduct a flora and vegetation assessment for the Project. The survey involved a reconnaissance survey as defined in Section 4.1 of the Environmental Protection Authority (EPA) *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment*.

The field survey of the Survey Area was undertaken in July 2024. This assessment was an out of season survey, with the aim being to assess if the area is likely to support significant flora and vegetation, based on the species identifiable at time of survey, vegetation types present and condition of the vegetation. Three relevés and 57 vegetation observation points were surveyed in the Survey Area, with this data used to prepare structural vegetation classification and mapping (including vegetation condition mapping). No quadrats were surveyed (as per EPA 2016), due to both the timing of the survey (outside of the primary survey season, spring) and degraded nature of the vegetation present.

A total of 70 discrete vascular flora taxa were recorded in the Survey Area by the survey. A total of 20 introduced flora taxa were recorded within the Study Area by the survey. Of these, one is a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), being *Zantedeschia aethiopica* (Arum Lily). No listed significant flora taxa (excluding one planted occurrence of *Grevillea fililoba* (P1)) were recorded by the survey. *Grevillea fililoba* (P1) naturally occurs east of Geraldton, typically occurring on slopes, hills and breakaways, typically with laterite. This taxon is not naturally present in the Survey Area (planted), and therefore, the individual recorded is not considered to be significant.

An assessment of the likelihood of occurrence of significant flora taxa identified that all 65 significant flora taxa known to occur within the Desktop Study Area are considered unlikely to occur in the Survey Area. This was due to habitat not considered to be present, either through landforms/soil not present in the Survey Area, or through the vegetation condition being too degraded to support populations of these taxa (Degraded; Completely Degraded). The lower stratum of the vegetation throughout the Survey Area comprised predominantly of pasture weeds, with the mid and upper stratums also severely impacted by historical clearing activities and potential Phytophthora Dieback.

The vegetation of the Survey Area was mapped and described via structural classification from floristic and structural data recorded at relevés and vegetation observation points. Due to the long history of disturbance within the Survey Area, there were many areas that still possess tree or large shrub taxa, but have other structural layers comprised largely of introduced taxa, or with significantly reduced native taxon diversity and are no longer considered to represent intact remnant vegetation. The classification of vegetation was therefore divided into two categories: Vegetation Types (VTs) and Highly Modified Areas (HMAs). It is likely that many of the Highly Modified Areas are degraded versions of described VTs, however it is not possible to confidently align them given their condition. Two VTs and 12 highly modified areas were described and mapped in the Survey Area. The two VTs included VTs BW (Banksia Woodland) and CpRcS (*Callitris pyramidalis / Regelia ciliata* shrubland); both of which were mapped as Degraded to Completely Degraded.

The majority of the vegetation of the Survey Area was rated as Completely Degraded (16 ha / 29.5 % of the Survey Area), with the vegetation structure of these areas was no longer intact, comprising of weed species with isolated native trees and shrubs, or comprising of previously cleared areas with the majority of vegetation present being planted trees and shrubs. A total of 8.7 ha (16.1 % of the Survey Area) was rated as Degraded, with the vegetation structure severely impacted by multiple disturbances including partial clearing, aggressive weeds, grazing and potential Phytophthora Dieback. No vegetation within the Survey Area was considered to be in Good or better condition. A total of 29.4 ha of 'Cleared' land was mapped, representing 54.4 % of the Survey Area.

A qualitative assessment of the relevé data recorded during the current survey was undertaken to assess for the Swan Coastal Plain (SCP) Floristic Community Types (FCTs) potentially present within the Survey Area. It is considered that the vegetation mapped as BW is potentially representative of Gibson et. al. (1994) SCP FCTs 23a or 21c; however, the vegetation is too degraded to confidentially align an FCT. It is unlikely that assessment through the use of quadrat data collection and classification analyses would be confident in determining SCP FCT due to the poor condition of the vegetation and relative lack of understory taxa. FCTs 23 and 21c can form part of the EPBC listed Banksia Woodlands of the SCP Threatened Ecological Community (TEC). VT CpRcS was assessed via vegetation observation points. It is possible that this VT represents Gibson et. al. (1994) FCT 4; however, the vegetation structure has been impacted such that it is not possible to align this with an SCP FCT. FCT 4 is not considered to represent any listed TECs or Priority Ecological Communities (PECs).

Further spring assessment of the Survey Area is not considered to be necessary based on the severely impacted vegetation present, with no vegetation rated as Good or better, mapped within the Survey Area.

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1.0 Introduction

1.1 Project Overview

Tronox Management Pty Ltd (Tronox) is investigating potential expansion of their Chandala Mineral Sands processing plant at Muchea (the Project), located approximately 50 kilometres (km) north-east of Perth (the Project). Previous flora and vegetation assessments have been undertaken within this area by Western Botanical (2012, 2013).

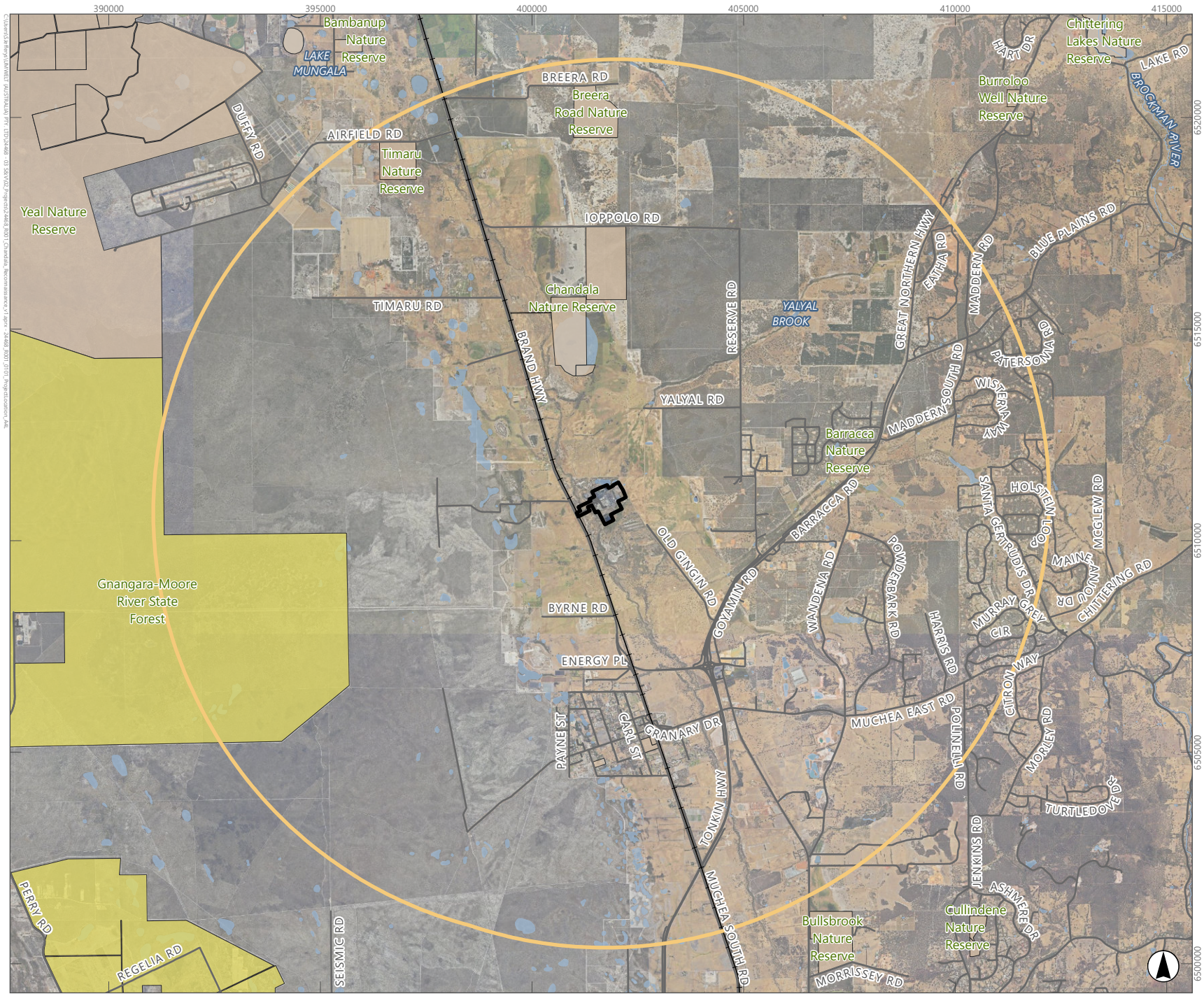
Umwelt were commissioned by Tronox to conduct a flora and vegetation assessment for the Project, including assessment of presence of the EPBC listed Threatened Ecological Community '*Banksia Woodlands of the Swan Coastal Plain'* (also listed as a Priority Ecological Community by the Department of Biodiversity, Conservation and Attractions (DBCA)). This report documents the methods from the survey and presents the desktop assessment and results of the field survey.

1.2 Survey Area and Desktop Study Area Definitions

A Survey Area for the purposes of the flora and vegetation assessment was provided by Tronox. The Survey Area for the Project is shown on **Figure 1.1**. The Survey Area is approximately 54 hectares (ha) in size and consists of cleared areas adjacent to existing infrastructure and remnant vegetation.

For the purposes of the desktop study, including interrogation of databases and searches for relevant literature, a Desktop Study Area has also been defined, as shown on **Figure 1.1**. The Desktop Study Area encompasses the Survey Area with a 10 km buffer.

FIGURE 1.1
Project Location



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve
- State Forest



0 2.5 5

Kilometres

Scale 1:125,000 at A4
GDA2020 MGA Zone 50

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Image Source: Landgate (2022-2024) | **Data Source:** Landgate (2024), DBCA (2024), Tronox (2024)

1.3 Aims and Objectives

The primary aim of the survey was to characterise the flora and vegetation values of the Survey Area to support future environmental approvals the Project.

The primary objectives of the flora and vegetation survey were:

- Opportunistic recording of the following significant flora taxa within the Survey Area that were identifiable at the time of the survey:
    - Listed Threatened Species (T) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth).
    - Threatened Flora (T) listed under the *Biodiversity Conservation Act 2016* (BC Act) (WA).
    - Priority Flora taxa (P) as classified by the WA Department of Biodiversity, Conservation and Attractions (DBCA).
    - Other significant flora taxa as defined by the WA Environmental Protection Authority (EPA) (2016a, 2016b).
- Undertake a likelihood of occurrence assessment of significant flora to identify areas which could potentially support any significant flora.
- Assess and describe vegetation types (VT) and associated vegetation condition in the Survey Area including spatial extent, and review for presence of significant flora taxa.
- Identify areas which could potentially support any significant flora that were not identifiable at the time of survey.
- Identification of areas that could potentially represent the following significant vegetation within the Survey Area:
    - Threatened Ecological Communities (TEC) listed under Commonwealth legislation or classified by DBCA and endorsed by the WA Minister for the Environment.
    - Priority Ecological Community (PEC) as classified by DBCA.
    - Other significant vegetation as defined by EPA (2016a, 2016b).

1.4 Level of Assessment

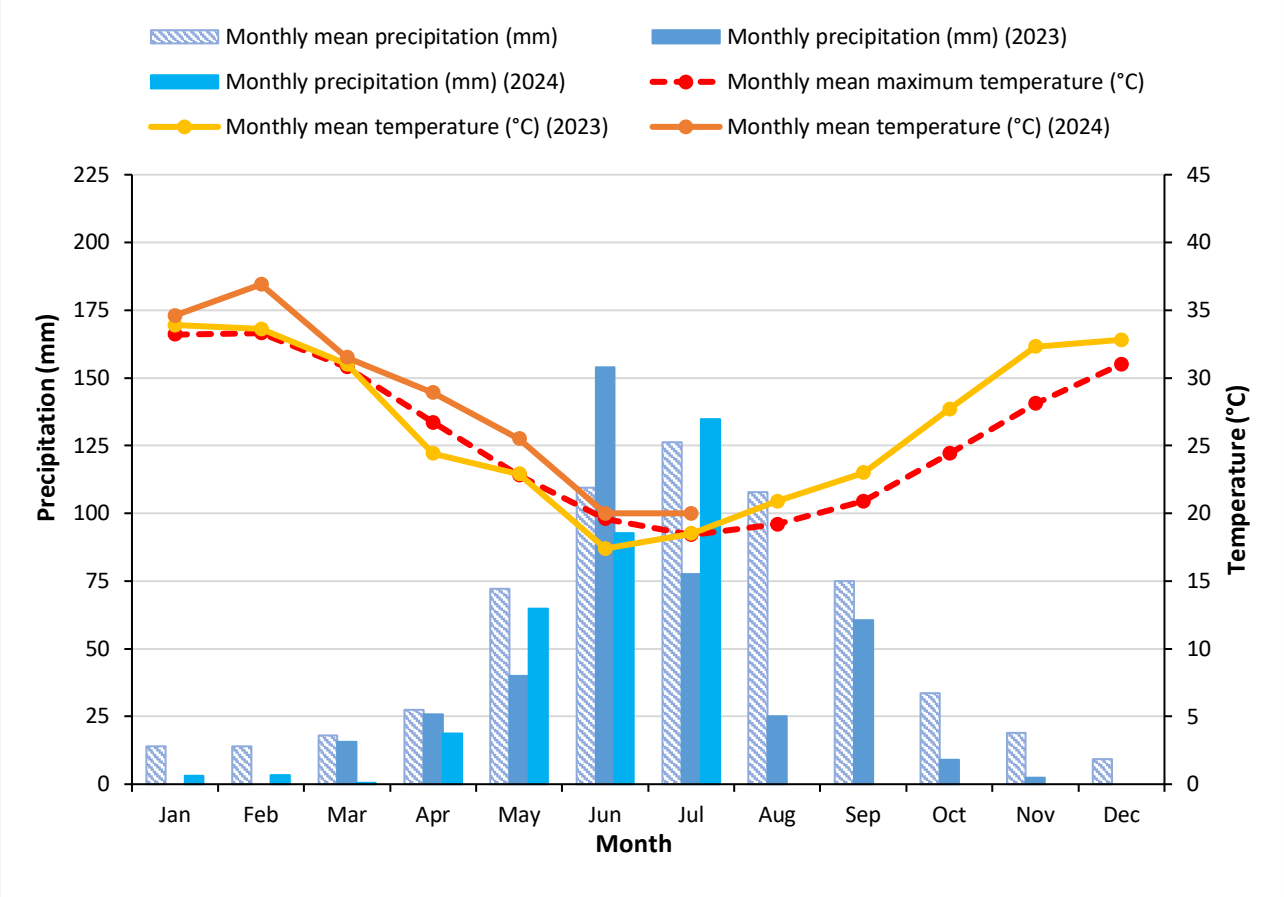
The flora and vegetation survey involved a reconnaissance survey as defined in Section 4.1 of the 'Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA, 2016b). This level of survey is considered the appropriate level of survey, based on the disturbance history over the area and the timing of the survey (out of season survey as discussed in **section 3.3.1**).

2.0 Background

2.1 Climate

The Survey Area is located in the Swan Coastal Plain (SCP) region (Darling Botanical District), within the Southwest Botanical Province as defined by Beard (2015). The climate of the SCP region is classified as warm Mediterranean, with predominantly winter precipitation (600 –1000 millimetres (mm)) and five to six dry months per year (Beard, 2015).

Graph 2.1 presents monthly precipitation totals and monthly maximum temperature statistics for 2023–2024, as well as long-term average monthly precipitation and maximum temperature data recorded at Bureau of Meteorology (BoM) Gingin Aero station (station number: 9178; data from 1968–2024) (BoM, 2024), the most relevant meteorological station to the Survey Area with long-term climate data. Gingin receives an annual average of 611.1 mm of rainfall, the majority of which occurs from June to August. Long-term average monthly maximum temperatures generally peak from December to March (31 °C to 33°C). The rainfall received in the months prior to survey (April to July) was slightly below average (311 mm compared to the long-term average of 335 mm); daily maximum temperatures from January to July 2024 were slightly above the long-term averages.



Graph 2.1 Temperature and Precipitation for Gingin Aero (BoM, 2024)

2.2 Geology, Soils and Landscape

The Survey Area is located in the SCP region as defined by Beard (2015), which is broadly equivalent to the SCP Interim Biogeographic Regionalisation for Australia (IBRA) region; specifically within the Perth (SWA-2) IBRA subregion (Department of Climate Change, Energy, the Environment and Water (DCCEEW (2023)). The geology of the region is Mesozoic to recent sediments of the Perth Basin (Beard, 2015). The SCP subregion consists of a coastal plain of low-lying, often swampy areas and sandhills, with soils consisting of sands or swamp deposits as well as dissected country rising the duricrusted Dandaragan Plateau on Mesozoics consisting of mainly yellow sandy soils. The Survey Area occurs within the Pinjarra Soil-Landscape Zone of the Swan Province. The Pinjarra Zone consists of alluvial deposits (early Pleistocene to Recent) between the Bassendean Dunes Zone and the Darling Scarp, colluvial and shelf deposits adjacent to the Darling Scarp, with clayey to sandy alluvial soils with wet areas (Schoknecht et al., 2004).

Soil landscape mapping has been compiled across South-West WA by the Department of Primary Industries and Regional Development (DPIRD) (2022). The mapping is based on a compilation of the results of a variety of soil and soil-landscape surveys, considering general ecological information, vegetation physiognomy and composition, patterns of variation, conservation status, gradational association and land system representation. The Survey Area occurs over one soil landscape system; the Yanga System, which in the Survey Area consists of a total of five soil landscape units (**Table 2.1**, **Figure 2.1** (DPIRD, 2022)); the majority of the Survey Area has been mapped as the Yanga disturbed land, mine Phase, coinciding with the majority of the cleared land associated with the Chandala processing plant.

Table 2.1 Soil-Landscape Units and Phases of the Survey Area

System	Unit	Name	Description	Area (ha) in the Survey Area
Yanga System – 213Ya	213Ya_6x	Yanga 6x Phase	Flat plain with occasional low dunes. Yellowish brown duplex and poorly structured clay soils often with pans underlying. Low woodland with occasional tall E. rudis, *Melaleuca* spp., Teatree and *E. camaldulensis* and *Casuarina* spp.	1.6
	213Ya_8x	Yanga 8x Phase	Flat plain with occasional low dunes. Subject to seasonal inundation. Deep white and pale yellow sands interspersed with swamp and generally underlain by siliceous/humic pans at depth.	3.3
	213Ya_9x	Yanga 9x Phase	Flat plain with occasional low dunes. Subject to seasonal inundation. Humic and peaty sands, wet and semi-wet soils generally underlain by siliceous / humic pans at depth. *E. rudis*, *Melaleuca* spp., reeds and some *Banksia* on dunes.	0.2
	213Ya12x	Yanga 12x Phase	Drainage depressions in very gently sloping plain. Yellowish brown and grey sandy duplex soils which may have a gravelly matrix. Woodland of E. *rudis. E. camaldulensis* and *Melaleuca* spp.	10.2
	213YaX_MINE	Yanga disturbed land, mine Phase	Mine. Disturbed land.	38.7

Source: Soil Landscape Mapping - Best Available (DPIRD-027) (DPIRD, 2022)

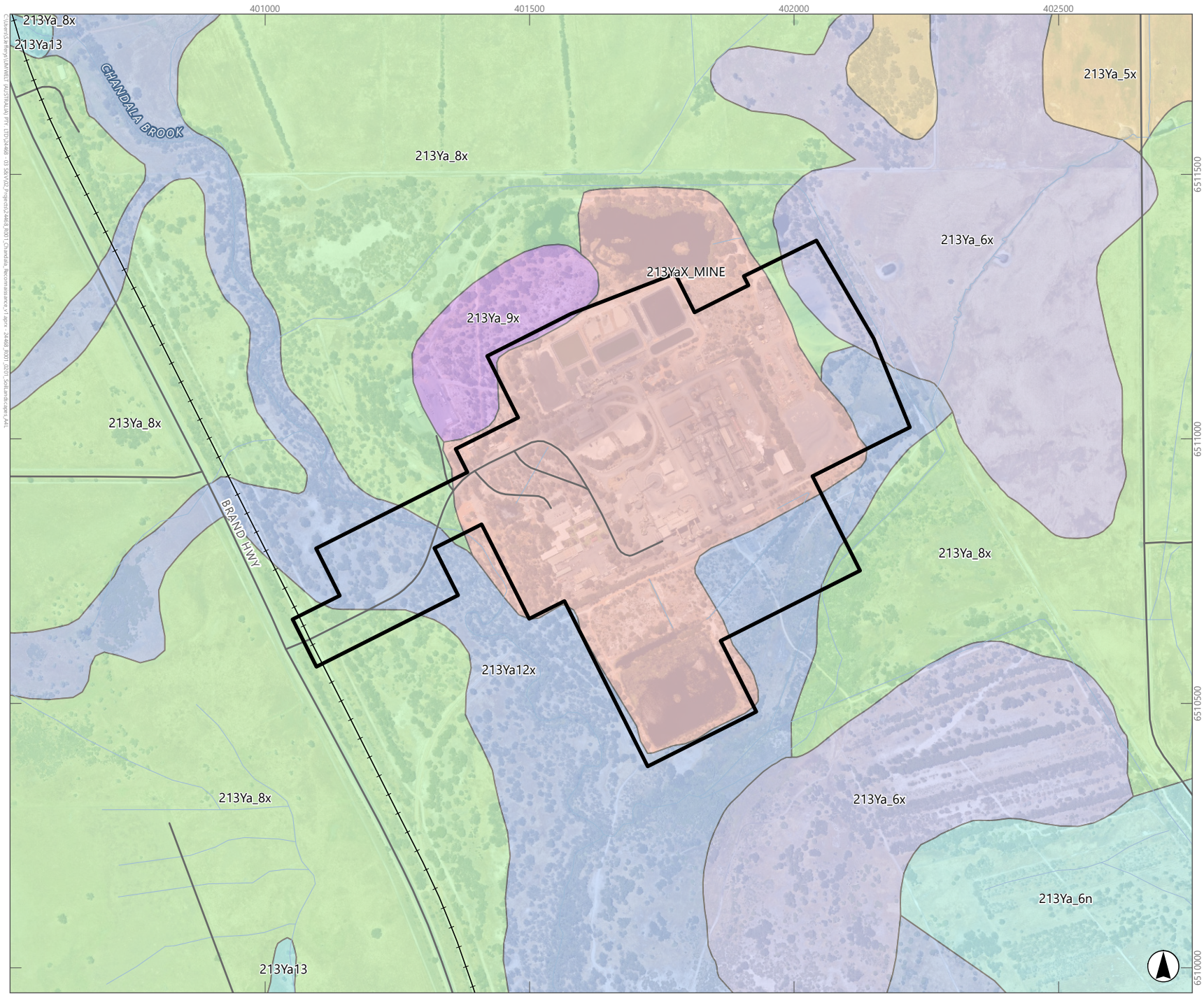


FIGURE 2.1
Soil Landscape Units of the Survey Area

Legend

- Survey Area
- Road
- Railway
- Watercourse

Soil Landscape Mapping

- 213Ya12x
- 213Ya13
- 213YaX_MINE
- 213Ya_5x
- 213Ya_6n
- 213Ya_6x
- 213Ya_8x
- 213Ya_9x

0 200 400
Metres

Scale 1:10,000 at A4
GDA2020 MGA Zone 50

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Image Source: Landgate (2022) | **Data Source:** Landgate (2024), Tronox (2024), DPIRD (2022)

2.3 Land Tenure

The Survey Area is situated within the Shire of Chittering and comprises predominantly of private property (freehold), as well as a small area of rail reserve, as presented on **Figure 2.2**. The Survey Area is within General Purpose Lease G7000275, and also overlaps Exploration Licences E7005173 and E 7006425.

There are no DBCA reserves within the Survey Area; however, several reserves and part of a National Park occur within the Desktop Study Area (see **Figure 1.1**).

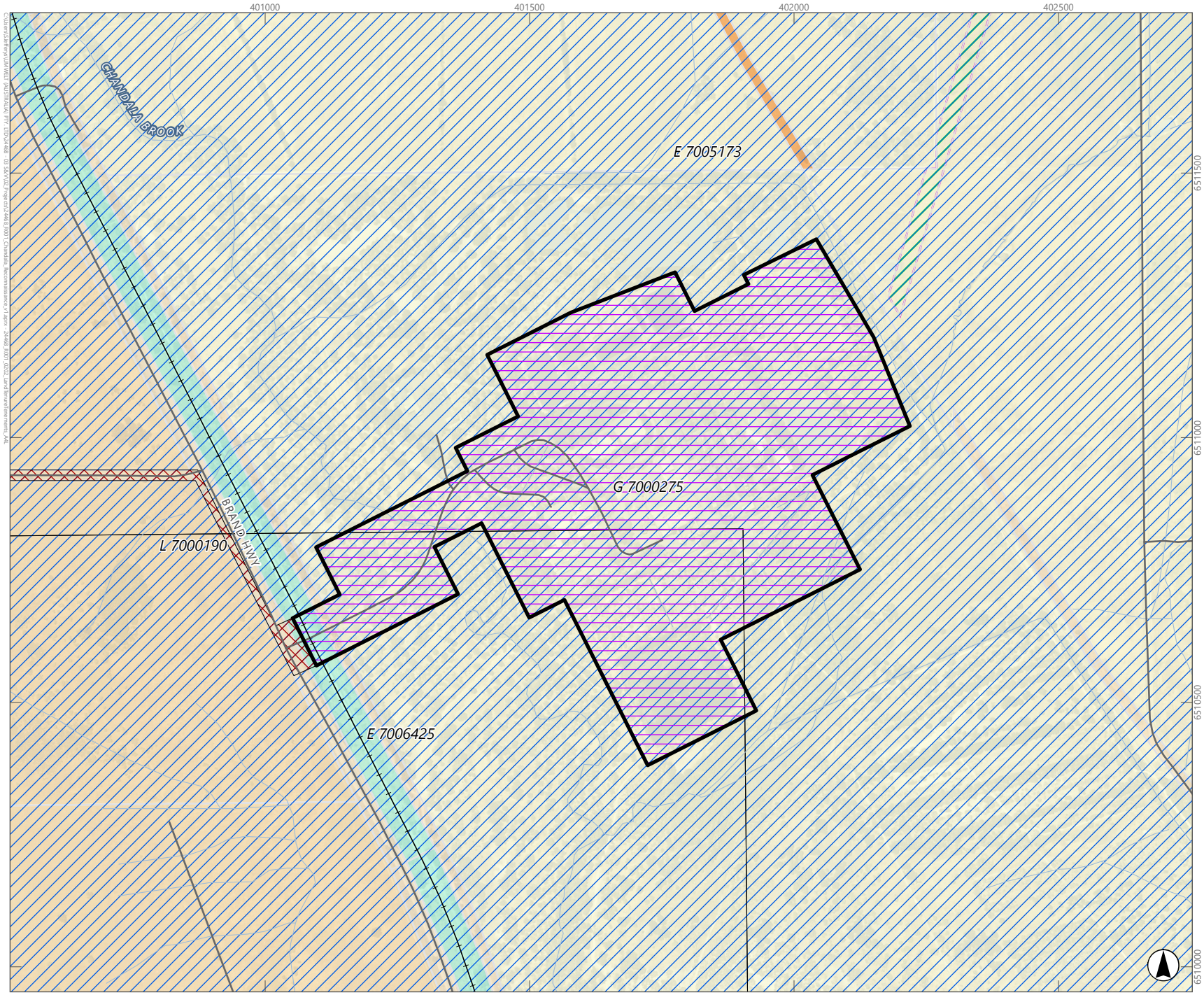


FIGURE 2.2
Land Tenure of the Survey Area

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Image Source: Landgate (2022) | **Data Source:** Landgate (2024), Tronox (2024), DMIRS (2024)

3.0 Methods

3.1 Desktop Assessment

Prior to commencement of the field survey, a review of all publicly available flora and vegetation data relevant to the Survey Area was undertaken, as listed in **Table 3.1**. This included obtaining and reviewing copies of reports of previous biological surveys carried out within the vicinity of the Survey Area (where available), including searches via the Index of Biodiversity Surveys for Assessments (IBSA) database. Where Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified by the desktop assessment, appropriate DBCA or DCCEEW nomination/listing descriptions and recovery plans of the TEC or PEC were also reviewed as well as the '*Methods for survey and identification of Western Australian threatened ecological communities*' (DBCA, 2023a).

Table 3.1 Flora and Vegetation Desktop Assessment Searches

Source	Search Attributes	Search Purpose
Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (DCCEEW, 2024)	Database searched using a 10 km buffer around the Survey Area.	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs listed under the EPBC Act, that occur or have the potential to occur within the Desktop Study Area.
DBCA Significant Flora Database (WA Herbarium Specimen Database and Threatened and Priority Flora (TPFL) Database) (search reference #08-0724FL) (DBCA, 2024b)	Database searched using Desktop Study Area (Survey Area boundary with a 10 km buffer applied). Search reference # 08-0724FL.	Obtain records of DBCA-listed significant flora within the Desktop Study Area.
DBCA Threatened and Priority Ecological Communities Database (search reference #1-0724EC) (DBCA, 2024a)	Database searched using Desktop Study Area (Survey Area boundary with a 10 km buffer applied). Search reference # 1-0724FL.	Obtain records of DBCA-classified TECs and/or PECs within the Desktop Study Area.
DBCA TEC and PEC lists (DBCA, 2023c, 2023e)	Review of DBCA-classified TECs and PECs mapped in proximity to the Survey Area.	Identify whether there are any additional DBCA-classified TECs or PECs that could occur within the Desktop Study Area.
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (DBCA, 2019; DPIRD, 2019)	Survey Area.	Identify extent of Vegetation System Associations (pre-European vegetation mapping) within the Survey Area.
Previous flora and vegetation surveys conducted within or in the vicinity of the Survey Area (various sources). Searches within the following websites (but not limited to) were the IBSA database (DWER, 2024), DWER Clearing Permit System and EPA WA, Tronox supplied previous study information. **See Table 5.2 for the list of reports reviewed**	Desktop Study Area.	Identify previous flora and vegetation surveys which are relevant to the current Project.

3.2 Personnel and Licensing

Table 3.2 lists the personnel involved in both fieldwork and plant identifications for the flora and vegetation assessment. The field team leader has had significant previous experience (> 15 years) in conducting flora and vegetation surveys in WA, including similar flora surveys in the SCP region. Other field personnel have previous experience (> 5 years) in undertaking flora and vegetation surveys in WA (including the SCP).

All plant material was collected under the relevant *Flora Taking (Biological Assessment) Licence* (under Regulation 62 of the *Biodiversity Conservation Regulations 2018* (BC Regs)) and *Authorisation to Take or Disturb Threatened Species* (pursuant to Section 40 of the BC Act) as outlined in **Table 3.2**. Plant identifications were reviewed by a botanist with extensive previous experience (> 15 years) in flora of the SCP region.

Table 3.2 Personnel and Licensing Information

Personnel	Flora Collecting Permit (BC Regs/BC Act)	Role
Cathy Godden **BSc (Biology) (Hons)**	FB62000050-2 TFL 130-2122	Project Director / Field Team Leader
Emalyn Loudon **BAgrib (Agriculture) (Hons)**	-	Field Team Member
David Coultas **BSc (Environmental Biology) (Hons)**	NA	Plant identifications manager
Shibi Ullas Chandran **BSc (Zoology) Masters (Fisheries Biology and Aquaculture)**	NA	Plant identifications

3.3 Field Survey Methods

3.3.1 Survey Timing and Access

The field survey of the Survey Area was undertaken on the 17 and 19 of July 2024. The field survey does not coincide with the most appropriate time to survey in the South West province as per EPA Technical Guidance (EPA, 2016b), with flora and vegetation surveys in this region typically undertaken in spring (September to November), coinciding with when most of the taxa are in flower.

Due to survey timing requirements, sampling of the Survey Area with quadrats and subsequent analysis with the DBCA SCP datasets (a requirement for the identification of many TECs and PECs that occur on the SCP) was not undertaken during this assessment. It is considered that the reconnaissance survey will serve to identify any areas that may require sampling via quadrats (dependent on condition of the vegetation), and any suitable habitat for significant flora taxa.

The Survey Area was accessed by foot transects. Note that some parts of the Survey Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be visually assessed.

3.3.2 Sample Sites

Three relevés and 54 vegetation observation points were undertaken in the Survey Area, with an additional three vegetation observation points undertaken just outside the Survey Area. Sample site locations were recorded using handheld Global Positioning System (GPS) units (Geocentric Datum of Australia (GDA) 2020, Zone 50). The area of survey for relevés covered a radius of approximately 10 m around a central point. Dominant vascular flora taxa (native and introduced) that were visually identifiable in each stratum level were recorded. Specimens of unknown taxa encountered were collected for verification and identification purposes (see **Section 3.3.3**). The following additional information was recorded at the relevés:

- Personnel
- GPS coordinates at centre of relevé
- Site photograph
- Topography
- Soil colour and type (including the presence of any rock outcropping and surface stones)
- Vegetation condition (EPA, 2016b); scale presented in **Section 3.3.5**)
- Approximate time since fire
- Structural description of vegetation (see **Section 3.3.4**).

Vegetation observation points were recorded in areas where the vegetation had been highly modified. These points included recording a GPS location at the point where the notes were taken and a brief description of the vegetation, including dominant and characteristic taxa, vegetation condition (**Section 3.3.5**) and photograph. The notes were used to aid in describing the vegetation and condition within the Survey Area.

All traverses and sampling points (relevés and vegetation observation points) in the Survey Area are presented on **Figure 3.1**.

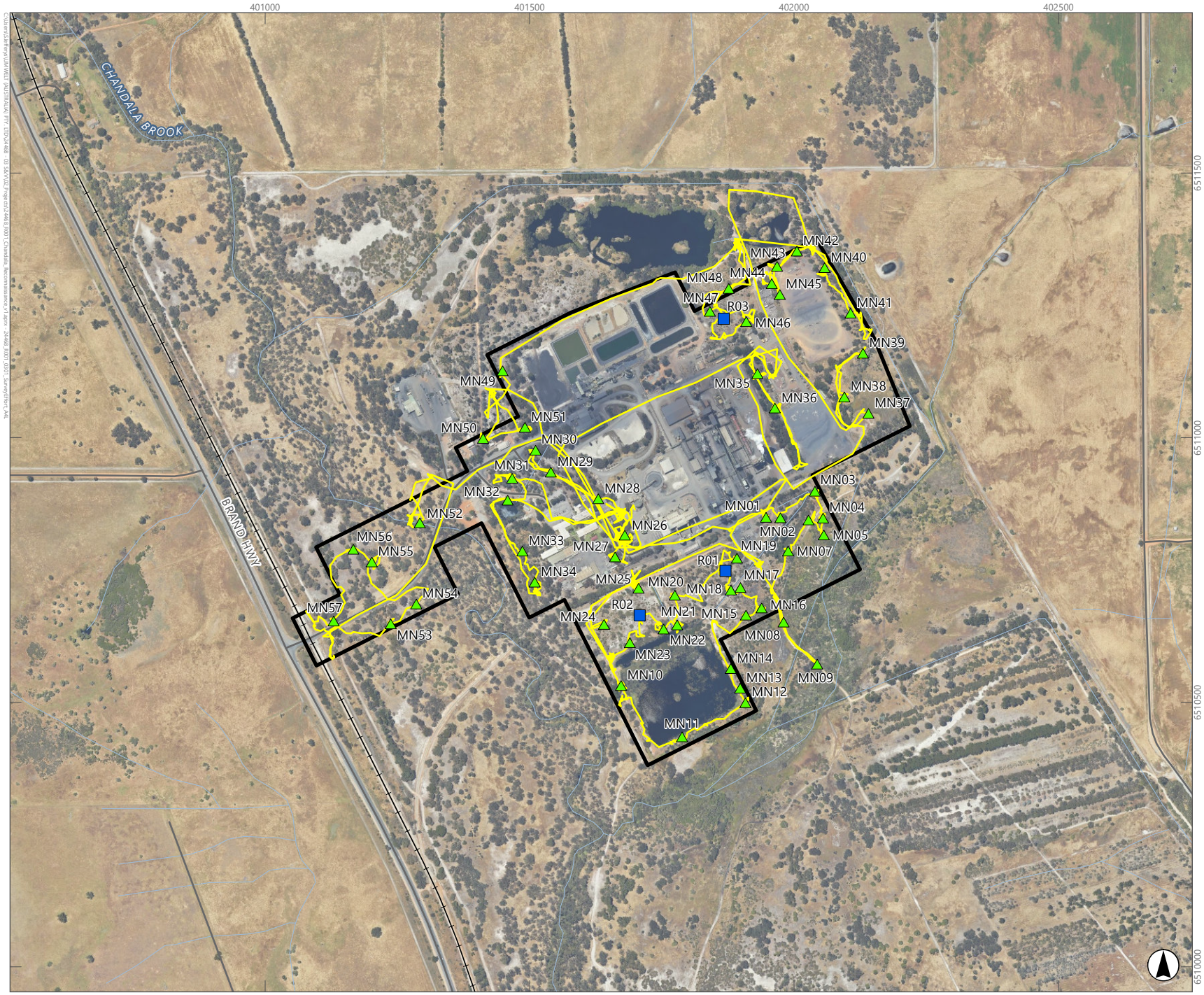


FIGURE 3.1
Survey Track Logs and Sampling Locations

Legend

- Survey Area
- Road
- Railway
- Watercourse
- Relevé
- Vegetation Mapping Note
- Track Log

0 200 400
Metres

Scale 1:10,000 at A4
GDA2020 MGA Zone 50

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Image Source: Landgate (2022) | **Data Source:** Landgate (2024), Tronox (2024), Umwelt (2024)

3.3.3 Plant Collection and Identification

Specimens of any unknown flora taxa encountered during the field survey were collected and pressed as per Western Australian Herbarium (WA Herbarium) guidelines (WA Herbarium, 2020). Plant identifications were undertaken at the WA Herbarium and reviewed by a Principal Ecologist – Botanist with extensive previous experience (> 15 years) in plant identifications for flora of the SCP region (**Section 3.2**). The identification of all flora taxa used the most up to date information available, including taxonomic keys published in books, journals and online, comparison with herbarium specimens, and consultation with taxonomic experts. External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest, including botanists at the WA Herbarium.

Taxon nomenclature generally follows Florabase (WA Herbarium, 1998-), with all names checked against the current DBCA Max database to ensure their validity. However, in cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on Florabase due to time constraints, nomenclature in the published literature is followed. The conservation status of each taxon was checked against Florabase, which provides the most up-to-date information regarding the conservation status of flora taxa in WA.

As per section 7.2 of EPA Technical Guidance, specimens of interest, including significant flora taxa, taxa representing range extensions, potential new taxa, and key species in new occurrences of TECs and PECs will be sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms (TPFRFs) submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (i.e. Threatened and Priority flora taxa).

3.3.4 Vegetation Definition, Mapping and Description

Vegetation in the Survey Area was mapped and described using structural vegetation classification as described in Section 8.1 of the EPA Technical Guidance (EPA, 2016b). Vegetation community descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (Executive Steering Committee for Australian Vegetation Information (ESCAVI) , as stipulated by EPA (2016b). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data are produced nation-wide.

The locations of the sample sites were used in conjunction with aerial photograph interpretation and field notes taken during survey to develop VT polygon boundaries. Mapping boundaries were delineated using aerial photography, and were then digitised using Geographic Information System (GIS) software.

3.3.5 Vegetation Condition Mapping

Vegetation condition was described using the vegetation condition scale presented in EPA Technical Guidance (2016b) for the South-West and Interzone Botanical Provinces (**Table 3.3**). Notes on vegetation condition were taken during the field survey during foot traverses undertaken within the Survey Area. Vegetation condition was also recorded at relevé and vegetation observation point locations. Vegetation condition category polygon boundaries were developed using this information in conjunction with introduced flora taxa location data and were digitised using GIS software as for vegetation polygon boundaries.

Table 3.3 Vegetation Condition Scale for the South-West and Interzone Botanical Provinces

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

3.3.6 Significant Flora

As per EPA definitions (2016a), flora taxa may be significant for a range of reasons, including, but not limited to the following:

- being identified as a Threatened or Priority species (formally listed significant taxa – includes taxa listed under both State and Commonwealth legislation, and classified as Priority by DBCA)
- being locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- being a new species or having anomalous features that indicate a potential new species
- being representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- being an unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- having a relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant flora taxa recorded within the Survey Area are discussed in **Section 5.2.2** with reference to the above categories. Data including point locations and individuals of significant flora recorded in the Survey Area are also presented in this section.

DBCA (2020) presents conservation codes for DBCA-listed taxa. Further information about Commonwealth conservation categories is provided in Threatened Species Scientific Committee's (TSSC) 'Guidelines for assessing the conservation status of native species according to the *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000' (TSSC, 2021).

3.3.7 Significant Vegetation

As per EPA definitions (2016a), vegetation may be significant for a range of reasons, including, but not limited to the following:

- being identified as a TEC or PEC (formally listed significant vegetation – includes vegetation listed under Commonwealth or State legislation, or classified as a PEC by DBCA)
- having restricted distribution
- having a degree of historical impact from threatening processes
- playing a role as a refuge
- providing an important function required to maintain ecological integrity of a significant ecosystem.

As outlined in **Section 3.3.1**, due to survey timing, this assessment mapped and described the vegetation via structural vegetation classification via relevés and vegetation observation point data, with no floristic data analysis undertaken. This method does not align with the methods to be used when assessing the significance of vegetation on the southern SCP (as per DBCA's 'Vegetation survey methods and analysis to determine floristic community types on the southern Swan Coastal Plain' (DBCA, 2023b)), which involves analyses of quadrat data with the Gibson et al. (1994) and Keighery et al. (2012) datasets. A qualitative assessment of the Floristic Community Types (FCTs) described by the Gibson et al. (1994) study was undertaken in the resulting VTs mapped to ascertain the likelihood of significant vegetation occurring in the Survey Area, and if further assessment using quadrats is likely to be required based on the vegetation types present and condition of the vegetation.

3.4 Likelihood of Occurrence Assessment

Following the field survey, likelihood of occurrence assessments were completed for significant flora taxa and significant vegetation identified in this desktop assessment as potentially occurring within the Survey Area, according to the criteria presented in **Table 3.4**.

Table 3.4 Criteria for Assessing Likelihood of Occurrence – Flora and Vegetation

Category	Description
Known	The taxon/community is known occur in the Survey Area, through desktop review.
Possible	The taxon/community may occur in the Survey Area; habitat is present in the Survey Area; known range of the taxon/community includes the Survey Area or is in proximity to the Survey Area.
Unlikely	The taxon/community is not known to occur in the Survey Area; habitat is not known to be present in the Survey Area; range of taxon/community does not include the Survey Area.

Category	Description
Not Considered to be Present	The taxon/community was not recorded in the Survey Area and is not considered to be present.

Key diagnostic characteristics of relevant TEC or PEC Approved Conservation Advice; nomination/listing descriptions; recovery plans; and the '*Methods for survey and identification of Western Australian threatened ecological communities*' (DBCA, 2023a), were also reviewed (where available) when assessing the likelihood of occurrence of a significant vegetation community in the Survey Area.

4.0 Limitations

Table 4.1 presents the limitations of the flora and vegetation assessment of the Survey Area in accordance with the requirements of EPA Technical Guidance (EPA, 2016b). The survey timing is considered to be a potential minor limitation of the survey, but is otherwise not considered to have significantly impacted the results of the Reconnaissance level flora and vegetation survey.

Table 4.1 Limitations of the Flora and Vegetation Survey

Limitation	Outcome	Comment
Effort and Extent	Not a limitation	A Reconnaissance level survey was undertaken across the entire Survey Area. Three relevés and 57 vegetation observation points were recorded within the Survey Area. Three relevés are considered adequate to characterise the flora and vegetation of the Survey Area given the limited amount of remnant vegetation present and the condition of the Survey Area. Targeted survey for significant flora taxa was not undertaken as part of the survey, rather potential habitat for significant flora was recorded. Mapping of vegetation boundaries was undertaken using a combination of aerial photography and information collected at relevés and vegetation observation points. No constraints prevented appropriate sampling techniques (relevé establishment, foot traverses) being employed. Most areas were easy to access using roads and tracks. Some parts of the Survey Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be assessed visually. Data reliability is therefore considered to be relatively high.
Competency/experience of the team carrying out the survey	Not a limitation	The field team leader for the field survey has > 15 years' experience in conducting flora and vegetation surveys in the SCP, and field assistant has >5 years' experience conducting flora and vegetation surveys in the SCP. Information relating to identifying characteristics of significant flora taxa and vegetation identified by the desktop assessment as potentially occurring in the Survey Area was provided to all field team members prior to undertaking the field survey. The plant identifications were managed and reviewed by a Principal Ecologist – Botanist with > 15 years' experience in plant identification for flora of the South-West and SCP.
Proportion of flora identified, recorded and/or collected	Minor limitation	All vascular groups that were present in the Survey Area were sampled. A high proportion of perennial vascular taxa were recorded based on the intensity and method of survey. Annual vascular taxa were recorded where identifiable; however, additional annual taxa would be expected to be present in the Survey Area during the peak flowering season for the region (spring). Any unknown vascular taxa were collected, and identified by an experienced Principal Ecologist - Botanist.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Not a limitation	Good contextual information for the Survey Area was available prior to the survey. Sources of information used included government databases (DBCA, DCCEEW), as well as numerous general sources pertaining to the climate, geomorphology, flora and vegetation of the region, and flora and vegetation surveys previously conducted in the Desktop Study Area.

Limitation	Outcome	Comment
Timing/weather/ season/cycle	Minor limitation	The field survey was conducted in July 2024. This does not correspond to the optimum survey or flowering period for the SCP bioregion and is a minor limitation in terms of the reconnaissance survey. However, survey aimed to assess and search for potential significant vegetation and potential habitat for significant flora and is not a limitation in the context. of the aims of the assessment.
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	Not a limitation	There was evidence of significant impact to vegetation composition and structure throughout the Survey Area as a result of human activities, including clearing and very high levels of introduced (weed) taxa. However, these disturbances did not affect the results of the survey, with the vegetation able to be confidently described and mapped, and flora taxa mature enough to be easily identified or collected.
Remoteness and/or access problems	Not a limitation	The Survey Area was accessed either via roads and on foot. Some parts of the Survey Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be assessed visually. Therefore, this is not considered to be a limitation of this assessment.

5.0 Results

5.1 Desktop Assessment

5.1.1 Regional Vegetation

The Survey Area is located in the Swan Coastal Plain IBRA bioregion and Perth IBRA subregion (DCCEEW, 2023). The vegetation of WA as it was presumed to have existed prior to European settlement has been mapped at a scale of 1:250,000 as vegetation system associations (VSAs), with the Pre-European Vegetation spatial database created (Beard et al., 2013; DPIRD, 2019). The Survey Area occurs across two VSAs as summarised in **Table 5.1** and presented on **Figure 5.1**. **Table 5.1** also presents the current extent of each VSA in relation to its pre-European extent (within the Swan Coastal Plain IBRA bioregion), the percentage of the current extent of each VSA currently protected for conservation (as a proportion of the current extent, within the Swan Coastal Plain IBRA bioregion), and the Pre-European extent within the Survey Area (DBCA, 2019). Note that as per (DBCA, 2019), protected areas in this context are considered to be any areas listed in DBCA-Legislated Lands and Waters dataset as either Crown reserves or lands managed under Section 8A of the *Conservation and Land Management Act 1984* that have an International Union for Conservation of Nature (IUCN) category of I to IV.

All VSAs that occur within the Survey Area have between 10% and 20% of their pre-European extents remaining and they have very little to no areas reserved for conservation in the bioregion (**Table 5.1**).

Table 5.1 Vegetation System Associations of the Survey Area

Vegetation System Association	Description*	Current Extent in the SCP bioregion (ha)*	Current Extent Remaining in the SCP bioregion (%)*	Current Extent Protected for Conservation in the SCP bioregion (%)*	Pre-European Extent in the Survey Area (ha)
Pinjarra_4	Medium woodland; marri & wandoo	1,237.66	11.64	1.17	51.0
Pinjarra_1018	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; *Casuarina obesa*	2,444.87	17.39	0.72	3.1

** Source: 2018 DBCA Statewide Vegetation Statistics report (DBCA, 2019).*

^ Source: Pre-European Vegetation spatial dataset (DPIRD-006) (DPIRD, 2019).

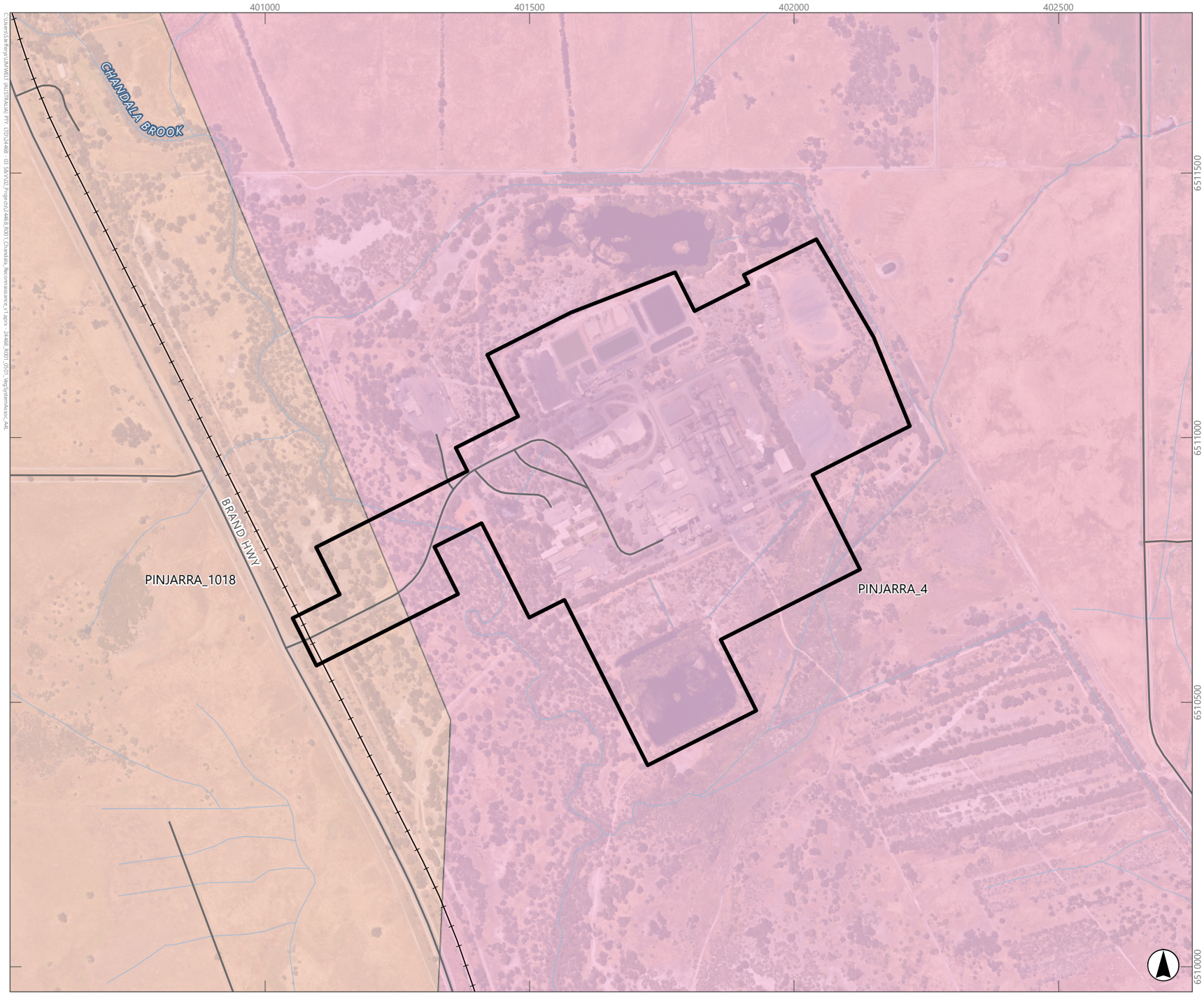


FIGURE 5.1
Vegetation System Associations

Legend

- Survey Area
- Road
- Railway
- Watercourse

Vegetation System Association

- PINJARRA_4
- PINJARRA_1018

0 200 400

Metres

Scale 1:10,000 at A4
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Image Source: Landgate (2022) | **Data Source:** Landgate (2024), Tronox (2024), DPIRD (2019)

5.1.2 Local Flora and Vegetation Surveys

The Survey Area itself is located within a cleared area, between large extents of remnant vegetation to both the west (including Gnangara – Moore River State Forest, Yeal Nature Reserve and Defence lands), and to the east (private property). Historically, the Survey Area was used for pasture and was grazed heavily by stock.

Table 5.2 lists a summary of the publicly available flora and vegetation surveys in within, and in the vicinity (within 5 km) of the Survey Area.

Table 5.2 Flora and Vegetation Surveys Previously Conducted Within and in the Vicinity of the Survey Area

Survey	Flora	Vegetation
Woodman Environmental (2014) Chandala Borefield Groundwater Drawdown Related Vegetation Monitoring 2014, Phase 1 – Multispectral Imagery Analysis and Field Verification • **Survey location: 1 km east of the Survey Area** • **Survey timing: February – March 2014**	• Flora surveyed opportunistically only • No significant flora recorded opportunistically	• 28 VTs sampled via 32 relevés • Vegetation at three point locations showed similarities with the 'Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain' TEC • Vegetation adjacent to two wetlands showed similarities to the '*Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain' TEC
Landform Research (2020) Energy Place Muchea PMR Quarries • **Survey location: 3.5 km south of the Survey Area** • **Survey timing: March 2020**	• 23 vascular taxa • No significant flora taxa recorded • 13 weeds	• Two broad VTs recorded • No TECs or PECs recorded
Astron (2020) Telstra Muchea Cable Alignment • **Survey location: 3.5 km SW of the Survey Area** • **Survey timing: July 2020**	• 132 vascular flora taxa, from 33 families and 87 genera • 3 significant flora taxa - *Leucopogon squarrosus* subsp. *trigynus* (P2), *Styphelia filifolia* (P3), *Tripterococcus*? sp. Brachylobus (A.S. George 14234) (P4) • Eight introduced taxa	• Nine VTs sampled via 11 relevés • VTs 1, 2, 3, 6, 7, 8 and 9 inferred to be the Banksia Woodlands of the Swan Coastal Plain TEC • VTs 6 and 7 described as having affinities to Low lying *Banksia attenuata* woodlands or shrublands (floristic community type 21c)' (P3) and '*Banksia ilicifolia* woodlands (floristic community type 22)' (P3) • VTs 1, 2, 3, 8, and 8 described as having affinities to FCT 23b • VT 5 and part of VT 4 represent wetland or riparian vegetation

Survey	Flora	Vegetation
Eco Logical (2021) **Stage 3 Resleepering Project (Muchea)** • **Survey location: central part of corridor 0.5 km SW of the Survey Area** • **Survey timing: October 2021**	• 153 vascular flora taxa, from 48 families and 106 genera • Two significant flora taxa – *Grevillea curviloba* (T) and *Grevillea evanescens* (P1) • 56 weeds including four Declared Pests	• Eight vegetation communities mapped via 34 relevés • One patch of the Banksia Woodlands of the Swan Coastal Plain TEC mapped • 4 TECs identified as potentially occurring - Clay Pans of the SCP; *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the SCP, Shrublands and Woodlands on Muchea Limestone of the SCP; and Shrublands and Woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the SCP
Landform Research (2017) WA Limestone Lots 2233 and 2238 • **Survey location: 2.3 km SW of the Survey Area** • **Survey timing: August 2016 and 2017**	• 56 vascular flora taxa • No significant flora taxa recorded • Three weed taxa recorded	• Four broad vegetation types mapped • No TECs or PECs recorded
Western Botanical (2012) Clearing Permit Survey of Chandala Processing Plant • **Survey location: overlaps the Survey Area** • **Survey timing: September 2012**	• 85 vascular flora taxa, from 26 families and 49 genera • One significant flora taxon - *Calothamnus graniticus* subsp. *leptophyllus* (P4) • 17 weed taxa including one Declared Pest: *Zantedeschia aethiopica*	• 18 vegetation associations mapped • No TECs or PECs recorded
Western Botanical (2013) **Chandala Processing Plant** • **Survey location: overlaps Survey Area** • **Survey timing: April 2013**	• 56 vascular flora taxa, from 19 families and 37 genera • No significant flora taxa recorded • 17 weed taxa including one Declared Pest: *Zantedeschia aethiopica*	• 17 vegetation associations mapped including seven mapped by Western Botanical (2012) • No TECs or PECs recorded

5.1.3 Previous Vegetation Mapping Within and Adjacent to the Survey Area

Two previous flora and vegetation surveys were carried out over the Chandala Processing Plant by Western Botanical (2012, 2013), including partially within the Survey Area. A number of rehabilitation planted and remnant vegetation associations were mapped over project area including 14 of these within the Survey Area. **Appendix A** lists the 28 vegetation associations along with vegetation condition notes from those surveys.

Overall, the vegetation condition of the vegetation mapped by Western Botanical was determined to be Degraded due to past grazing and clearing. Ground storey weed invasion is widespread throughout the project areas. Western Botanical also noted that some areas were likely to be affected by Dieback.

5.1.4 Significant Flora

A total of 26 Threatened flora and 39 Priority flora have been recorded in the Desktop Study Area from database and literature searches (outlined in **Section 5.1**) and these are listed in **Table 5.3**. The results of the DBCA WAHerb and TPFL database searches (#08-0724FL) listed 10 Threatened Flora and 37 Priority flora species as occurring within the Desktop Study Area and are presented on **Figure 5.2**. Literature searches identified an additional two priority flora species as occurring in the Desktop Study Area from previous surveys (with a total of one Threatened Flora and five Priority flora recorded from previous surveys conducted in the Desktop Study Area).

Searches of relevant DCCEEW databases for MNES listed under the EPBC Act using the PMST, identified 25 flora listed as Threatened Species under the EPBC Act, or habitat for such species, that are known, are likely to, or may occur within the Desktop Study Area (DCCEEW, 2024). The full results of the DCCEEW database search are presented in **Appendix B**.

There are no current records of significant flora taxa from within the Survey Area.

Table 5.3 Significant Flora Taxa Known from or Potentially Occurring Within the Desktop Study Area

Taxon	Status	Flowering Period	Habitat	Source
Acacia anomala	T (EPBC & WA - VU)	August to September	Lateritic soils. Slopes.	DBCA, DCCEEW
Acacia cummingiana	P3	May, June, August	Grey or yellow sand, lateritic gravel. Sandplains, lateritic breakaways.	DBCA
Acacia drummondii* subsp. *affinis	P3	June to September, December	Laterite, slopes or flats.	DBCA
Adenanthos cygnorum* subsp. *chamaephyton	P3	July, September to December, January	Grey sand, lateritic gravel.	DBCA
Andersonia gracilis	T (EPBC - EN, WA - VU)	September to November	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	DCCEEW
Anigozanthos humilis* subsp. *chrysanthus	P4	July to October	Grey or yellow sand.	DBCA
Anigozanthos viridis* subsp. *terraspectans	T (EPBC & WA - VU)	August to September	Grey sand, clay loam. Winter-wet depressions.	DCCEEW
Banksia mimica	T (EPBC - EN, WA - VU)	December to February	White or grey sand over laterite, sandy loam.	DCCEEW
Caladenia huegelii	T (EPBC - EN, WA - CR)	September to October	Grey or brown sand, clay loam.	DCCEEW
***Caleana dixonii* (*Paracaeleana dixonii*)**	T (EPBC - EN, WA - VU)	October to January	Grey sand over granite.	DCCEEW

Taxon	Status	Flowering Period	Habitat	Source
Calothamnus graniticus* subsp. *leptophyllus	P4	June to August	Clay over granite, lateritic soils. Hillsides.	Western Botanical
Caustis gigas	P2	May	White or grey sand.	DBCA
Chamaescilla gibsonii	P3	August to November	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	DBCA
Chamelaucium lullfitzii	T (EPBC - EN, WA - VU)	September to December	Usually orange-yellow sand (occasionally grey), sometimes with gravel, on hill slopes.	DBCA, DCCEEW,
Conospermum densiflorum* subsp. *unicephalatum	T (EPBC & WA - EN)	September to November	Clay soils. Low-lying areas.	DCCEEW
Cyathochaeta teretifolia	P3	January, July, September	Grey sand, sandy clay. Swamps, creek edges.	DBCA
Darwinia foetida	T (EPBC - CR, WA - EN)	September to December, February	Plains, loam soil, road drain / drainage line, winter wet areas, ridge crest	DBCA, DCCEEW,
Diplolaena andrewsii	T (EPBC & WA - EN)	July to October	Loam, clay. Granite outcrops & hillsides.	DCCEEW
Diuris drummondii	T (EPBC - VU, WA - EN)	November to January	Swamps, often in shallow water.	DBCA
Diuris micrantha	T (EPBC & WA - VU)	September to October	Brown loamy clay. Winter-wet swamps, in shallow water.	DCCEEW
Diuris purdiei	T (EPBC & WA - EN)	September to October	Grey-black sand, moist. Winter-wet swamps.	DCCEEW
Drakaea elastica	T (EPBC - EN, WA - CR)	October to November	White or grey sand. Low-lying situations adjoining winter-wet swamps.	DCCEEW
Drosera occidentalis	P4	October to December or January	Seasonally wet swamp, damp flats, depressions and seppage lines	DBCA
Drosera sewelliae	P2	October to December	Laterite & silica sand soils.	DBCA
Eleocharis keigheryi	T (EPBC & WA - VU)	August to November	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	DCCEEW
***Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459)**	P3	October to November	Winter-wet flats. Brown sandy loam Clay, sandy clay. Claypans, seasonally wet flats.	DBCA
Eucalyptus leprophloia	T (EPBC & WA - EN)	August to October	White or grey sand over laterite. Valley slopes.	DCCEEW

Taxon	Status	Flowering Period	Habitat	Source
Grevillea althoferorum* subsp. *fragilis	T (EPBC - EN, WA - CR)	September to November	Flat to undulating plains, grey-yellow sand.	DBCA, DCCEEW (listed as *G. althoferorum*)
Grevillea candolleana	P2	August to October	Laterite, lateritic loam. Hillsides.	DBCA
Grevillea corrugata	T (EPBC - EN, WA - VU)	August to September	Slopes, brownish loamy soils with laterite. Road verges.	DCCEEW
Grevillea curviloba	T (EPBC & WA - EN)	August to October	Grey sand, sandy loam. Winter-wet heath.	DBCA, DCCEEW (both subsp. listed in PMST are recently known as *G. curviloba*), Eco Logical
Grevillea evanescens	P1	March, June to November	Winter-wet flats, brown light clay or clay loam.	DBCA, Eco Logical
Hibbertia glomerata* subsp. *ginginensis	P2	July to September	Slopes, hills and rises with brown sand or clay, laterite	DBCA
Hypocalymma lateriticola	P1	August, September	Grey or yellow sand, lateritic gravel.	DBCA
Hypocalymma sylvestre	T (EPBC & WA - EN)	August	Yellow-brown sandy loam. Woodland on lateritic hilltop.	DBCA, DCCEEW
Hypolaena robusta	P4	September to October	White sand. Sandplains.	DBCA
Isotropis cuneifolia* subsp. *glabra	P3	September	Sand, clay loam. Winter-wet flats.	DBCA
Leucopogon squarrosus* subsp. *trigynus	P2	June, July, September	White, grey sand. Dune, seasonally wet flats, low-lying flats.	DBCA, Astron
Macarthuria keigheryi	T (EPBC & WA - EN)	September to December, February to March	White or grey sand. Flats, plains	DCCEEW
Meionectes tenuifolia	P3	September to December	Seasonally inundated areas, edges of wetlands. Clay or clayey loam over laterite.	DBCA
Millotia tenuifolia* var. *laevis	P2	September to October	Granite or laterite soils.	DBCA
Myriophyllum echinatum	P3	September to November	Clay. Winter-wet flats.	DBCA
***Netrostylis* sp. Chandala (G.J. Keighery 17055)**	P2	July, October, November	Peat sand. Swamp edges, damplands, brook and mound spring.	DBCA

Taxon	Status	Flowering Period	Habitat	Source
Ornduffia submersa	P4	September to October	Black-grey sandy clay in seasonally inundated wetlands.	DBCA
Persoonia rudis	P3	September to December, January	White, grey or yellow sand, often over laterite.	DBCA
Platysace ramosissima	P3	November to February	Sandy clay soils, usually on flats or plains, often near wetlands.	DBCA
Poranthera moorokatta	P2	September to November	Slopes and plains, damp areas. Grey or white sand. Grey or white silica sand in open spaces between shrubs, not in shaded areas or in areas of high litter cover.	DBCA
Ptychosema pusillum	T (EPBC & WA - VU)	August to October	Sand. Rises.	DBCA; DCCEEW
Rumex drummondii	P4	August to November	Winter-wet disturbed areas.	DBCA
Schoenus griffinianus	P4	September to October	Sandy soils, usually on flats, plains.	DBCA
Stylidium longitubum	P4	October to December	Claypans, sometimes slightly saline.	DBCA
Stylidium squamellosum	P2	October to November	Brown to red-brown clay loam. Winter-wet habitats and depressions, open woodland, shrubland.	DBCA
Stylidium striatum	P4	October to November	Lateritic soils on hill slopes.	DBCA
Styphelia allittii	P3	March to June, August	Uplands, outcrops, lateritic hills gravelly yellow sandy soil.	DBCA
Styphelia filifolia	P3	February to June	Sand, sometimes winter damp.	DBCA, Astron
Synaphea grandis	P4	October to November	Low rises with laterite gravel and boulders, grey-brown-yellow sandy soil.	DBCA
***Synaphea* sp. Fairbridge Farm (D. Papenfus 696)**	T (EPBC & WA - CR)	October	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	DCCEEW
Thelymitra dedmaniarum	T (EPBC & WA - CR)	November to December	Granite outcrops on slopes.	DCCEEW
Thelymitra pulcherrima	P2	July, August	Breakaways, sand health to laterite ridge, lateritic hill, low lying hill between dunes.	DBCA
Thelymitra stellata	T (EPBC & WA - EN)	October to November	Lateritic soils on hill tops and breakaways.	DBCA, DCCEEW
Thelymitra variegata^	T (WA - CR)	June to September	Sandy clay, sand, laterite.	DBCA

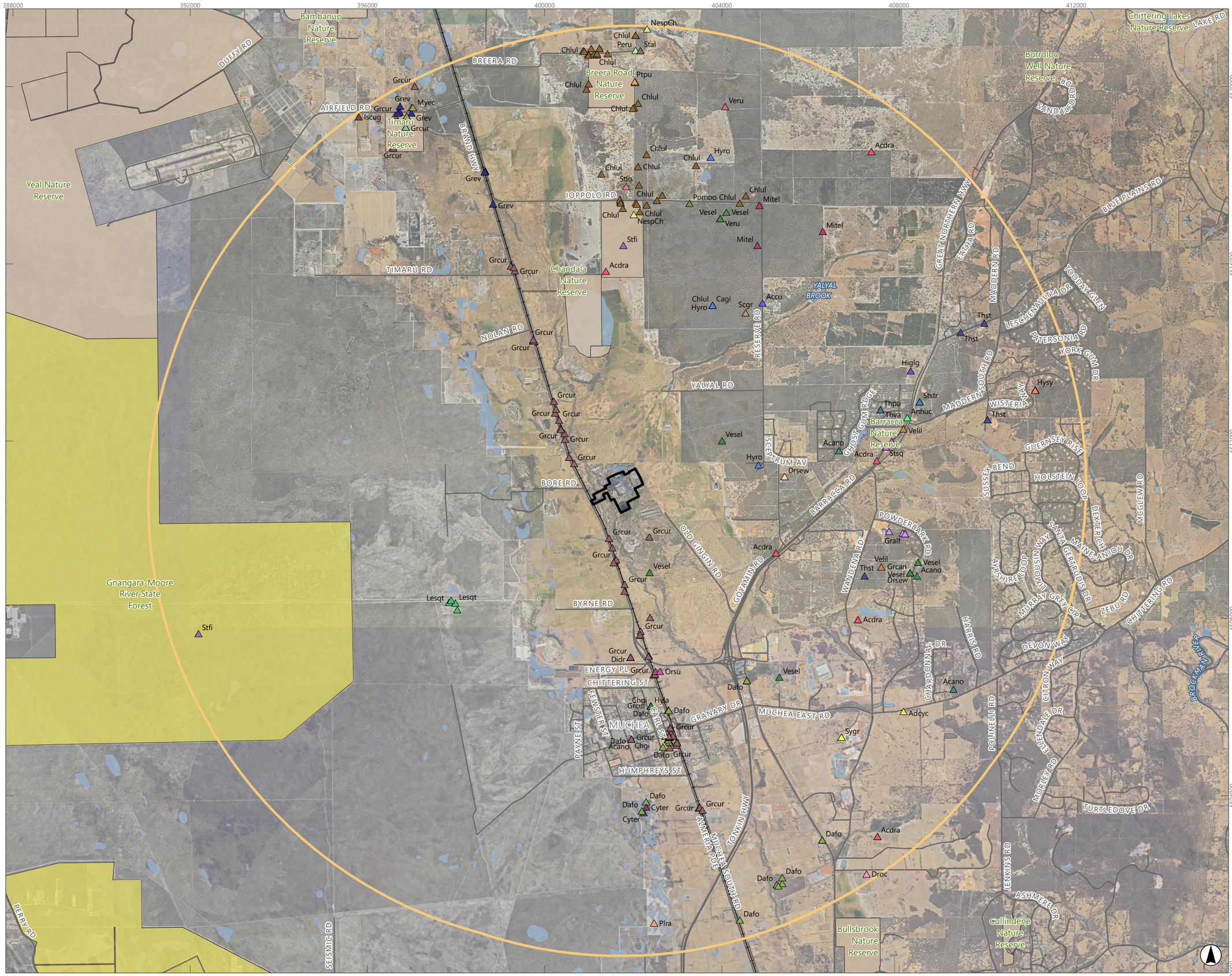
Taxon	Status	Flowering Period	Habitat	Source
***Tripterococcus* sp. Brachylobus (A.S. George 14234)**	P4	February to April, October to December	Winter damp flat, depressions, wetlands with grey soil. Plains. Peaty sand over clay.	Astron
Verticordia lindleyi* subsp. *lindleyi	P4	May or November to January	Sand, sandy clay. Winter-wet depressions.	DBCA
Verticordia rutilastra	P3	September to November	Sand & lateritic gravel. Hills.	DBCA
Verticordia serrata* var. *linearis	P3	September to October	White sand, gravel. Open woodland.	DBCA

Data sources are: Astron – Astron (2020); Eco Logical – Eco Logical (2021); DBCA – DBCA (2024b); DCCEEW – DCCEEW (2024), Western Botanical – Western Botanical (2012)

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FIGURE 5.2

Significant Flora Taxa within the Desktop Study Area



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve
- State Forest

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Kilometres

Scale: 1:80,000 at A3
GDA2020 MGA Zone 50

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Image Source: Landgate (2022-2024) | **Data Source:** Landgate (2024), DBCA (2024, 2024b), Tronox (2024)

Significant Flora (DBCA, 2024b)

- Acano *Acacia anomala* (T)
- Accu *Acacia cummingiana* (P3)
- Acdra *Acacia drummondii* subsp. *affinis* (P3)
- Adcyc *Adenanthos cygnorum* subsp. *chamaephyton* (P3)
- Anhuc *Anigozanthos humilis* subsp. *chrysanthus* (P4)
- Cagi *Caustis gigas* (P2)
- Chgi *Chamaescilla gibsonii* (P3)
- Chlul *Chamelaucium lullfitzii* (T)
- Cyter *Cyathochaeta teretifolia* (P3)
- Dafo *Darwinia foetida* (T)
- Didr *Diuris drummondii* (T)
- Droc *Drosera occidentalis* (P4)
- Drsew *Drosera sewelliae* (P2)
- ErpiP *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459) (P3)
- Gralf *Grevillea althoferorum* subsp. *fragilis* (T)
- Grcan *Grevillea candolleana* (P2)
- Grcur *Grevillea curviloba* (T)
- Grev *Grevillea evanescens* (P1)
- Higlg *Hibbertia glomerata* subsp. *ginginensis* (P2)
- Hyla *Hypocalymma lateriticola* (P1)
- Hyro *Hypolaena robusta* (P4)
- Hysy *Hypocalymma sylvestre* (T)
- Iscug *Isotropis cuneifolia* subsp. *glabra* (P3)
- Lesqt *Leucopogon squarrosus* subsp. *trigynus* (P2)
- Mete *Meionectes tenuifolia* (P3)
- Mitel *Millotia tenuifolia* var. *laevis* (P2)
- Myec *Myriophyllum echinatum* (P3)
- NespCh *Netrostylis* sp. Chandala (G.J. Keighery 17055) (P2)
- Orsu *Ornduffia submersa* (P4)
- Peru *Persoonia rudis* (P3)
- Plra *Platysace ramosissima* (P3)
- Pomoo *Poranthera moorokatta* (P2)
- Ptpu *Ptychosema pusillum* (T)
- Rudr *Rumex drummondii* (P4)
- Scgr *Schoenus griffinianus* (P4)
- Stlo *Stylidium longitubum* (P4)
- Stsq *Stylidium squamellosum* (P2)
- Ststr *Stylidium striatum* (P4)
- Stal *Styphelia allittii* (P3)
- Stfi *Styphelia filifolia* (P3)
- Sygr *Synaphea grandis* (P4)
- Thpu *Thelymitra pulcherrima* (P2)
- Thst *Thelymitra stellata* (T)
- Thva *Thelymitra variegata* (T)
- Velil *Verticordia lindleyi* subsp. *lindleyi* (P4)
- Veru *Verticordia rutilastra* (P3)
- Vesel *Verticordia serrata* var. *linearis* (P3)

FIGURE 5.2

LEGEND: Significant Flora Taxa within the Desktop Study Area

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Image Source: Landgate (2022-2024) | **Data Source:** Landgate (2024), DBCA (2024, 2024b), Tronox (2024)

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5.1.5 Significant Vegetation

The results of the DBCA TEC and PEC Database search and DCCEEW's PMST returned 13 significant communities that have records in the Desktop Study Area as summarised in **Table 5.4** and presented in **Figure 5.3**. As outlined in **Table 5.4** many of these significant communities are listed by both WA and the Commonwealth, often under slightly different names, or the WA community often forms a component of a Commonwealth community; for example, four such significant communities listed in WA commonly form part of the Commonwealth 'Banksia woodlands of the Swan Coastal Plain ecological community' TEC (**Table 5.4**).

The definitions, categories and criteria for TECs and PECs are presented on the DBCA Threatened Species and Communities website (DBCA, 2023f).

Table 5.4 Significant Vegetation Known from the Desktop Study Area

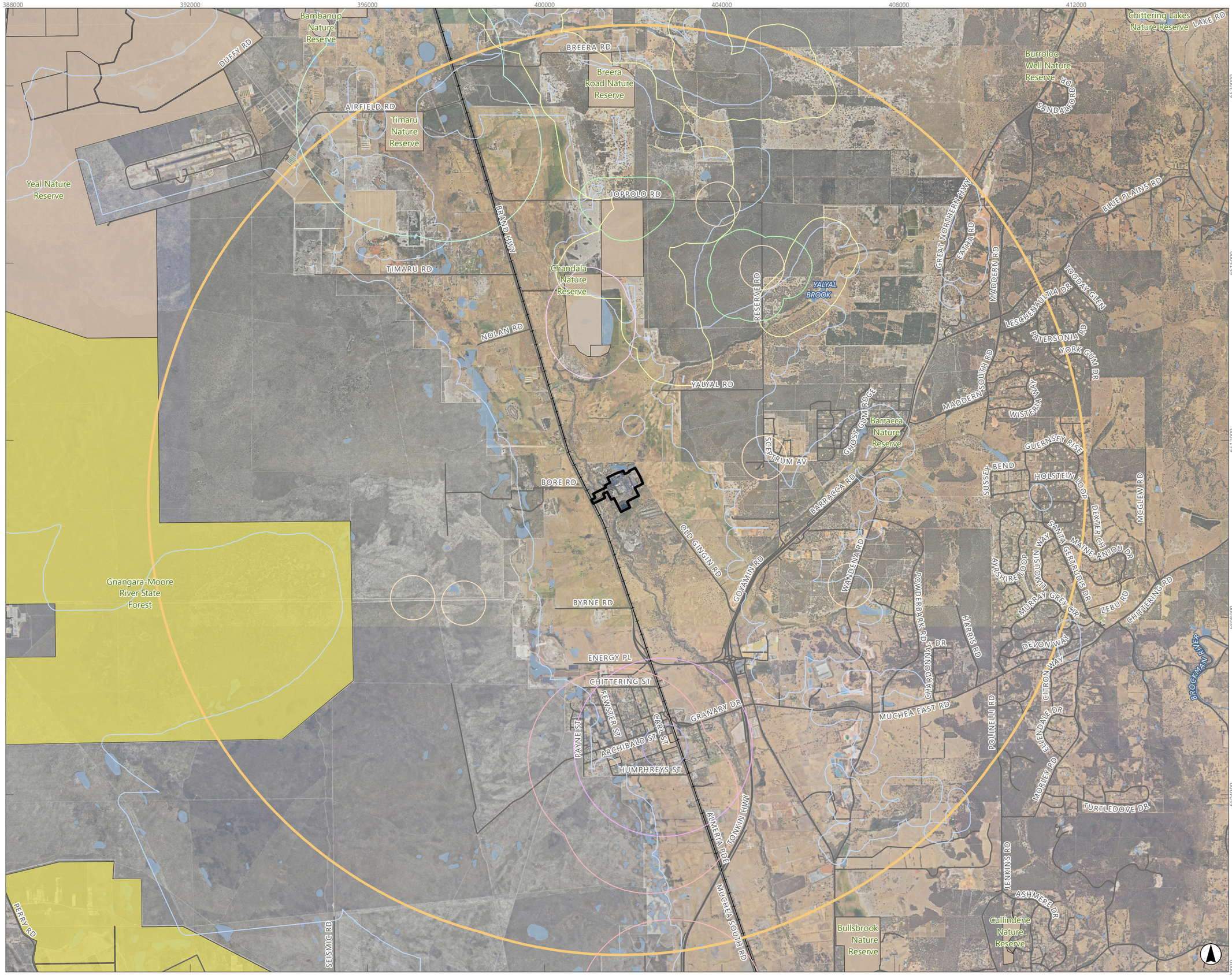
Ecological Community	EPBC Act Status	WA Status	Source*
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Critically Endangered	DCCEEW
***Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. 1994)**	Endangered^	Critically Endangered	DBCA
Clay Pans of the Swan Coastal Plain	Critically Endangered	-	DCCEW
Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Endangered	Critically Endangered	DBCA
Empodisma peatlands of southwestern Australia	Endangered	-	DCCEEW
Perth to Gingin Ironstone Association	Endangered	Critically Endangered	DBCA; DCCEEW
Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	Endangered	DBCA; DCCEEW
Swan Coastal Plain *Banksia attenuata - Banksia menziesii* woodlands ('floristic community type 23b')	Endangered^	P3	DBCA
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	P3	DBCA; DCCEEW
Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands	Endangered^	P2	DBCA
Wooded wetlands which support colonial waterbird nesting areas	-	P2	DBCA
Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa* woodlands (floristic community type 25)	Critically Endangered / Endangered#	P3	DBCA
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community	Critically Endangered	P3	DCCEEW

**Data sources are: Astron – Astron (2020); Eco Logical – Eco Logical (2021); DBCA – DBCA (2024b); DCCEEW – DCCEEW (2024), Western Botanical – Western Botanical (2012)*
^Commonly a component of 'Banksia Woodlands of the Swan Coastal Plain ecological community' (Endangered)
^Can be a component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC, or the Tuart woodlands and forests of the Swan Coastal Plain EPBC listed TEC)

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FIGURE 5.3

DBCA Significant Vegetation Records from the Desktop Study Area



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve
- State Forest

Significant Vegetation (DBCA, 2024a)

- Banksia Woodlands of the Swan Coastal Plain ecological community (WA - P3, Comm - EN)
- Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands (WA - P2)
- Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain) (WA - BCACE, Comm - EN)
- Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain (WA - BCAE, Comm - EN)
- Perth to Gingin Ironstone Association (WA - BCACE, Comm - EN)
- SCP20a: Banksia attenuata woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. 1994) (WA - BCACE, Comm - EN)
- SCP23b: Swan Coastal Plain Banksia attenuata - Banksia menziesii woodlands (WA - P3, Comm - EN)
- SCP25: Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands (WA - P3)
- Wooded wetlands which support colonial waterbird nesting areas (WA - P2)

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Image Source: Landgate (2022-2024) | **Data Source:** Landgate (2024), DBCA (2024, 2024a), Tronox (2024)

5.2 Field Survey

5.2.1 Vascular Flora Census

A total of 70 discrete vascular flora taxa were recorded in the Survey Area by the reconnaissance survey. The taxa represent 24 families and 44 genera. The most well-represented families were Myrtaceae (28 taxa), Asteraceae (six taxa), Fabaceae (5 taxa) and Poaceae (5 taxa). A total of 20 taxa were introduced (See **Section 5.2.4**).

A full list of taxa recorded by the survey is presented in **Appendix C**, with raw relevé data and parameters presented in **Appendix D** and vegetation mapping observation notes presented in **Appendix E**.

Note that several collections could not be identified to species level due to poor material; none of these are considered likely to represent significant flora taxa.

5.2.2 Significant Flora

No listed significant flora (excluding one planted occurrence of *Grevillea fililoba* (P1) - discussed below) were recorded during the field survey of the Study Area. No other taxa recorded in the Study Area are considered to represent significant flora for any other reason (as per EPA (2016a, 2016b)).

Grevillea fililoba (P1) is listed as P1 by DBCA (2023d), which is only known from a limited range, east of Geraldton, typically occurring on slopes, hills and breakaways on loamy soils, in association with laterite (WA Herbarium, 1998-). Within the Survey Area the taxon was recorded in a flat area on grey sand, which had been largely historically disturbed, was deemed to be planted and not considered to be naturally present in the Study Area. Therefore, this taxon is not considered to be significant and it is not discussed further in this report in the context of significant flora.

5.2.3 Likelihood of Occurrence of Significant Flora Taxa

Appendix B presents an assessment of the likelihood of occurrence of significant taxa within the Survey Area. This list includes significant taxa identified as occurring (or potentially occurring within the Desktop Study Area prior to survey (listed in **Table 5.3**). The assessment considered whether a taxon was identifiable at the time of survey, the known range of the taxon, if habitat is present in the Survey Area, proximity of known records to the Survey Area, when determining the potential for a taxon to occur in the Survey Area.

A total of 65 taxa have been assessed within **Appendix F** including 26 Threatened flora and 39 Priority flora taxa. None of these taxa were recorded within the Survey Area by the survey, and 17 taxa were not identifiable at the time of survey. It is considered that the 48 remaining taxa were identifiable during the survey, either because the survey period coincides with the taxon's flowering period, or the taxon can be identified reliably when in fruit or sterile. The survey included walk throughs of all major vegetation units both discernible through aerial photography and with reference to the original mapping undertaken by Western Botanical (2013); whilst a full census of plant taxa was not undertaken, opportunistic taxa were recorded or collected for identification through this process.

The likelihood of occurrence assessment identified that all 65 taxa are considered unlikely to be occur in the Survey Area, due to potential habitat is not considered to be present, and with the Study Area also being outside the known distribution of some taxa (as listed in **Appendix F**). Potential habitat was considered with respect to the type of habitat and also the condition of habitat present, with the entirety of the Survey Area mapped as Degraded or Completely Degraded, and subject to historical disturbance vectors including clearing, replanting, grazing and potential Phytophthora Dieback (see **Section 5.2.6**). The lower stratum of the vegetation of the Survey Area comprised throughout predominantly of pasture weeds, with the majority of the mid and upper stratums also severely impacted by historical disturbance. It was therefore considered unlikely that the vegetation could be potential habitat for any of the significant flora identified by the desktop assessment.

5.2.4 Introduced Taxa

A total of 20 introduced flora taxa were recorded within the Survey Area by the current survey, as listed in **Table 5.5**. It should be noted that this does not represent a comprehensive survey of all introduced flora taxa / locations in the Survey Area, as this was beyond the scope of this survey. In addition, as this survey was undertaken out of season, it is likely that more introduced taxa would be present in the Survey Area in spring.

The significance of the recorded introduced flora taxa, with reference to the ecological impact and invasiveness ratings for each introduced taxon as per 'Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife for the Swan Region' (DBCA, 2016) is also presented in **Table 5.5**. One of the recorded introduced flora taxa is a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), being *Zantedeschia aethiopica*. No Weed of National Significance (WoNS) as per Weeds Australia (2024) were recorded during the survey.

Several other taxa considered to be serious weeds were also recorded in the Survey Area. *Eragrostis curvula* (African Lovegrass) was recorded during the survey at vegetation observation points. This taxon is a widespread and serious weed of road verges and disturbed ground from Carnarvon to the Nullarbor, and is highly invasive (DBCA, 2016; Hussey et al., 2007). *Ehrharta calycina* (Perennial Veldt Grass) was also noted at a number of vegetation observation points. It is known to be a significant weed, occurring extensively within roadsides and bushland on sandy soils from Geraldton to Esperance, and is particularly common on the SCP, where it is one of the most serious bushland weeds and a significant fire hazard (Hussey et al., 2007). These taxa are rated as High for ecological impact and Rapid for invasiveness (DBCA, 2016).

Overall, eight introduced taxa recorded in the Survey Area by the survey are rated as having 'High' ecological impact (including *Ixia* sp.; of the four species of Ixia assessed by the DBCA (2016), three were rated as 'Unknown' and one was rated as 'High') (**Table 5.5**). Taxa with this ecological impact rating are considered significant weeds capable of causing acute disruption of ecological processes, as well as dominating and/or significantly altering the vegetation structure, composition and function of ecosystems. Nine introduced taxa recorded in the Survey Area are rated as having 'Rapid' invasiveness in native vegetation (DBCA, 2016).

Table 5.5 Introduced Flora Taxa Recorded in the Survey Area

Taxon	Common Name	Significance	Ecological Impact^	Invasiveness^
Acacia iteaphylla	Flinders Range wattle		Not rated	Note rated
Acacia podalyriifolia	Queensland Silver Wattle		High	Moderate
Arctotheca calendula	Cape Weed		Medium	Moderate
Briza maxima	Blowfly Grass		Low	Moderate
Callitriche stagnalis	Common Starwort		Unknown	Rapid
Casuarina cunninghamiana **subsp. *cunninghamiana***	River Sheoak		Low	Slow
Dittrichia graveolens	Stinkwort		Medium	Rapid
Ehrharta calycina	Perennial Veldt Grass		High	Rapid
Eragrostis curvula	African Lovegrass		High	Rapid
Eucalyptus botryoides	Bangalay		High	Moderate
Eucalyptus grandis	Flooded Gum		Not rated	Note rated
Eucalyptus leucoxylon	White Ironbark		Not rated	Note rated
Gladiolus caryophyllaceus	Pink Gladiolus		High	Rapid
Hypochaeris glabra	Smooth Cats Ear		High	Rapid
***Ixia* sp.**	Ixia		High / Unknown	Rapid
Jacaranda mimosifolia	Jacaranda		Not rated	Note rated
Poa annua	Winter Grass		Unknown	Unknown
Rumex conglomeratus	Clustered Dock		Unknown	Rapid
Ursinia anthemoides	Ursinia		Unknown	Rapid
Zantedeschia aethiopica	Arum Lily	Declared Pest	High	Moderate

^Ecological impact and invasiveness sourced from DBCA (2016)

5.2.5 Vegetation

The vegetation of the Survey Area was mapped and described via structural classification from floristic and structural data recorded at relevés and vegetation observation points. Due to the long history of disturbance within the Survey Area, there are many areas that still possess tree or large shrub taxa, but have other structural layers comprised largely of introduced taxa, or with significantly reduced native taxon diversity. Such areas have clearly been highly modified since European settlement and are no longer considered to represent intact remnant vegetation. To account for this, the classification of vegetation has been divided into two categories: VTs and Highly Modified Areas (HMA). It is likely that many of the Highly Modified Areas are degraded versions of described VTs, however it is not possible to confidently align them given their condition.

Two VTs were described and mapped in the Survey Area, covering a total area of 5.1 ha (9.4 % of the Survey Area). There were 12 HMAs described and mapped in the Survey Area, covering a total area of 19.6 ha (36.2 % of the Survey Area). VTs are described in **Table 5.6** and HMAs are described in **Table 5.7,** with mapping presented on **Figure 5.4.**

Areas where natural vegetation has been completely removed (isolated trees and shrubs may be present), have been mapped as 'Cleared' (Cl). This includes roads, road verges and cleared areas associated with the Chandala processing plant. A total of 29.4 ha of 'Cleared' land was mapped, representing 54.4 % of the Study Area (**Figure 5.4**).

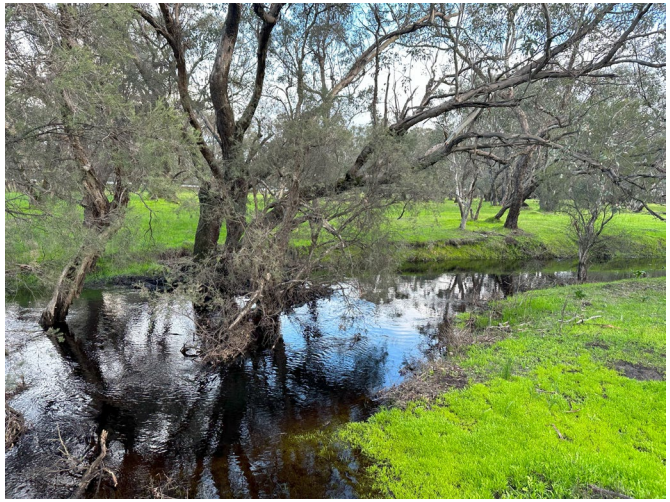
Table 5.6 Description of Vegetation Types Mapped in the Survey Area

VT	Description	Photograph
BW	**Community Name:** Banksia woodland **Description:** *Banksia attenuata, Banksia menziesii* and *Eucalyptus todtiana* woodland over *Melaleuca trichophylla*, *Melaleuca seriata* and *Xanthorrhoea preissii* isolated shrubs over mixed herbs and pasture weeds on flats and plains. **Area mapped:** 3.8 ha **Sampling:** 3 relevés (R01, R02, R03); 6 vegetation observation points (MN17, MN19, MN20, MN24, MN25, MN47)	 **Photo 5.1 Relevé R01**
CpRcS	**Community Name:** *Callitris pyramidalis / Regelia ciliata* shrubland **Description:** *Callitris pyramidalis, Regelia ciliata* and *Astartea scoparia* shrubland over weeds on flats. **Area mapped:** 1.3 ha **Sampling:** 4 vegetation observation points (MN07, MN15, MN16, NM18)	 **Photo 5.2 Vegetation Observation Point MN07**

Table 5.7 Description of Highly Modified Area Mapped in the Survey Area

HMA	Description	Photograph
AsSTdR	**Community Name:** *Acacia saligna* shrubland / *Typha domingensis* rushland **Description:** Isolated shrubs of *Acacia saligna* over open to closed rushland of *Typha domingensis* over pasture weeds on flats and in drainage lines. **Area mapped:** 0.9 ha **Sampling:** 2 vegetation observation points (MN04, MN05, MN21)	 **Photo 5.3 Vegetation Observation Point MN05**
CcW	**Community Name:** *Corymbia calophylla* woodland **Description:** *Corymbia calophylla* woodland over pasture weeds on flats and plains. Subject to intensive historical clearing processes and also contains planted Eucalyptus. **Area mapped:** 2.5 ha **Sampling:** 2 vegetation observation points (MN46, MN55)	 **Photo 5.4 Vegetation Observation Point MN55**

HMA	Description	Photograph
EcEsAS	**Community Name:** *Eucalyptus camaldulensis* / *Eucalyptus sideroxylon* woodland artificial sump **Description:** Planted *Eucalyptus camaldulensis* and *Eucalyptus sideroxylon* woodland surrounding artificial sump. **Area mapped:** 0.4 ha **Sampling:** 1 vegetation observation point (MN32)	 **Photo 5.5 EcEsAS – Vegetation Observation Point MN32**

HMA	Description	Photograph
ErW	**Community Name:** *Eucalyptus rudis* woodland **Description:** *Eucalyptus rudis* woodland over *Melaleuca rhaphiophylla* woodland over pasture weeds on flats and drainage lines. **Area mapped:** 3.1 ha **Sampling:** 5 vegetation observation points (MN39, MN52, MN54, MN56, MN57) **Variation:** More degraded areas of this VT lack or have significantly reduced cover of the *Melaleuca rhaphiophylla* woodland – this taxon tends to be more prominent in drainage lines	 **Photo 5.6 ErW – Vegetation Observation Point MN54**  **Photo 5.7 ErW – Vegetation Observation Point MN52**

HMA	Description	Photograph
ErWRW	**Community Name:** *Eucalyptus rudis* woodland revegetated wetland **Description:** Low woodland of *Eucalyptus rudis* over *Astartea scoparia*, *Melaleuca leucandra*, *Melaleuca rhaphiophylla* and *Melaleuca viminea* subsp. *viminea* shrubland on inundated wetlands. *Note: this area has been subject to historical community revegetation projects and is a revegetated/replanted landscape.* **Area mapped:** 1.5 ha **Sampling:** 2 vegetation observation points (MN33, MN34)	 **Photo 5.8 ErWRW – Vegetation Observation Point MN33**
MFG	**Community Name:** Mixed forbland and grassland **Description:** Low forbland and grassland of mixed species on flats. Highly modified and subject to historical clearing processes. **Area mapped:** 0.2 ha **Sampling:** 1 vegetation observation point (MN04)	 **Photo 5.9 MFG – Vegetation Observation Point MN04**

HMA	Description	Photograph
MpW	**Community Name:** *Melaleuca preissiana* woodland **Description:** Low woodland to open woodland of *Melaleuca preissiana* and occasionally *Melaleuca viminea* subsp. *viminea,* over pasture weeds on flats and depressions. This community was noted to often have planted *Eucalyptus* trees. Note the furthest eastern polygon was not assessed during this survey due to lack of access (flooded). That portion was most likely to be in better condition than the areas assessed. **Area mapped:** 1.3 ha **Sampling:** 4 vegetation observation points (MN10, MN11, MN12, MN23)	 **Photo 5.10 Vegetation Observation Point MN10**
MrW	**Community Name:** *Melaleuca rhaphiophylla* woodland **Description:** *Melaleuca rhaphiophylla* open woodland over pasture weeds on flats and seasonally inundated wetlands. *Typha domingensis* rushland present in wetter areas. Highly modified and subject to historical clearing processes. **Area mapped:** 1.3 ha **Sampling:** 5 vegetation observation points (MN37, MN38, MN43, MN44, MN45)	 **Photo 5.11 MrW – Vegetation Observation Point MN37**

HMA	Description	Photograph
PCq	**Community Name:** Planted *Calothamnus quadrifidus* shrubland **Description:** Planted *Calothamnus quadrifidus* and *Melaleuca ryeae* shrubs over weeds on flats. Highly modified. **Area mapped:** 0.08 ha **Sampling:** 1 vegetation observation point (MN01)	 **Photo 5.12 PCqS – Vegetation Observation Point MN01**
PE	**Community Name:** Planted Eucalyptus woodland **Description:** Planted *Eucalyptus* trees over weeds on flats. These areas constituted planted gardens and landscapes within the operations and administration areas, as well as closer to Brand Highway. **Area mapped:** 4.3 ha **Sampling:** 8 vegetation observation points (MN22, MN26, MN27, MN28, MN35, MN36, MN50, MN51)	 **Photo 5.13 Vegetation Observation Point MN28**

HMA	Description	Photograph
PENV	**Community Name:** Planted Eucalyptus trees over native vegetation **Description:** Planted Eucalyptus trees over sparse remnant native trees and/or shrubs on flats. These areas were highly disturbed and included planted *Eucalyptus* trees over sparse remaining native taxa. **Area mapped:** 3.9 ha **Sampling:** 12 vegetation observation points (MN06, MN10, MN11, MN12, MN14, MN29, MN30, MN31, MN40, MN41, MN42, MN49)	 **Photo 5.14 Vegetation Observation Point MN30**
XpS	**Community Name:** *Xanthorrhoea preissii* isolated shrubs **Description:** Remnant isolated *Xanthorrhoea preissii* over weeds on plains.Highly modified and subject to historical clearing processes. **Area mapped:** 0.2 ha **Sampling:** 1 vegetation observation point (MN02)	 **Photo 5.15 Vegetation Observation Point MN02**

FIGURE 5.4

Vegetation Types and Other Areas Mapped in the Survey Area

401000 401200 401400 401600 401800 402000 402200

6511400 6511200 6511000 6510800 6510600 6510400

Legend

- Survey Area
- Road
- Railway

Vegetation Type

- BW
- CpRcS

Other Areas Described

- AsSTdR
- CcW
- EcEsAS
- ErW
- ErWRW
- MFG
- MpW
- MrW
- PCq
- PE
- PENV
- XpS
- C

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Vegetation Type

BW	*Banksia attenuata, Banksia menziesii* and *Eucalyptus todtiana* woodland over *Melaleuca trichophylla*, *Melaleuca seriata* and *Xanthorrhoea preissii* isolated shrubs over herbs and pasture weeds on flats and plains
CpRcS	*Callitris pyramidalis, Regelia ciliata* and *Astartea scoparia* shrubland over weeds on flats

Other Areas Described

AsSTdR	Isolated shrubs of *Acacia saligna* over open to closed rushland of *Typha domingensis* over pasture weeds on flats and in drainage lines
CcW	*Corymbia calophylla* woodland over pasture weeds on flats and plain
EcEsAS	Planted *Eucalyptus camaldulensis* and *Eucalyptus sideroxylon* woodland surrounding artificial sump
ErW	*Eucalyptus rudis* woodland over *Melaleuca rhaphiophylla* woodland over pasture weeds on flats and drainage lines
ErWRW	Low woodland of *Eucalyptus rudis* over *Astartea scoparia*, *Melaleuca leucandra*, *Melaleuca rhaphiophylla* and *Melaleuca viminea* subsp. *viminea* shrubland on inundated wetlands
MFG	Low forbland and grassland of mixed species on flats
MpW	Low woodland to open woodland of *Melaleuca preissiana* and occasionally *Melaleuca viminea* subsp. *Viminea* over pasture weeds on flats and depressions
MrW	*Melaleuca rhaphiophylla* open woodland over pasture weeds on flats and seasonally inundated wetlands
PCq	Planted *Calothamnus quadrifidus* and *Melaleuca ryeae* shrubs over weeds on flats
PE	Planted Eucalyptus trees over weeds on flats
PENV	Planted Eucalyptus trees over sparse remnant native trees and/or shrubs on flats
XpS	Remnant isolated *Xanthorrhoea preissii* over weeds on plains
C	Cleared land

FIGURE 5.4

LEGEND: Vegetation Types and Other Areas Mapped in the Survey Area

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5.2.6 Vegetation Condition

Table 5.8 presents the vegetation condition areas mapped within the Survey Area, with the condition mapping polygons presented on **Figure 5.5**. Areas mapped as Cleared land are not rated, as the vegetation condition rating is applied to vegetated lands only. As mentioned previously, a total of 29.4 ha (54.4 % of the Survey Area) was mapped as cleared by the survey.

The majority of the vegetation of the Survey Area was rated as Completely Degraded, with a total of 16 ha (29.5 % of the Survey Area) of Completely Degraded vegetation mapped within the Survey Area. The vegetation structure of these areas was no longer intact, comprising of weed species with isolated native trees and shrubs, or comprising of previously cleared areas with the majority of vegetation present being planted trees and shrubs.

The remainder of vegetation within the Survey Area was rated as Degraded, with a total of 8.7 ha (16.1 % of the Survey Area) of Degraded vegetation mapped within the Survey Area. The structure of this vegetation was severely impacted by multiple disturbances. Impacts included partial clearing, aggressive weeds, grazing and potential Phytophthora Dieback. No vegetation within the Survey Area was considered to be in Good or better condition.

Table 5.8 Vegetation Condition Areas Mapped within the Survey Area

Type	Code	Area Mapped (ha)		
		Degraded	Completely Degraded	Total
VT	BW	3.0	0.8	3.8
	CpRcS	0.8	0.5	1.3
HMA	AsSTdR	0.7	0.1	0.9
	CcW	0.6	1.8	2.5
	EcEsAS		0.4	0.4
	ErW	0.2	2.9	3.1
	ErWRW	1.5		1.5
	MFG		0.2	0.2
	MpW	1.3	0.0	1.3
	MrW	0.1	1.2	1.3
	PCq		0.1	0.1
	PE		4.3	4.3
	PENV	0.4	3.5	3.9
	XpS		0.2	0.2
	Cleared	NA	NA	29.4
Total		**8.7**	**16.0**	**54.1**
Percentage of Survey Area		**16.1**	**29.5**	**45.6**

FIGURE 5.5

Vegetation Condition and Introduced Flora of the Survey Area

401000 401200 401400 401600 401800 402000 402200

6511400 6511200 6511000 6510800 6510600 6510400

Legend

- Survey Area
- Road
- Railway

Vegetation Condition

- D Degraded
- CD Completely degraded
- C Cleared land

Label

- Acit **Acacia iteaphylla*
- Acpo **Acacia podalyriifolia*
- Arc **Arctotheca calendula*
- Brma **Briza maxima*
- Cas **Callitriche stagnalis*
- Cacc **Casuarina cunninghamiana* subsp. *cunninghamiana*
- Dig **Dittrichia graveolens*
- Ehc **Ehrharta calycina*
- Ercu **Eragrostis curvula*
- Eub **Eucalyptus botryoides*
- Eug **Eucalyptus grandis*
- Eul **Eucalyptus leucoxylon*
- Glc **Hypochaeris glabra*
- Hyg **Hypochaeris glabra*
- Ixi **Ixia* sp.
- Jam **Jacaranda mimosifolia*
- Poan **Poa annua*
- Ruc **Rumex conglomeratus*
- Ura **Ursinia anthemoides*
- Zaa **Zantedeschia aethiopica*

0 80 160

Metres

Scale: 1:4,000 at A3
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5.2.7 Swan Coastal Plain Floristic Community Types

The current procedure recommended by DBCA for determining FCTs on the southern SCP is to establish and survey quadrats in the appropriate season and carry out analyses with the Gibson et. al. (1994) and Keighery et.al. (2012) datasets as per the '*Methods for survey and identification of Western Australian threatened ecological communities*' procedure (2023b). The current survey does not comply with this procedure as it was an out of season survey and the timing was not suitable to undertake a quadrat survey of the flora and vegetation; as per **Section 1.3**, one of the aims of the current assessment was to identify whether there is a requirement for a spring quadrat assessment, based on the vegetation present in the Survey Area and the condition of the vegetation.

The majority of the Survey Area has been cleared or disturbed (as per **Section 5.2.6**), with 12 types of Highly Modified Areas mapped (such areas no longer considered to represent intact remnant vegetation) and two VTs mapped, including BW and CpRcS. The vegetation condition of the Survey Area was rated as Degraded to Completely Degraded by the current survey (including the three VTs mapped), as per the condition scale presented in EPA (2016b), with the vegetation of the Survey Area severely impacted by multiple disturbances (see **Section 5.2.6**). In addition to the survey being outside of the prime season (Spring), due to the degraded nature of the vegetation native species richness was considered inadequate to provide suitable data for statistical analysis, with the vegetation sampled via relevés rather than quadrats (as per DBCA (2023b)).

A qualitative assessment of the relevé data recorded during the current survey was undertaken to assess for the SCP FCTs potentially present within the Survey Area. The description of each FCT and the typical / common species described in the Gibson et. al. (1994) report was reviewed. A summary of this review is presented in **Table 5.9**. VT CpRcS was assessed via vegetation observation points. It is possible that this VT represents Gibson et. al. (1994) FCT 4; however, the vegetation structure has been impacted such that it is not possible to align this with an SCP FCT.

The qualitative assessment of the three relevés assessed during the survey (all within the vegetation mapped as VT BW) indicates that the relevés are potentially representative of SCP FCTs 23a or 21c. However, the vegetation was too degraded to confidently align to a particular FCT (suitable quadrat data also required to perform this task). Although there were no Banksia trees recorded in relevé R02, there were Banksia trees in close proximity, and there were several other taxa in the relevé which indicate the area potentially represents FCTs 23a or 21c. FCTs 23 and 21c form part of the '*Banksia Woodlands of the Swan Coastal Plain ecological community'* (discussed in **Section 5.2.8.2**). In addition, these FCTs are listed Priority 3 PECs (DBCA, 2023c). The potential for these PECs to be present within the Survey Area with respect to the condition of the vegetation is discussed further in **Section 5.2.8.1**.

Table 5.9 Summary of Comparison of Typical Habitat Features to Determine Relationships of Study Area Relevés to the Swan Coastal Plain Floristic Community Types

Relevé	Dominant Taxa	Relevé Parameters	Determination
R01	*Banksia attenuata* *Banksia ilicifolia* *Banksia menziesii* *Eucalyptus todtiana* *Macrozamia riedlei* *Melaleuca ryeae* *Melaleuca trichophylla* *Xanthorrhoea preissii*	**VSA:** Pinjarra_4 **Land System:** Yanga System **Landform:** flat **Soil / Substrate:** white sand **Condition:** Degraded	**Inconclusive – possibly FCT 21c or 23b** Several of the dominant taxa are common taxa in many FCT 21c and 23b quadrats. These FCTs are known to occur in the general vicinity of the Survey Area. However, vegetation of the relevé is too degraded to infer an SCP FCT with certainty.
R02	*Eucalyptus todtiana* *Macrozamia riedlei* *Melaleuca ryeae* *Regelia ciliata* *Xanthorrhoea preissii*	**VSA:** Pinjarra_4 **Land System:** Yanga System **Landform:** flat **Soil / Substrate:** white sand **Condition:** Degraded	**Inconclusive – possibly FCT 21c or 23b** Several of the dominant taxa are common taxa in many FCT 21c and 23b quadrats. These FCTs are known to occur in the general vicinity of the Survey Area. However, vegetation of the relevé is too degraded to infer an SCP FCT with certainty.
R03	*Banksia attenuata* *Banksia menziesii* **Eucalyptus leucoxylon* *Eucalyptus todtiana* *Melaleuca seriata* *Xanthorrhoea preissii*	**VSA:** Pinjarra_4 **Land System:** Yanga System **Landform:** flat **Soil / Substrate:** grey sand **Condition:** Degraded	**Inconclusive – possibly FCT 21c or 23b** Several of the dominant taxa are common taxa in many FCT 21c and 23b quadrats. These FCTs are known to occur in the general vicinity of the Survey Area. However, vegetation of the relevé is too degraded to infer an SCP FCT with certainty.

5.2.8 Significant Vegetation

5.2.8.1 Significant Vegetation of the Survey Area

The desktop assessment identified 13 listed significant vegetation communities that have records (or could potentially occur) within the Desktop Study Area (**Section 5.1.5**). Of these, one was identified by the flora and vegetation assessment in the Survey Area, being the 'Banksia Woodlands of the Swan Coastal Plain ecological community' TEC. This TEC is listed under the EPBC Act but is listed as a PEC (P3) by DBCA. This significant vegetation community is discussed in further detail in **Section 5.2.8.2**.

DBCA has acknowledged that in general, a vegetation condition threshold of 'Good' is applied to State listed TECs, in that areas of TECs are generally no longer considered to be extant where vegetation condition is poorer than 'Good'. However, they state that there can be exceptions to this, for example where much of the remaining area of a TEC is in relatively poor condition (V. English pers. comm., 2022). In addition, in some cases, this contradicts the definition of TECs at a Federal level, with some Federally listed TECs having no minimum condition thresholds. Based on this, degraded areas of all the significant communities recorded within the Survey Area are not considered to be occurrences of the community, with the exception of the Banksia Woodlands of the Swan Coastal Plain TEC which can also include degraded areas in accordance with the conservation advice (DoEE, 2016) for the community.

5.2.8.2 Banksia Woodlands of the Swan Coastal Plain TEC

The 'Banksia Woodlands of the Swan Coastal Plain ecological community' is listed as a PEC in WA, and as a TEC under the EPBC Act. DBCA state that the description, area and condition thresholds that apply to the EPBC-listed TEC also apply to the PEC (DBCA, 2023c); therefore, these are discussed together in the context of the EPBC-listed TEC. Note that a number of other DBCA-listed TECs and PECs (based on SCP FCTs from the Gibson et al. (1994) study) also form part of the EPBC-listed TEC; such other communities present in the Survey Area are discussed in **Section 5.2.9**.

The Approved Conservation Advice for this community (DoEE, 2016) stipulates a stepwise process for identifying occurrences of the TEC community. These steps are followed in the context of identifying whether vegetation of the Survey Area represents this TEC, as outlined below.

The first step involves key diagnostic characteristics (location and physical environment, soils and landform, structure, and composition). The Survey Area satisfies the first two key diagnostic characteristics, as it occurs within the SCP IBRA bioregion, and contains areas of well drained, low nutrient soils on sandplain landforms. With regard to the remaining two key diagnostic characteristics, the Banksia Woodland VT (BW) is considered to have a basic low woodland structure dominated by a combination of *Banksia attenuata* and *Banksia menziesii*; however, the understorey lacks a diverse sclerophyllous shrub and herbaceous ground layer, with limited native taxa present in the mid and lower stratums of this VT. Furthermore, the condition of VT BW does not meet the minimum patch size and condition requirements stipulated in the conservation advice, with the area mapped as Degraded, nor does the VT qualify as the TEC on the basis that the patch may be degraded but contributes to the overall function of the ecological community (and other environmental components) across the landscape.

There is an area of Banksia Woodland immediately north of the northern patch of VT BW which may be considered to be in Good condition (outside of the Survey Area) (see vegetation observation point VMN 48 in **Appendix E**. Western Botanical (2012) mapped a polygon of *Banksia menziesii* and *Banksia attenuata*, open woodland in this area, covering a total area of 0.3 ha. No further Banksia woodland vegetation associations were mapped in the northern polygon of the Western Botanical project area. The area of VT BW bordering this area (within the Survey Area), as mapped by the current survey is 0.5 ha. Therefore, the combined area of these two Banksia woodland vegetation communities do not meet the minimum patch size and condition requirements stipulated in the conservation advice, with the minimum size of a patch rated as Good being 2 ha (DoEE, 2016). Furthermore, the areas of VT BW mapped within the Survey Area are isolated (based on field observations during the current survey, polygons mapped by Western Botanical (2012, 2013) and aerial photography of the surrounding areas), and do not contribute to diversity or connectivity of areas of the TEC in better condition. Therefore, the Banksia Woodlands of the Swan Coastal Plain TEC is not considered to occur in the Survey Area.

5.2.9 Likelihood of Occurrence of Significant Vegetation

Appendix G presents an assessment of the likelihood of occurrence of significant vegetation within the Survey Area as per **Section 3.4**. Of the nine significant ecological communities recorded in the Desktop Study Area, none are considered to be present in the Survey Area based on the vegetation types, substrate and vegetation condition.

6.0 Conclusions and Recommendations

The reconnaissance survey of the Survey Area was conducted in July 2024 which does not correspond to the optimum survey or flowering period for the SCP bioregion. However, survey aimed to assess and search for potential significant vegetation and potential habitat for significant flora. Additional annual taxa would be expected to be present in the Survey Area during the peak flowering season for the region (spring).

The survey recorded 70 discrete vascular flora taxa, including 20 introduced taxa. The species richness is considered to be lower than what would typically be recorded on the SCP due to the condition of the vegetation. No significant flora were recorded during the survey of the Survey Area. *Grevillea fililoba* (P1) was recorded at one locations; however, this individual was planted, and is therefore not considered to be significant. An assessment of likelihood of occurrence of significant flora identified in the desktop assessment considered all significant taxa to be unlikely to be occur in the Survey Area, due to potential habitat not considered to be present, and with the Study Area also being outside the known distribution of some taxa. Potential habitat was considered with respect to the type of habitat present and also the condition of habitat present, with the entirety of the Survey Area mapped as Degraded or Completely Degraded and the lower stratum comprising of predominantly pasture weeds.

Two VTs and 12 Highly Modified Areas were described and mapped in the Survey Area. These areas were rated as Degraded or Completely Degraded, with the structure of the vegetation considered to be severely impacted by multiple disturbances, or no longer intact. Of the vegetation types described, VT BW is considered to have a basic low woodland structure dominated by a combination of *Banksia attenuata* and *Banksia menziesii*; as per the diagnostic characteristics for Approved Conservation Advice for Banksia Woodlands of the Swan Coastal Plain ecological community (DoEE, 2016). However, the understorey lacks a diverse sclerophyllous shrub and herbaceous ground layer, with limited native taxa present in the mid and lower stratums of this VT. In addition, the condition of VT BW does not meet the minimum patch size and condition requirements stipulated in the conservation advice, with the area mapped as Degraded, nor does the VT qualify as the TEC on the basis that the patch may be degraded but contributes to the overall function of the ecological community (and other environmental components) across the landscape. The areas mapped are isolated, and do not contribute to diversity or connectivity of areas of the TEC in better condition. Therefore, the Banksia Woodlands of the Swan Coastal Plain TEC is not considered to occur in the Survey Area.

An assessment of the likelihood of occurrence of significant vegetation within the Survey Area found that of the nine ecological communities identified by the desktop assessment, none are considered to be present in the Survey Area based on the vegetation types, substrate and vegetation condition recorded in the Survey Area.

Overall, further spring assessment of the Survey Area is not considered to be necessary based on the severely impacted vegetation present, with no vegetation rated as Good or better, mapped within the Survey Area.

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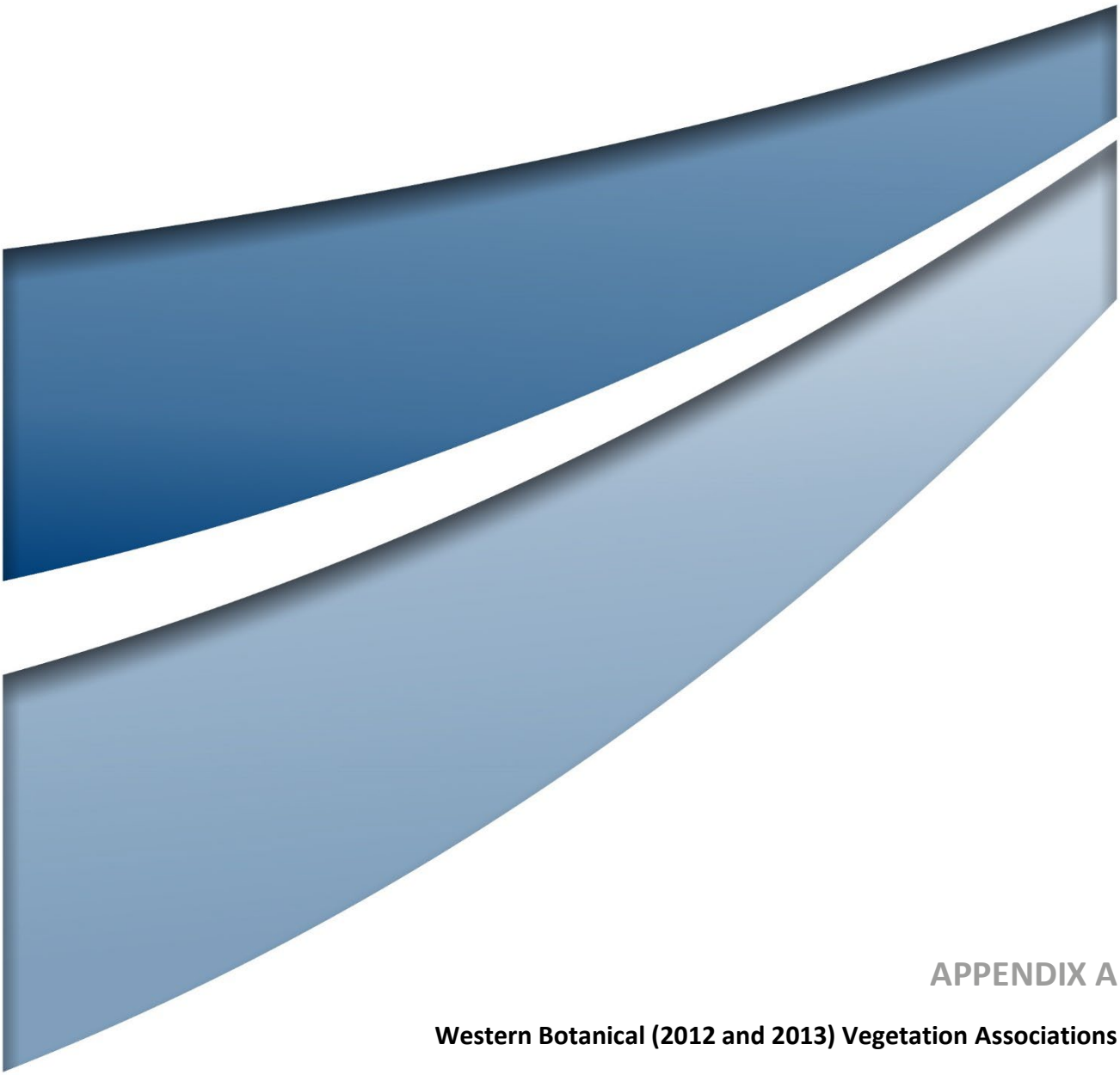
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APPENDIX A

Western Botanical (2012 and 2013) Vegetation Associations

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
EPW	Eucalyptus Planted Woodland	Variable mix of planted Eucalypt (**E. botryoides*, *E. camaldulensis* subsp. *obtusa*, *E. caesia*, *E. maculata*, *E. macrandra*, *E. urna*, and *E. gomphocephala*) open woodland to woodland over variable mix of **Ehrharta longiflora*, **Arctotheca calendula*, **Ursinia anthemoides*, **Zantedeschia aethiopica* grassland/herbland.	Very Degraded. Entirely cleared pasture lands dominated by ground stratum weeds with rehabilitative Eucalypt plantings. An anthropogenic vegetation association with almost no original flora remaining.	2012, 2013
EPEtOW	Eucalyptus Plantings in *Eucalyptus todtiana* Open Woodland	Planted *Eucalyptus camaldulensis* subsp. *obtusa* amongst scattered remnant *Eucalyptus todtiana* Open Woodland over *Xanthrohoea priesii* sparse shrubland over **Ehrharta longiflora* grassland.	Degraded. A dispersed remnant stand of *Eucalyptus todtiana* woodland now dominated by planted *E. camaldulensis* subsp. *obtusa* and numerous single specimens of planted mid stratum species. Ground stratum dominated by weeds.	2012
EPBW	Eucalyptus Plantings in Banksia Woodland	Variably distributed mixed Eucalypt plantings (*E. botryoides*, *E. conferruminata*, *E. camaldulensis* subsp. *obtusa*), *Banksia attentuata*, *B. menziesii* Woodland over occasional *Xanthorhoea priesii* shrubs over **Ehrharta longiflora*, **Arctotheca calendula*, (with **Briza maxima* and **Ehrharta calycina* along northern strip of southern polygon) grassland/herbland. **Mapped within the Survey Area.**	Degraded to Very Degraded. An anthropogenic vegetation association dominated by mixed Eucalypt plantings within degraded remnant Banksia woodland. Ground stratum composed of weeds.	2012, 2013
MpAfPW	*Melaleuca preissiana* and *Agonis flexuosa* Planted Woodland	Lakeside planting of *Melaleuca preissiana* and *Agonis flexuosa* woodland over occasional *Melaleuca* aff. *quinquenervia*, *Callistemon phoeniceus*, *Juncus kraussii*, over **Ehrharta longiflora*, and **Cotula coronopifolia* grassland (above water line).	Very Degraded. An anthropogenic vegetation association bordering artificial lakes. However, appears to robustly protect lake banks.	2012

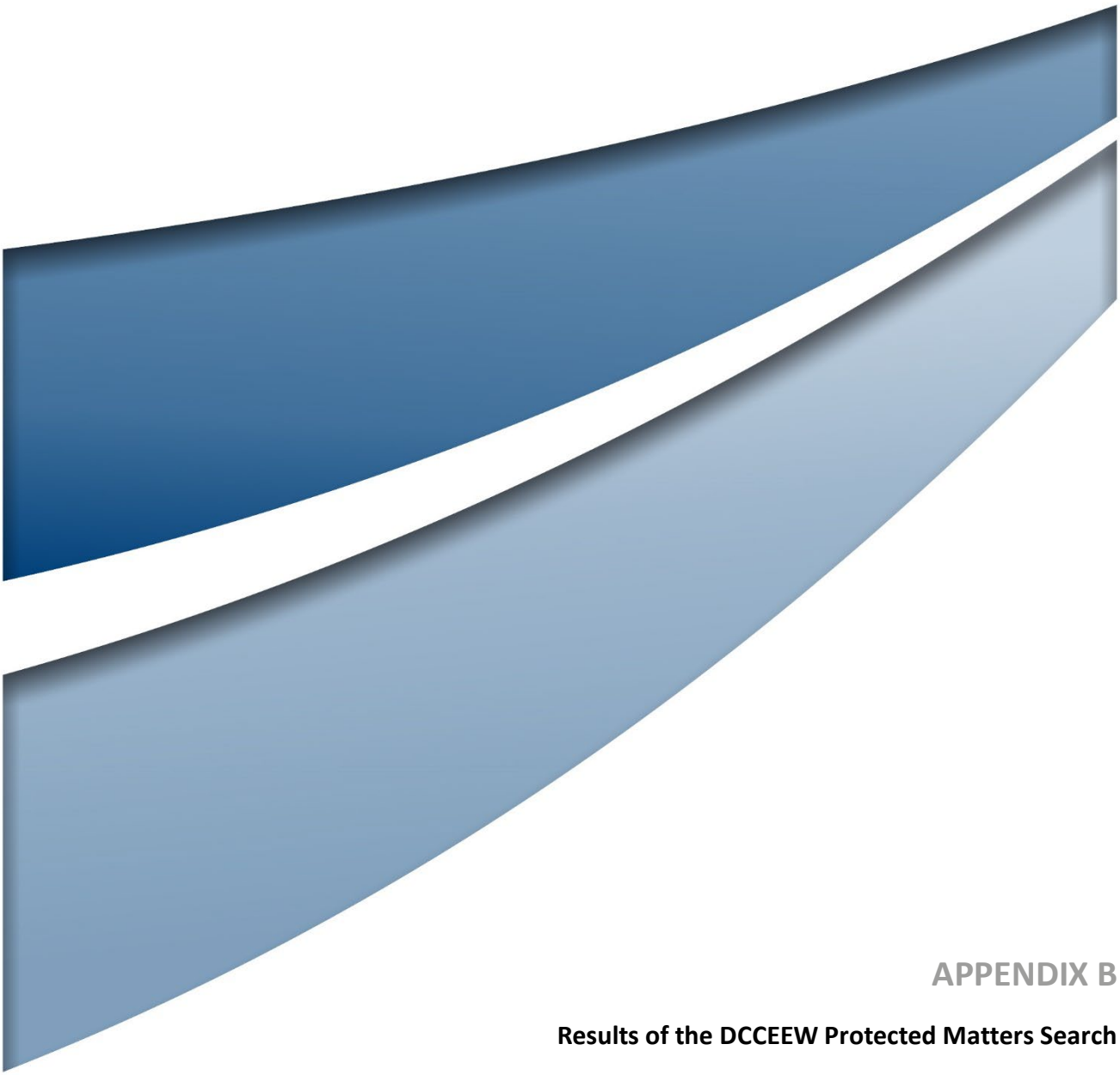
Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
CcW	*Corymbia calophylla* Woodland	*Corymbia calophylla* open woodland to woodland over *Xanthorrhoea preisii* and *Acacia saligna* (senescent) scattered low shrubland over **Ehrharta longiflora* dense grassland with occasional *Podotheca gnaphalioides* and **Zantedeschia aethiopica*. **Mapped within the Survey Area.**	Degraded. Remnant woodland highly impacted by past grazing. Upper stratum intact with sparse degraded mid stratum and weed-dominated ground stratum.	2012
ErW	*Eucalyptus rudis* Woodland	*Eucalyptus rudis* subsp. *rudis* open woodland to woodland over very occasional *Xanthorrhoea preissii* and *Hypocalymma angustifolia* over **Ehrharta longiflora* grassland with occasional **Arctotheca calendula* and **Zantedeschia aethiopica*.	Degraded to Good. Remnant woodland highly impacted by past grazing, upper stratum intact with sparse degraded mid stratum and a weed-dominated ground stratum.	2012
EtW	*Eucalyptus todtiana* Woodland	*Eucalyptus todtiana* woodland over *Regelia ciliata* scattered low shrubland over **Ehrharta longiflora*, **Hypochaeris glabra*, **Zantedeschia aethiopica* grassland/herbland.	Degraded. Loss of mid stratum with ground stratum composed of weeds.	2012
AsLW	*Acacia saligna* Low Woodland	Senescing *Acacia saligna* low woodland to open woodland over **Ehrharta longiflora*, **Arctotheca calendula*, **Zantedeschia aethiopica*, **Romulea rosea* var. *australis* grassland/herbland.	Degraded to Very Degraded. *Acacia saligna* is senescing (~60% dead), no mid stratum remains, ground stratum composed of weeds.	2012
AsRcT	*Acacia saligna* and *Regelia ciliata* Thicket	*Acacia saligna* thicket over *Regelia ciliata*, *Hypochalymma angustifolia* low heath over variable mix of *Drosera glanduligera*, **Moraea flaccida*, **Ehrharta longiflora*, **Arctotheca calendula* sparse grassland/herbland. **Mapped within the Survey Area.**	Good. Upper stratum and mid stratum intact though floristically simple, moderate weed density in ground stratum.	2012, 2013
AsBaBmOW	*Acacia saligna*, *Banksia attenuata*, and *Banksia menziesii* Open Woodland	*Acacia saligna* (with scattered *Banksia attenuata* and *B. menziesii*) open woodland over Juncus pallidus scattered sedgeland over **Ehrharta longiflora* (and occasional **Eragrostis curvula*) grassland. **Mapped within the Survey Area.**	Very Degraded to Degraded. Post-earthworks disturbance vegetation lining the artificial drainage ditch of the south boundary of the southern polygon.	2012, 2013

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
BmBaRcOW	*Banksia menziesii*, *Banksia attenuata*, *Regelia ciliata* Open Woodland	*Banksia menziesii, Banksia attenuata* open woodland over *Xanthorrhoea preissii*, *Regelia ciliata* scattered shrubland over *Hibbertia vaginata*, *Dasypogon bromeliifolius* scattered dwarf shrubland over **Ehrharta longiflora*, *Podotheca gnaphalioides*, **Hypochaeris glabra*, **Ursinia anthemoides*, and scattered **Zantedeschia aethiopica* grassland/herbland. **Mapped within the Survey Area**.	Degraded. Upper stratum structure intact, but mid stratum largely removed and floristically simple due to past grazing. Ground stratum dominated by weeds.	2012, 2013
BxErMrOW	Mixed Banksia, *Eucalyptus rudis*, and *Melaleuca ryeae* Open Woodland	*Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, (and scattered *Eucalyptus rudis* subsp. *rudis*) open woodland over *Xanthorrhoea preisii*, *Acacia saligna*, *Macrozamia fraseri* scattered shrubland over *Melaleuca ryeae* and *Dasypogon bromeliifolius* scattered dwarf shrubland over variable mixed **Ehrharta longiflora*, *Podotheca gnaphalioides*, **Arctotheca calendula*, and **Hypochaeris glabra* grassland/herbland. **Mapped within the Survey Area.**	Degraded. Upper stratum structure reasonably intact, but mid stratum largely removed and floristically simple due to past grazing. Ground stratum dominated by weeds. Dead and dying Banksias and *E. rudis* subsp. *rudis* suggest possibility of Dieback (Phytophthora) widespread within this association.	2012, 2013
XpMrLH	*Xanthorrhoea preisii* and *Melaleuca ryeae* Low Heath	*Xanthorrhoea preisii* and *Calitris pyramidalis* open low shrubland over *Melaleuca ryeae* low heath to shrubland over **Ehrharta longiflora* and **Arctotheca calendula* grassland with occasional **Zanthedeschia aethiopica*.	Good. Moderate disturbance to mid stratum probably due to past grazing with a weed dominated ground stratum.	2012
RcLH	*Regelia ciliata* Low Heath	*Melaleuca preissiana*, *Acacia saligna*, *Callitris pyramidalis* scattered shrubland over *Regelia ciliata* low heath over variable mix of *Drosera glanduligera*, **Moraea flaccida*, **Ehrharta longiflora*, **Arctotheca calendula*. **Mapped within the Survey Area.**	Degraded to Good. Structure reasonably intact but with ground stratum dominated by weeds. Rabbit warrens abundant.	2012, 2013
RcLS	*Regelia ciliata* Low Shrubland	*Regelia ciliata* (variably senescent) with occasional *Kunzea glabrescens* low open shrubland to shrubland over **Ehrharta longiflora*, **Arctotheca calendula*, **Hypochaeris glabra*, **Zantedeschia aethiopica* grassland/herbland.	Degraded. Shrubland composition simple with ground stratum completely dominated by weeds.	2012

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
EpODS	*Eremaea pauciflora* Open Dwarf Shrubland	Very scattered woodland of *Banksia attenuata*, *B. menziesii,* and planted *Eucalyptus* sp. over *Acacia saligna* (standing and fallen dead) and *Macrozamia fraseri* scattered shrubland over *Eremaea pauciflora* var. *pauciflora* open dwarf shrubland over *Podotheca gnaphalioides*, **Ehrharta longiflora*, **Ursinia anthemoides*, **Arctotheca calendula* herbland.	Degraded. Appears to have been mechanically disturbed in the past, followed by limited plantings of *Eucalyptus* sp. (supportive stakes present) and natural regeneration. Ground stratum dominated by weeds.	2012
PaMH	*Pentameris airoides* Mixed Herbland	Mixed, seasonally wet, open herbland composed of **Pentameris airoides* subsp. *airoides*, *Podotheca gnaphalioides*, **Ursinia anthemoides*, *Crassula colorata* var. *colorata*, **Hypochaeris glabra*, and *Drosera glanduligera*.	Degraded. Herbland dominated by weed species.	2012
JpDL	Sparse *Juncus pallidus* Drainage Line	Wet depressions often with anthropogenic drainage lines. Occasional remnant *Melaleuca preissiana* over sparse *Juncus pallidus* sedgeland over **Arctotheca calendula* (30%), **Moraea flaccida* (20%), and **Zantedeschia aethiopica* herbland. **Mapped within the Survey Area.**	Very Degraded. Dominated by ground layer weed species with no remnant vegetation beside occasional *Melaleuca preissiana* and sparse *Juncus pallidus*.	2012
EPAW	Eucalypt plantings in Acacia Woodland	Variably distributed mixed eucalypt plantings (*Eucalyptus botryoides*, *Eucalyptus conferruminata*, *Eucalyptus dendromorpha*, *Eucalyptus rudis* subsp. *rudis*, *Eucalyptus leucoxylon*) and *Acacia saligna* woodland, over **Ehrharta longiflora* and **Hordeum* sp. low open grassland. **Mapped within the Survey Area.**	Degraded. Ground stratum dominated by weeds with rehabilitation mixed eucalypt and *Acacia saligna* plantings.	2013
PCqMcS	Planted *Calothamnus quadrifidus* and *Melaleuca cordata* Shrubland	Planted *Calothamnus quadrifidus* and *Melaleuca cordata* tall shrubland, over **Eragrostis curvula* and **Ehrharta longiflora* mid open grassland. **Mapped within the Survey Area.**	Degraded. Planted upper stratum intact with no mid stratum and a weed dominated ground stratum.	2013

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
AsCpS	*Acacia saligna* and *Callitris pyramidalis* Shrubland	*Acacia saligna* tall sparse shrubland over *Callitris pyramidalis*, *Hypocalymma angustifolium* and *Melaleuca ryeae* mid closed shrubland, over *Dielsia stenostachya* and **Hordeum* sp. low open sedgeland/grassland. **Mapped within the Survey Area.**	Good. Upper stratum with many burnt tall shrubs. Mid stratum healthy, with a few weed species in the ground stratum.	2013
MpS	*Melaleuca preissiana* Shrubland	*Melaleuca preissiana* tall open shrubland to shrubland (with variable mix of planted *Eucalyptus grandis* and *Acacia saligna*), over *Regelia ciliata*, *Typha domingensis* and *Juncus pallidus* mid shrubland/tall rushland/sedgeland over **Ehrharta longiflora* low grassland. **Mapped within the Survey Area.**	Good. Upper and mid strata intact with few weed species within the ground stratum.	2013
XpSS	*Xanthorrhoea preissii* Sparse Shrubland	An area that has been previously partially cleared and planted. *Eucalyptus* sp. (unidentified, planted trees) low isolated trees, over *Xanthorrhoea preissii* mid sparse shrubland, over **Ehrharta longiflora* low open grassland. **Mapped within the Survey Area.**	Degraded. Large areas of disturbed bare soil. All strata very patchy with no solid cover spanning all three strata. Weeds present in the ground stratum.	2013
CpLH	**Conyza parva* Low Herbland	*Acacia saligna* tall isolated shrubs, over **Conyza parva* low herbland, over **Hordeum* sp. and **Cynodon dactylon* low grassland.	Very Degraded. Upper stratum and mid stratum largely removed. Ground stratum dominated by weeds. Originally completely cleared for powerline access.	2013
CcSH	*Cotula coronopifolia* Sparse Herbland	Area subject to inundation and waterlogging. **Cotula coronopifolia* low sparse herbland, over **Hordeum* sp. and **Polypogon monspeliensis* low open grassland.	Very Degraded. Upper stratum and mid stratum removed. Ground stratum dominated by weeds.	2013
DsLS	*Dielsia stenostachya* Low Sedgeland	**Conyza parva*, *Juncus pallidus* and *Typha domingensis* tall herbland/sedgeland/rushland, over *Dielsia stenostachya* low closed sedgeland.	Very Degraded. Upper and mid strata removed but ground stratum intact, dominated by weeds.	2013

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
TdR	Typha domingensis Rushland	*Acacia saligna* and *Melaleuca preissiana* tall isolated shrubs, over *Typha domingensis* tall closed rushland, over **Paspalum dilatatum*, **Conyza parva* sparse shrubland/grassland and scattered small clumps of **Zantedeschia aethiopica* (Arum Lily).	Good. Upper stratum scattered but reasonably intact. Mid stratum present. Scattered weeds in the ground stratum. Mostly cleared for powerlines.	2013
TdDL	*Typha domingensis* Drainage Line	Flowing drainage line with isolated *Melaleuca preissiana* and *Acacia saligna* tall shrubs, over *Typha domingensis* tall closed rushland, over **Ehrharta longiflora* low open grassland and scattered **Zantedeschia aethiopica* (Arum Lily).	Good. Upper and mid strata present with scattered weeds throughout the ground stratum.	2013
Cpwr / CPint	Cleared for Powerlines / Cleared for Plant	Cleared for powerlines and road access. Weed species sprouting (**Arctotheca calendula*, **Solanum nigrum*, **Sonchus asper*, **Hordeum* sp., **Eragrostis curvula*, and **Ehrharta longiflora*) Cleared for plant. Contains scattered weed grass species (**Hordeum* sp., **Eragrostis curvula*, and **Ehrharta longiflora*). **Mapped within Survey Area.**	Very degraded. All strata levels removed.	2023



APPENDIX B

Results of the DCCEEW Protected Matters Search

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 13-Aug-2024

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	38
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	10
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	8
Regional Forest Agreements:	1
Nationally Important Wetlands:	1
EPBC Act Referrals:	13
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area	In buffer area only
Empodisma peatlands of southwestern Australia	Endangered	Community may occur within area	In feature area
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Shrublands and Woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus			
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calyptorhynchus banksii naso](#) Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Leipoa ocellata](#) Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Zanda latirostris listed as Calyptorhynchus latirostris](#) Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
FISH			
[Galaxiella nigrostriata](#) Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area	In feature area
INSECT			
[Hesperocolletes douglasi](#) Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
OTHER			
Westralunio carteri			
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area	In feature area
PLANT			
Acacia anomala			
Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Andersonia gracilis			
Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area	In feature area
Anigozanthos viridis subsp. terraspectans			
Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Banksia mimica			
Summer Honeypot [82765]	Endangered	Species or species habitat may occur within area	In feature area
Caladenia huegelii			
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caleana dixonii listed as Paracaleana dixonii			
Sandplain Duck Orchid [87944]	Endangered	Species or species habitat may occur within area	In feature area
Chamelaucium lullfitzii listed as Chamelaucium sp. Gingin (N.G.Marchant 6)			
Gingin Wax [92777]	Endangered (listed as Chamelaucium sp. Gingin	Species or species habitat known to occur within area	In feature area
Conospermum densiflorum subsp. unicephalatum			
One-headed Smokebush [64871]	Endangered	Species or species habitat may occur within area	In buffer area only
Darwinia foetida			
Muchea Bell [83190]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Diplolaena andrewsii			
[6601]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area	In feature area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area	In feature area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat may occur within area	In buffer area only
Grevillea althoferorum [64906]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Grevillea corrugata a shrub [65445]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Grevillea curviloba subsp. curviloba Curved-leaf Grevillea [64908]	Endangered	Species or species habitat known to occur within area	In feature area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat known to occur within area	In feature area
Hypocalymma sylvestre chittering Myrtle [86384]	Endangered	Species or species habitat known to occur within area	In buffer area only
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ptychosema pusillum			
Dwarf Pea [11268]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Synaphea sp. Fairbridge Farm (D.Papenfus 696)			
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Thelymitra dedmaniarum			
Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area	In feature area
Thelymitra stellata			
Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - GIN GIN SATELLITE AIRFIELD [50112]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50094]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50091]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50069]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50071]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50073]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50088]	WA	In buffer area only
Defence - MUCHEA ARMAMENT RANGE [50095]	WA	In buffer area only
Defence - PEARCE - AP6 OBSTRUCTION BEACON NO.3 [50241]	WA	In buffer area only
Unknown		
Commonwealth Land - [50856]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Barracca	Nature Reserve	WA	In buffer area only
Breera Road	Nature Reserve	WA	In buffer area only
Bullsbrook	Nature Reserve	WA	In buffer area only
Chandala	Nature Reserve	WA	In buffer area only
Timaru	Nature Reserve	WA	In buffer area only
Unnamed WA02336	Nature Reserve	WA	In buffer area only
Unnamed WA44622	Nature Reserve	WA	In buffer area only
Unnamed WA50678	Nature Reserve	WA	In buffer area only

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
South West WA RFA	Western Australia	In buffer area only

Nationally Important Wetlands		[Resource Information]
Wetland Name	State	Buffer Status
Chandala Swamp	WA	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
"Muchea 6" Clay Pit Expansion project	2022/09342		Assessment	In buffer area only
Gonneville Nickel-Copper-Platinum Group Element Mine Development Project	2024/09839		Assessment	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Muchea Silica Sand Project	2022/09370		Referral Decision	In buffer area only
Controlled action				
Clearing and development of Lot 9001 Rosewood Drive, Chittering, WA	2016/7759	Controlled Action	Further Information Request	In buffer area only
Great Northern Highway-Bindoon Bypass, WA	2017/8035	Controlled Action	Post-Approval	In buffer area only
Great Northern Highway Muchea to Wubin Upgrade Stage 2 - Muchea North, WA	2016/7656	Controlled Action	Post-Approval	In buffer area only
Muchea Industrial Precinct, Part of Lot 102 Great Northern Highway, Muchea, WA	2017/8119	Controlled Action	Post-Approval	In buffer area only
Natural Gas Pipeline Expansion	2006/2813	Controlled Action	Post-Approval	In buffer area only
Perth-Darwin National Highway alignment (Swan Valley Section), WA	2013/7042	Controlled Action	Post-Approval	In buffer area only
Proposed Transport Depot & Warehouse Development - Lot 195 Great Northern Highway, Muchea	2017/7901	Controlled Action	Post-Approval	In buffer area only
Sand quarry development, Lot 2, Bingham Road, Bullsbrook, WA	2017/8104	Controlled Action	Assessment Approach	In buffer area only
Not controlled action				
Boral Bricks Western Australia Pty Ltd, Muchea East Road, Muchea, Western Australia	2019/8522	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

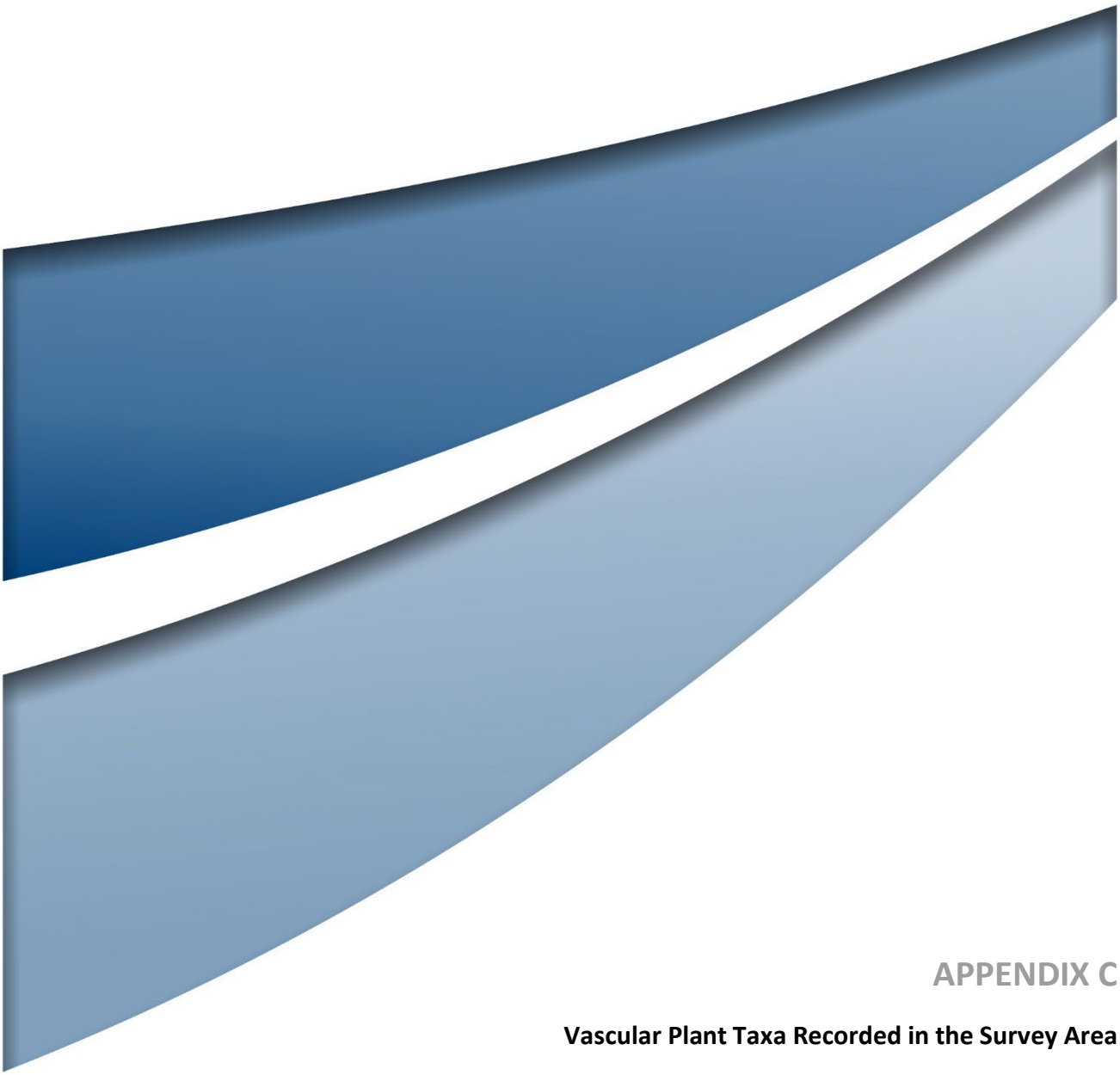
This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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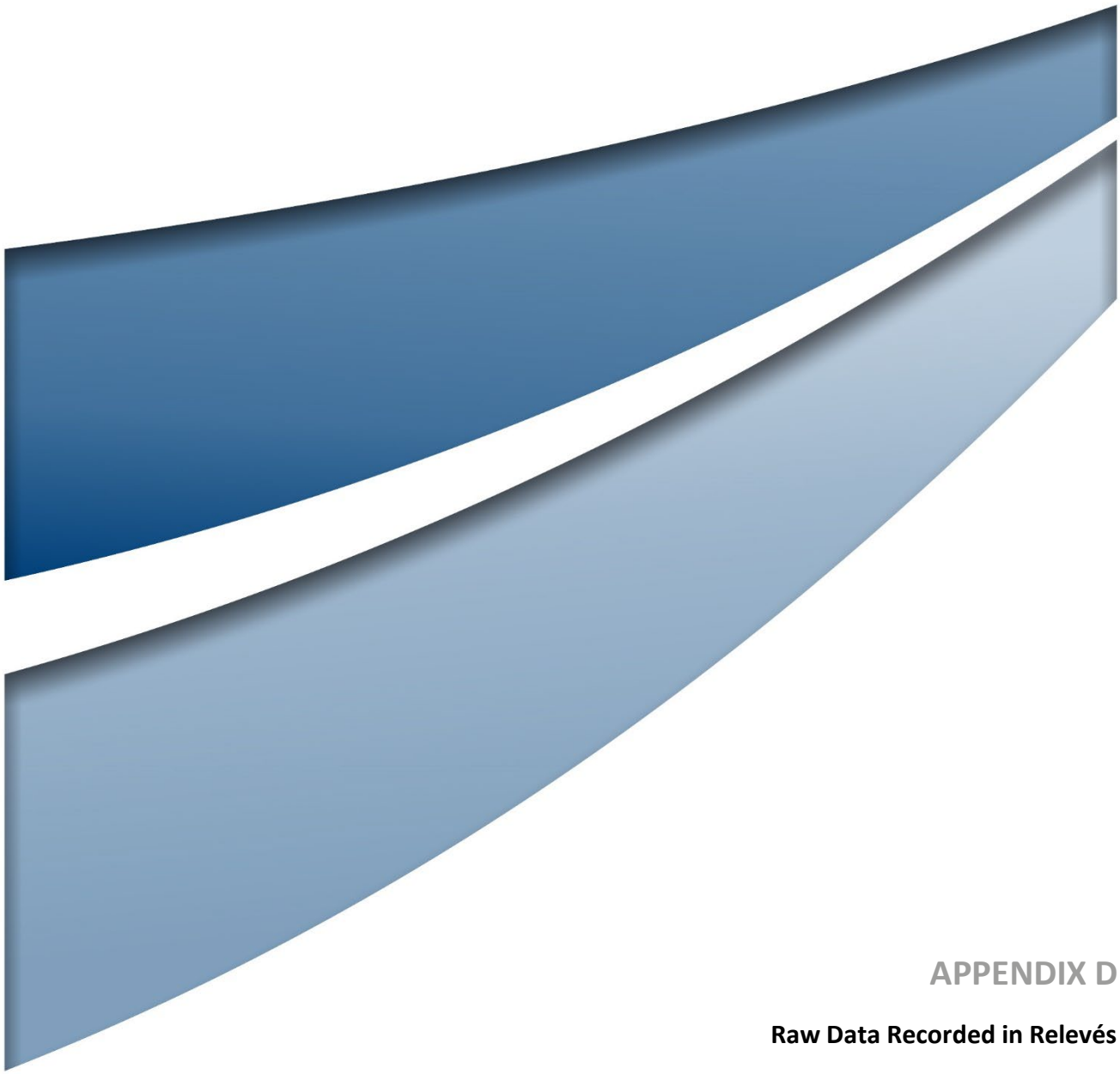


APPENDIX C

Vascular Plant Taxa Recorded in the Survey Area

Family	Taxon
Araceae	**Zantedeschia aethiopica*
Asteraceae	**Arctotheca calendula*
	**Dittrichia graveolens*
	**Hypochaeris glabra*
	Myriocephalus ?helichrysoides
	Podotheca sp.
	**Ursinia anthemoides*
Bignoniaceae	**Jacaranda mimosifolia*
Casuarinaceae	**Casuarina cunninghamiana* subsp. *cunninghamiana*
	Casuarina obesa
Chenopodiaceae	*Dysphania pumilio*
Crassulaceae	*Crassula decumbens*
Cupressaceae	*Callitris pyramidalis*
Dasypogonaceae	*Dasypogon bromeliifolius*
Fabaceae	**Acacia iteaphylla*
	**Acacia podalyriifolia*
	Acacia saligna
	Acacia sessilispica
	Jacksonia sternbergiana
Iridaceae	**Gladiolus caryophyllaceus*
	**Ixia* sp.
Juncaceae	*Juncus pallidus*
Lamiaceae	*Westringia dampieri*
Lauraceae	*Cassytha racemosa* forma *racemosa*
Myrtaceae	*Agonis flexuosa*
	Astartea scoparia
	Callistemon glaucus
	Calothamnus quadrifidus subsp. *quadrifidus*
	Calothamnus rupestris
	Corymbia calophylla
	**Eucalyptus botryoides*
	Eucalyptus camaldulensis
	Eucalyptus gomphocephala
	**Eucalyptus grandis*
	**Eucalyptus leucoxylon*
	Eucalyptus macrandra

Family	Taxon
	Eucalyptus rudis
	Eucalyptus sp. (planted)
	Eucalyptus todtiana
	Eucalyptus utilis
Myrtaceae cont.	*Kunzea glabrescens*
	Melaleuca concreta
	Melaleuca leucandra
	Melaleuca nesophila
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca ryeae
	Melaleuca seriata
	Melaleuca striata
	Melaleuca trichophylla
	Melaleuca viminea subsp. *viminea*
	Regelia ciliata
Orchidaceae	*Caladenia* sp.
Plantaginaceae	**Callitriche stagnalis*
Poaceae	**Briza maxima*
	**Ehrharta calycina*
	**Eragrostis curvula*
	Paspalidium sp.
	**Poa annua*
Polygonaceae	*Muehlenbeckia adpressa*
	**Rumex conglomeratus*
Proteaceae	*Banksia attenuata*
	Banksia ilicifolia
	Banksia menziesii
	Grevillea fililoba (P1) (planted)
Restionaceae	*Desmocladus ?flexuosus*
Santalaceae	*Exocarpos sparteus*
Typhaceae	*Typha domingensis*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia riedlei*



APPENDIX D

Raw Data Recorded in Relevés

Site Name:	R01
Site Type:	RELEVE
Survey Date:	17/07/2024
GPS Location:	GDA94 Zone 50 401869.3E 6510746.79N
Landform Type:	Flat
Slope Class:	Very Gently Inclined (1°)
Aspect:	SE
Soil Type:	Sand
Soil Colour:	White (other)
Rock Outcrop:	No bedrock exposed
CF Abundance:	0%
Vegetation Condition:	Southern Vegetation Condition - 5 - Degraded
Disturbance:	Grazing, Clearing, Weeds, Animal, Proximity to refinery (other)
Fire:	5
Habitat:	Low open woodland (to 4 m) over sparse shrubs (to 1 m) over low herbs / grasses (to 0.1 m)
Comments:	Pasture weeds (including ?*Ehrharta* sp.) - 60% cover

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
**Arctotheca calendula*	0.1	5
Banksia attenuata	4	6
Banksia ilicifolia	1	1
Banksia menziesii	4	6
Crassula decumbens	0.1	3
Eucalyptus todtiana		
**Hypochaeris glabra*	0.1	5
Macrozamia riedlei	2	1
Melaleuca ryeae	1	1
Melaleuca trichophylla		
Podotheca sp.	0.1	2
Xanthorrhoea preissii	1	2

PHOTOS



Site Name:	R02
Site Type:	RELEVE
Survey Date:	17/07/2024
GPS Location:	GDA94 Zone 50 401707.07E 6510662.78N
Landform Type:	Flat
Slope Class:	Very Gently Inclined (1°)
Aspect:	WNW
Soil Type:	Sand
Soil Colour:	White (other)
Rock Outcrop:	No bedrock exposed
CF Abundance:	0%
Vegetation Condition:	Southern Vegetation Condition - 5 - Degraded
Disturbance:	Grazing, Clearing, Weeds, Animal
Fire:	>5 years
Habitat:	Isolated trees over open heath (to 1.5 m) over herb / grass layer (0.1 m)
Comments:	Pasture weeds (including ?*Ehrharta* sp.) - 15% cover

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
**Arctotheca calendula*	0.1	10
Eucalyptus todtiana	6	1
**Hypochaeris glabra*	0.1	5
Macrozamia riedlei	1.5	1
Melaleuca ryeae	0.7	1.5
Podotheca sp.	0.1	5
Regelia ciliata	1.5	15
Xanthorrhoea preissii	1.5	7

PHOTOS



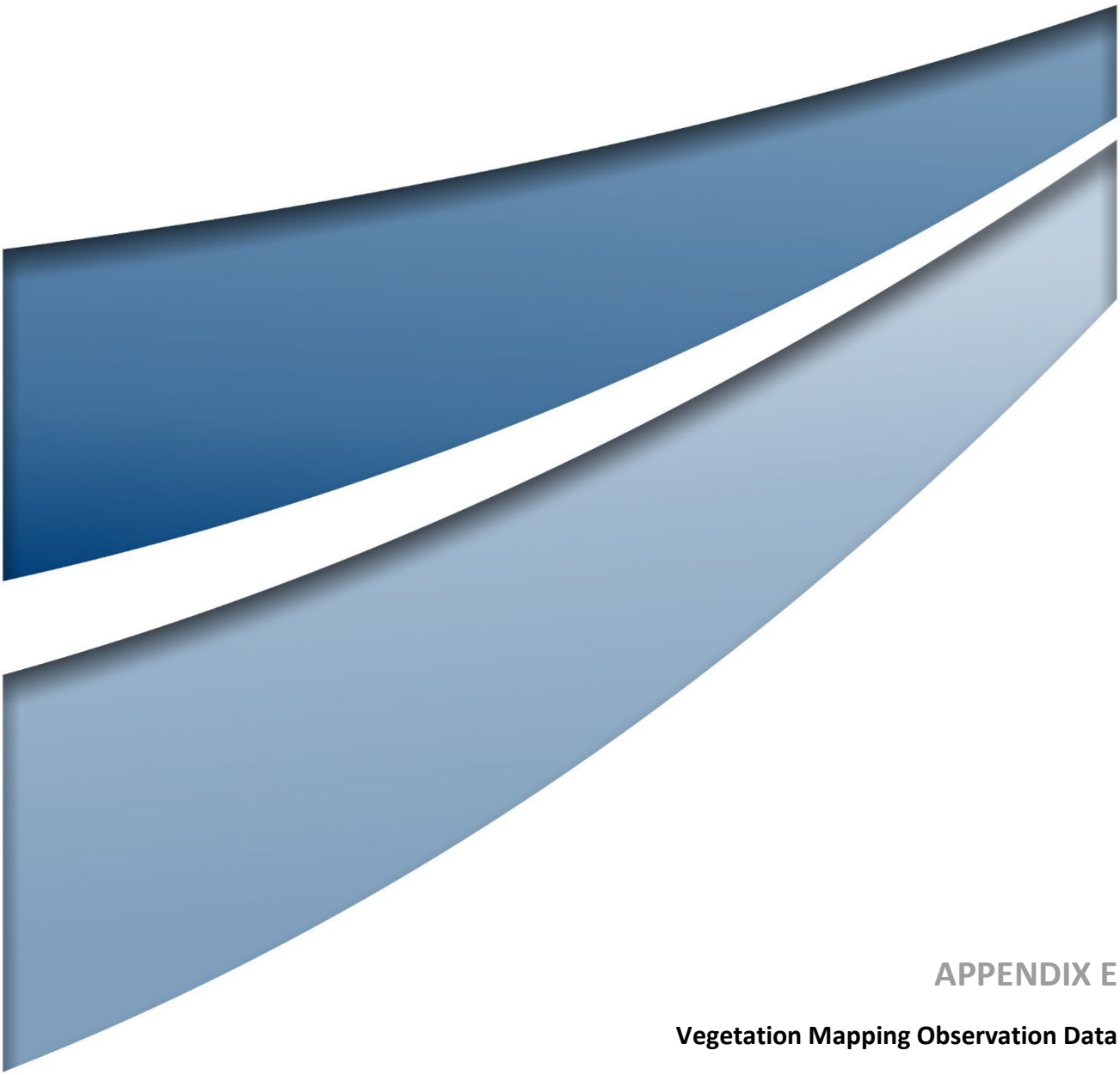
Site Name:	R03
Site Type:	RELEVE
Survey Date:	17/07/2024
GPS Location:	GDA94 Zone 50 401865.94E 6511223.2N
Landform Type:	Flat
Slope Class:	Level (0°)
Soil Type:	Sand
Soil Colour:	Grey
Rock Outcrop:	No bedrock exposed
CF Abundance:	0%
Vegetation Condition:	Southern Vegetation Condition - 5 - Degraded
Disturbance:	Grazing, Clearing, Weeds, (other) - Proximity to plant
Fire:	>5 years
Habitat:	Very open woodland (to 5 m) over very open shrubland (to 1 m) over weedy understorey
Comments:	*Ehrharta* sp. and *Sonchus* sp. present

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
**Arctotheca calendula*	0.1	5
Banksia attenuata	4	4
Banksia menziesii	5	4
**Eucalyptus leucoxylon*	4	0.1
Eucalyptus todtiana	5	4
**Gladiolus caryophyllaceus*	0.5	0.1
**Hypochaeris glabra*	0.1	5
**Ixia* sp.	0.3	0.1
Melaleuca seriata	1	5
**Poa annua*	0.1	5
Podotheca sp.	0.1	5
Xanthorrhoea preissii	1	6
**Zantedeschia aethiopica*	0.2	0.2

PHOTOS





APPENDIX E

Vegetation Mapping Observation Data

GPS Locations are GDA94, Zone 50

VMN	Easting	Northing	Description
MN01	401946	6510849	Completely Degraded, grey sand, wet but not flooded. Originally mapped as planted *Calothamnus quadrifidus*, *Melaleuca ryeae*, many introduced grasses; *Acacia sessilispica*, **Eragrostis curvula.*
MN02	401973	6510848	Completely Degraded, grey sand. *Xanthorrhoea preissii*, very low density, many introduced grasses.
MN03	402038	6510899	Completely degraded, grey sand. *Eucalyptus camaldulensis*, **Eucalyptus leucoxylon*, **Zantedeschia aethiopica*; weedy understorey.
MN04	402054	6510848	Completely Degraded, dark grey loamy sand, wet. **Ixia sp.*, *Acacia saligna* (to W of WP). *Typha domingensis* under powerline.
MN05	402055	6510816	Dense *Typha domingensis* under power line, very wet (inundated), Good to Degraded. **Callitriche stagnalis*, *Myriocephalus ?helichrysoides*, **Zantedeschia aethiopica*, *Acacia saligna* on perimeter of *Typha domingensis.*
MN06	402026	6510844	Originally mapped as EPAW. Planted *Eucalyptus camaldulensis* over *Melaleuca concreta*, **Ixia sp.*, degraded understorey.
MN07	401988	6510786	Dense *Callitris pyramidalis* – much death; *Astartea scoparia*, *Melaleuca ryeae*, minor grassy/weedy incursion.
MN08	401979	6510651	Outside of survey area. *Typha domingensis*- dominated wetland, **Zantedeschia aethiopica*, **Callitriche stagnalis.*
MN09	402043	6510572	Outside of survey area. *Typha domingensis*, **Zantedeschia aethiopica*
MN10	401672	6510531	Degraded. *Melaleuca rhaphiophylla*, *Eucalyptus camaldulensis*, *Eucalyptus gomphocephala*, *Acacia saligna* (sump side of track). Most veg planted, over introduced pasture grasses. *Melaleuca preissiana*, *Casuarina obesa*, *Regelia ciliata*, *Caladenia* sp., all species very sparse. *Ursinia anthemoides*, *Hypochaeris glabra*, *Astartea scoparia.*
MN11	401787	6510435	Degraded, kangaroo evidence. *Melaleuca viminea* subsp. *viminea* over introduced pasture grasses, occasional *Acacia saligna* on sump side, **Zantedeschia aethiopica*, limestone gabions on s side, limestone on track. *Melaleuca preissiana*, occasional *Eucalyptus gomphocephala*, *Eucalyptus* sp. planted.
MN12	401907	6510499	Degraded. Very wet, standing water. *Melaleuca preissiana*, *Acacia saligna*, *Melaleuca viminea* subsp. *viminea*, *Eucalyptus rudis*, **Zantedeschia aethiopica* over pasture weeds, **Ixia sp.* lots of dead *Acacia saligna.*
MN13	401897	6510526	Degraded/Completely Degraded, planted *Eucalyptus camaldulensis*, **Zantedeschia aethiopica*, pasture weeds, a lot of dead *Acacia saligna.*
MN14	401879	6510564	**Eucalyptus botryoides.*
MN15	401908	6510664	Degraded. *Callitris pyramidalis* (2.5 m), *Regelia ciliata* (mostly dead, 1 m - 40% alive, 2% dead), **Zantedeschia aethiopica*, *Hypochaeris glabra*, *Podotheca* sp, *Xanthorrhoea preissii*; annual pasture grasses.
MN16	401938	6510678	Degraded. *Callitris pyramidalis* over pasture weeds, **Hypochaeris glabra*, **Sonchus* sp. **Acacia saligna.* To east is power line/wetland + *Melaleuca concreta* over weeds.
MN17	401898	6510717	Degraded, man-made drainage to north. *Banksia menziesii* (several trees newly dead), pasture weeds. Occasional *Xanthorrhoea preissii* + *Regelia ciliata* + *Callitris pyramidalis*, **Ixia sp.*, **Hypochaeris glabra.*
MN18	401880	6510712	Drainage - *Callitris pyramidalis, Regelia ciliata*, *Juncus pallidus*, *Astartea scoparia*, weedy grasses, *Hypochaeris glabra*, *Eucalyptus rudis.*

VMN	Easting	Northing	Description
MN19	401891	6510772	Degraded. Patch of *Kunzea glabrescens*, dead *Regelia ciliata* (to 1.5 m) (very dense small thicket to 3 m); very few weeds (due to less light), right next to track/disturbance (historical) by machinery.
MN20	401773	6510702	Completely degraded. Historically impacted area; was originally *Banksia* woodland (dead). *Melaleuca ryeae* to 0.5 m, alive *Banksia attenuata/ Banksia menziesii* to north; drain to west.
MN21	401778	6510646	Degraded. *Typha domingensis* in drain, weedy banks with **Rumex* sp. *Acacia saligna*, *Eucalyptus rudis*, *Eucalyptus camaldulensis.*
MN22	401752	6510638	Completely Degraded. *Eucalyptus grandis* patch + near drain with planted *Acacia* species.
MN23	401688	6510612	*Melaleuca preissiana*, planted Eucalypts, *Regilia ciliata*, weedy understorey grasses/herbs, *Acacia saligna*, *Kunzea glabrescens* - No Banksia species.
MN24	401640	6510647	Degraded. *Eucalyptus todtiana* (to 6 m, 5%); *Banksia attenuata*, *Banksia menziesii* (to 3.5 m, 3.5%); *Xanthorrhoea preissii*, *Melaleuca ryeae* (to 1 m), *Regelia ciliata*, *Banksia ilicifolia* over pasture weeds (*Ehrharta* sp., *Hypochaeris glabra*), **Zantedeschia aethiopica.* Many dead Banksia logs, evidence of burning. Dense *Banksia* along northern Very degraded understorey. *Muehlenbeckia adpressa.*
MN25	401705	6510715	Degraded. *Banksia attenuata*, *Banksia menziesii* (on southern side, occasional deaths) with *Eucalyptus todtiana*, occasional *Xanthorrhoea preissii* over pasture weeds, **Eucalyptus leucoxylon*, *Macrozamia riedlei*, *Eucalyptus* sp. (planted). Opposite side of fence is *Eucalyptus camaldulensis*, occasional *Banksia menziesii*, *Agonis flexuosa* (planted) over weeds. *Melaleuca striata* – planted.
MN26	401679	6510816	Completely Degraded. Planted Eucalyptus spp. over weeds (**Ehrharta* sp., *?*Cotula* sp., **Hypochaeris glabra*, **Paspalidum sp.*. *Eucalyptus camaldulensis*, *Eucalyptus* sp. (planted), *Eucalyptus grandis* (dead), *Eucalyptus camaldulensis, *Jacaranda mimosifolia*, *Melaleuca nesophila*, *Callistemon glaucus*, *Eucalyptus utilis* (planted).
MN27	401661	6510774	Completely Degraded. Planted *Eucalyptus camaldulensis* over weeds (**Ehrharta* sp., **Arctotheca calendula*). *Caladenia* sp., **Ehrharta calycina*, *Calothamnus rupestris*, *Chamelaucium uncinatum* (planted).
MN28	401629	6510884	Completely Degraded. Planted *Eucalyptus camaldulensis* over weeds (**Hypochaeris glabra*, **Ursinia anthemoides*, **Ehrharta* sp., **Arctotheca calendula*, **Ehrharta calycina*, GOK (R01-01), **Paspalidum sp.*
MN29	401539	6510935	Completely degraded: same as MN28 + *Eucalyptus sideroxylon.*
MN30	401510	6510976	*Regelia ciliata*, dead *Banksia attenuata* (1x alive), *Xanthorrhoea preissii* on north side of drain. Planted *Melaleuca leucandra.*
MN31	401466	6510923	Planted Eucalyptus species dominated by *Eucalyptus camaldulensis*. *Regelia ciliata* (mix of healthy and dead), *Banksia menziesii, Westringia dampieri*, *Dasypogon bromeliifolius*, *Xanthorrhoea preissii*, *Melaleuca preisiana*, *Calothamnus rupestris*, *Callitris pyramidalis, Acacia saligna*, *Grevillea fililoba* (P1) – planted, over weeds (dominated by *Ehrharta* sp.).
MN32	401457	6510882	*Typha* sp., *Acacia saligna*, planted *Eucalyptus sideroxylon* + *Eucalyptus camaldulensis* over weedy pasture spp. Man-made sump area.
MN33	401485	6510786	Degraded. Wetland with mechanical disturbance, mix of planted + natural species. *Eucalyptus rudis* (5 m), thicket of *Astartea scoparia*, *Melaleuca preissiana*, *Melaleuca rhaphiophylla*, *Melaleuca viminea* subsp. *viminea*.

VMN	Easting	Northing	Description
			Pasture weeds (*Ehrharta* sp., *Hypochaeris glabra*ra), **Ixia sp.*, **Zantedeschia aethiopica*. *Melaleuca leucandra*, **Acacia iteaphylla*. Rabbits.
MN34	401509	6510727	Continuation of wetland, *Eucalyptus rudis* open woodland with scattered *Melaleuca preissiana* + *Astartea scoparia* over pasture weeds. Occasional planted Eucalyptus sp, *Regelia ciliata*, *Desmocladus ?flexuosus*, *Exocarpos sparteus*, **Ursinia anthemoides.*
MN35	401930	6511121	Planted **Eucalyptus grandis*, occasional shrubs over weeds grasses/pasture weeds. *Calothamnus quadrifidus*, **Briza maxima*, **Eragrostis curvula*. *Melaleuca ryeae*, **Eucalyptus utilis*, *Acacia saligna.*
MN36	401963	6511056	Completely degraded. *Eucalyptus **sideroxylon* and planted Agonis flexuosa over weeds. **Acacia iteaphylla*. **Zantedeschia aethiopica* in drain adjacent to shed + **Paspalum* sp.
MN37	402140	6511046	Wetland/pond, pasture weeds. **Eragrostis curvula*, *Melaleuca rhaphiophylla*, *Typha domingensis*. Completely degraded. Rabbits.
MN38	402094	6511077	Planted Eucalyptus trees with *Agonis flexuosa*, *Melaleuca rhaphiophylla* on edges of wetland, pasture weeds (**Ehrharta* sp., **Arctotheca calendula*, **Hypochaeris glabra*) **Zantedeschia aethiopica*, *Melaleuca viminea* subsp. *viminea*, **Acacia podalyriifolia.*
MN39	402129	6511159	*Completely Degraded.* **Eucalyptus macrandra* - planted along fenceline. *Eucalyptus rudis* low woodland over pasture weeds. **Ixia sp.*, **Arctotheca calendula.*, **Hypochaeris glabra*, **Zantedeschia aethiopica.*
MN40	402057	6511321	**Eucalyptus macrandra*, *Melaleuca preissiana*, *Eucalyptus rudis*, **Eucalyptus camaldulensis*, **Eucalyptus grandis* over weeds (*Ehrharta* sp., **Ursinia anthemoides*). Completely degraded.
MN41	402106	6511235	*Eucalyptus rudis*, *Eucalyptus camaldulensis*, **Eucalyptus grandis* (all planted) over weeds (*Hypochaeris glabra*, *Arctotheca calendula*, *Ehrharta* sp., *Ursinia anthemoides*). Completely degraded.
MN42	402004	6511352	Similar to MN40 and MN41.
MN43	401967	6511324	*Melaleuca rhaphiophylla* on low area, pasture weeds, **Zantedeschia aethiopica, **Rumex conglomeratus*. Green waste pile, soil disturbance.
MN44	401957	6511291	Small degraded area of *Melaleuca rhaphiophylla* (to 4 m) with planted *Eucalyptus camaldulensis* over weeds (**Ehrharta* calycinus, **Sonchus* sp.), *Juncus pallidus*), *Melaleuca concreta.* Area is damp, moss present.
MN45	401972	6511270	Similar notes to MN44.
MN46	401909	6511219	Degraded. Woodland (to 12 m) over open shrubland (to 4 m) over sparse shrubs (0.5 m) over introduced grasses/herbs. *Corymbia calophylla*, *Acacia saligna*, *Melaleuca preissiana*, *Jacksonia sternbergiana* (2 m), *Regelia ciliata*, **Zantedeschia aethiopica*, **Ehrharta* sp., **Hypochaeris glabra*ra.
MN47	401840	6511238	Degraded. *Banksia attenuata*, *Banksia menziesii* (some nearly dead) *Xanthorrhoea preissii*, *Melaleuca seriata*, *Dasypogon bromeliifolius*, same weeds as R03, significant weedy understorey. *Eucalyptus todtiana* (not as many as R03), *Regelia ciliata*, *Melaleuca trichophylla.*
MN48	401875	6511282	Good. *Banksia attenuata* (dead and alive), *Corymbia calophylla*, *Melaleuca preissiana*, *Xanthorrhoea preissii*(2.5 m)(6%), *Dasypogon bromeliifolius*, *Melaleuca seriata* (10%), *Cassytha racemosa* forma *racemosa*. Significant weedy understorey per R03. Note this location is immediately north and outside of the Survey Area.
MN49	401448	6511126	Planted *Eucalyptus camaldulensis* along road edge. Occasional *Xanthorrhoea preissii* + weedy grasses.

VMN	Easting	Northing	Description
MN50	401411	6510999	Completely Degraded. Planted *Eucalyptus camaldulensis;* 1 x remnant *Eucalyptus marginata*, **Casuarina cunninghamiana* subsp. *cunninghamiana.* Weedy understorey.
MN51	401490	6511019	Completely Degraded. Planted trees over weedy understorey. *Eucalyptus camaldulensis*, *Corymbia calophylla* (remnants), **Zantedeschia aethiopica*, *Calothamnus* (unknown sp.) *Agonis flexuosa.*
MN52	401291	6510839	Completely Degraded (cleared, weeds, kangaroos). *Eucalyptus rudis*, *Melaleuca rhaphiophylla* (8 m) over weedy pasture grasses (*Arctotheca calendula, *Ixia sp., *Ehrharta* sp., **Oxalis* sp., **Dittrichia graveolens*, *Dysphania pumilio.* Trees fringe the creekline.
MN53	401236	6510648	Planted *Eucalyptus camaldulensis*, *Eucalyptus macrandra*, occasional *Corymbia calophylla* over pasture weeds. Completely degraded understorey (**Ehrharta* sp., **Ixia sp.*, **Ursinia anthemoides*).
MN54	401285	6510685	Start of *Eucalyptus rudis* in area influenced by the creek. Very weedy understorey (**Ixia sp.*, pasture weeds*).* Completely Degraded.
MN55	401201	6510765	Open *Corymbia calophylla* woodland (8 m, 10%), over weedy understorey (**Arctotheca calendula*, **Ursinia anthemoides*, **Ehrharta* sp., **Lupinus* sp., *Podotheca* sp. (80% weed cover). *Eucalyptus rudis* to creekline to north vehicle track. *Desmocladus ?flexuosus.*
MN56	401166	6510789	*Melaleuca preissiana*, *Melaleuca rhaphiophylla*, *Eucalyptus rudis* with occasional *Corymbia calophylla* to north towards creek.
MN57	401129	6510653	Patch of *Eucalyptus rudis*, weedy understorey, *Desmocladus ?flexuosus*, *Astartea scoparia.*



APPENDIX F

Likelihood of Occurrence of Significant Flora Taxa

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Acacia anomala	T (EPBC & WA - VU)	August to September	Perennial, shrub	Lateritic soils. Slopes.	4.5 km E	Yes	Unlikely: habitat not considered to be present
Andersonia gracilis	T (EPBC - EN, WA - VU)	September to November	Perennial, shrub	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	No records within 10 km of Survey Area	Yes	Unlikely: suitable habitat not considered to be present; not known from the vicinity of the Desktop Study Area
Anigozanthos viridis* subsp. *terraspectans	T (EPBC & WA - VU)	August to September	Perennial, herb	Grey sand, clay loam. Winter-wet depressions.	No records within 10 km of Survey Area	Yes	Unlikely: suitable habitat not considered to be present; not known from the vicinity of the Desktop Study Area
Banksia mimica	T (EPBC - EN, WA - VU)	December to February	Perennial, shrub	White or grey sand over laterite, sandy loam.	No records within 10 km of Survey Area	Yes	Unlikely: habitat not considered to be present; not known from the vicinity of the Desktop Study Area
Caladenia huegelii	T (EPBC - EN, WA - CR)	September to October	Perennial, herb	Grey or brown sand, clay loam.	No records within 10 km of Survey Area	No	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
***Caleana dixonii* (*Paracaleana dixonii*)**	T (EPBC - EN, WA - VU)	October to January	Perennial, herb	Grey sand over granite.	No records within 10 km of Survey Area	No	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Chamelaucium lullfitzii	T (EPBC - EN, WA - VU)	September to December	Perennial, shrub	Usually orange-yellow sand (occasionally grey), sometimes with gravel, on hill slopes.	4.1 km NE	Yes	Unlikely: habitat not considered to be present

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Conospermum densiflorum* subsp. *unicephalatum	T (EPBC & WA - EN)	September to November	Perennial, shrub	Clay soils. Low-lying areas.	No records within 10 km of Survey Area	Yes	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Darwinia foetida	T (EPBC - CR, WA - EN)	September to December, February	Perennial, shrub	Plains, loam soil, road drain / drainage line, winter wet areas, ridge crest.	4.6 km S	Yes	Unlikely: suitable habitat not considered to be present
Diplolaena andrewsii	T (EPBC & WA - EN)	July to October	Perennial, shrub	Loam, clay. Granite outcrops & hillsides.	No records within 10 km of Survey Area	Yes	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Diuris drummondii	T (EPBC - VU, WA - EN)	November to January	Perennial, herb	Swamps, often in shallow water.	3.3 km S	No	Unlikely: suitable habitat not considered to be present
Diuris micrantha	T (EPBC & WA - VU)	September to October	Perennial, herb	Brown loamy clay. Winter-wet swamps, in shallow water.	No records within 10 km of Survey Area	No	Unlikely: suitable habitat not considered to be present
Diuris purdiei	T (EPBC & WA - EN)	September to October	Perennial, herb	Grey-black sand, moist. Winter-wet swamps.	No records within 10 km of Survey Area	No	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Drakaea elastica	T (EPBC - EN, WA - CR)	October to November	Perennial, herb	White or grey sand. Low-lying situations adjoining winter-wet swamps.	No records within 10 km of Survey Area	No	Unlikely: suitable habitat not considered to be present; not known from the vicinity of the Desktop Study Area

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Eleocharis keigheryi	T (EPBC & WA - VU)	August to November	Perennial, sedge	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	No records within 10 km of Survey Area	Yes	Unlikely: suitable habitat not considered to be present; not known from the vicinity of the Desktop Study Area
Eucalyptus leprophloia	T (EPBC & WA - EN)	August to October	Perennial, mallee	White or grey sand over laterite. Valley slopes.	No records within 10 km of Survey Area	Yes	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Grevillea althoferorum subsp. ***fragilis***	T (EPBC - EN, WA - CR)	September to November	Perennial, shrub	Flat to undulating plains, grey-yellow sand.	5.7 km E	Yes	Unlikely: suitable habitat not considered to be present
Grevillea corrugata	T (EPBC - EN, WA - VU)	August to September	Perennial, shrub	Slopes, brownish loamy soils with laterite. Road verges.	No records within 10 km of Survey Area	Yes	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Grevillea curviloba	T (EPBC & WA - EN)	August to October	Perennial, shrub	Grey sand, sandy loam. Winter-wet heath.	0.6 km S (Eco Logical and TPFL)	Yes	Unlikely: habitat not considered to be present; not recorded during survey
Hypocalymma sylvestre	T (EPBC & WA - EN)	August	Perennial, shrub	Yellow-brown sandy loam. Woodland on lateritic hilltop.	9.1 km E	Yes	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Macarthuria keigheryi	T (EPBC & WA - EN)	September to December, February to March	Perennial, herb	White or grey sand. Flats, plains.	No records within 10 km of Survey Area	Yes	Unlikely: habitat not considered to be present; not known from the vicinity of the Desktop Study Area (note – area has also not been burnt in a long time)
Ptychosema pusillum	T (EPBC & WA - VU)	August to October	Perennial, herb	Sand. Rises.	8.8 km N	No	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
***Synaphea* sp. Fairbridge Farm (D. Papenfus 696)**	T (EPBC & WA - CR)	October	Perennial, shrub	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	No records within 10 km of Survey Area	Yes	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Thelymitra dedmaniarum	T (EPBC & WA - CR)	November to December	Perennial, herb	Granite outcrops on slopes.	No records within 10 km of Survey Area	No	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Thelymitra stellata	T (EPBC & WA - EN)	October to November	Perennial, herb	Lateritic soils on hill tops and breakaways.	5.4 km SE	No	Unlikely: habitat not considered to be present
Thelymitra variegata	T (WA - CR)	June to September	Perennial, herb	Sandy clay, sand, laterite.	5.6 km E	No	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Grevillea evanescens	P1	March, June to November	Perennial, shrub	Winter-wet flats, brown light clay or clay loam.	5.1 km N (Eco Logical), 6.7 km N (DBCA searches)	Yes	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Hypocalymma lateriticola	P1	August, September	Perennial, shrub	Grey or yellow sand, lateritic gravel.	4.4 km S	Yes	Unlikely: suitable habitat not considered to be present
Caustis gigas	P2	May	Perennial, sedge	White or grey sand.	4.1 km NE	Yes	Unlikely: suitable habitat not considered to be present
Drosera sewelliae	P2	October to December	Perennial, herb	Laterite & silica sand soils.	3.2 km E	No	Unlikely: habitat not considered to be present
Grevillea candolleana	P2	August to October	Perennial, shrub	Laterite, lateritic loam. Hillsides.	6.3 km E	Yes	Unlikely: habitat not considered to be present
Hibbertia glomerata* subsp. *ginginensis	P2	July to September	Perennial, shrub	Slopes, hills and rises with brown sand or clay, laterite.	6.6 km E	Yes	Unlikely: habitat not considered to be present
Leucopogon squarrosus* subsp. *trigynus	P2	June, July, September	Perennial, shrub	White, grey sand. Dune, seasonally wet flats, low-lying flats.	3.1 km SW (Astron), 3.8 km SW (WAHERB)	Yes	Unlikely: suitable habitat not considered to be present
Millotia tenuifolia* var. *laevis	P2	September to October	Annual, herb	Granite or laterite soils.	5.8 km NE	No	Unlikely: habitat not considered to be present
***Netrostylis* sp. Chandala (G.J. Keighery 17055)**	P2	July, October, November	Perennial, sedge	Peat sand. Swamp edges, damplands, brook and mound spring.	5.7 km N	Yes	Unlikely: suitable habitat not considered to be present

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Poranthera moorokatta	P2	September to November	Annual, herb	Slopes and plains, damp areas. Grey or white sand. Grey or white silica sand in open spaces between shrubs, not in shaded areas or in areas of high litter cover.	6.1 km S	No	Unlikely: suitable habitat not considered to be present
Stylidium squamellosum	P2	October to November	Perennial, herb	Brown to red-brown clay loam. Winter-wet habitats and depressions, open woodland, shrubland.	5.5 km E	Yes	Unlikely: suitable habitat not considered to be present
Thelymitra pulcherrima	P2	July, August	Perennial, herb	Breakaways, sand health to laterite ridge, lateritic hill, low lying hill between dunes.	5.6 km E	Yes	Unlikely: habitat not considered to be present
Acacia cummingiana	P3	May, June, August	Perennial, shrub	Grey or yellow sand, lateritic gravel. Sandplains, lateritic breakaways.	4.7 km NE	Yes	Unlikely: suitable habitat not considered to be present
Acacia drummondii* subsp. *affinis	P3	June to September, December	Perennial, shrub	Laterite, slopes or flats.	3.4 km SE	Yes	Unlikely: habitat not considered to be present
Adenanthos cygnorum* subsp. *chamaephyton	P3	July, September to December, January	Perennial, shrub	Grey sand, lateritic gravel.	7.7 km SE	Yes	Unlikely: suitable habitat not considered to be present
Chamaescilla gibsonii	P3	August to November	Perennial, herb	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	4.6 km S	Yes	Unlikely: suitable habitat not considered to be present

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Cyathochaeta teretifolia	P3	January, July, September	Perennial, sedge	Grey sand, sandy clay. Swamps, creek edges.	5.5 km S	Yes	Unlikely: suitable habitat not considered to be present
Eryngium pinnatifidum **subsp. Palustre (G.J. Keighery 13459)**	P3	October to November	Perennial, herb	Winter-wet flats. Brown sandy loam Clay, sandy clay. Claypans, seasonally wet flats.	9.1 km N	Yes	Unlikely: suitable habitat not considered to be present
Isotropis cuneifolia **subsp. *glabra***	P3	September	Perennial, herb	Sand, clay loam. Winter-wet flats.	4.4 km S	Yes	Unlikely: suitable habitat not considered to be present
Meionectes tenuifolia	P3	September to December	Annual, herb	Seasonally inundated areas, edges of wetlands. Clay or clayey loam over laterite.	9.3 km N	No	Unlikely: suitable habitat not considered to be present
Myriophyllum echinatum	P3	September to November	Annual, herb	Clay. Winter-wet flats.	9.4 km N	No	Unlikely: suitable habitat not considered to be present
Persoonia rudis	P3	Sepetmber to December, January	Perennial, shrub	White, grey or yellow sand, often over laterite.	9.5 km N	Yes	Unlikely: suitable habitat not considered to be present
Platysace ramosissima	P3	November to February	Perennial, herb	Sandy clay soils, usually on flats or plains, often near wetlands.	9.3 km S	Yes	Unlikely: suitable habitat not considered to be present
Styphelia allittii	P3	March to June, August	Perennial, shrub	Uplands, outcrops, lateritic hills gravelly yellow sandy soil.	9.5 km N	Yes	Unlikely: habitat not considered to be present
Styphelia filifolia	P3	February to June	Perennial, shrub	Sand, sometimes winter damp.	7.7 km W (Astron), 5 km N (WAHERB)	Yes	Unlikely: suitable habitat not considered to be present

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Verticordia rutilastra	P3	September to November	Perennial, shrub	Sand & lateritic gravel. Hills.	6 km N	Yes	Unlikely: habitat not considered to be present
Verticordia serrata* var. *linearis	P3	September to October	Perennial, shrub	White sand, gravel. Open woodland.	1.5 km S, 2 km E	Yes	Unlikely: habitat not considered to be present
Anigozanthos humilis* subsp. *chrysanthus	P4	July to October	Perennial, herb	Grey or yellow sand.	6.3 km E	Yes	Unlikely: suitable habitat not considered to be present
Calothamnus graniticus* subsp. *leptophyllus	P4	June to August	Perennial, shrub	Clay over granite, lateritic soils. Hillsides.	Planted individual was located by WB within Chandala Processing Plant project area <50 m from current Survey Area; closest WA Herb record >40 km S	Yes	Unlikely: habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Drosera occidentalis	P4	October to December or January	Perennial, herb	Seasonally wet swamp, damp flats, depressions and seepage lines.	9.8 km SE	No	Unlikely: suitable habitat not considered to be present; Survey Area is outside of the known distribution of this taxon
Hypolaena robusta	P4	September to October	Perennial, herb	White sand. Sandplains.	2.6 km E	Yes	Unlikely: suitable habitat not considered to be present
Ornduffia submersa	P4	September to October	Perennial, aquatic herb	Black-grey sandy clay in seasonally inundated wetlands.	3.7 km S	Yes	Unlikely: suitable habitat not considered to be present

Species	Rank	Flowering Period	Habit	Habitat	Closest Known Distance to Survey Area	Identifiable During Survey	Likelihood of Occurrence
Rumex drummondii	P4	August to November	Perennial, herb	Winter-wet flats and creek edges with black peaty sand or dark brown sandy loam, sometimes over limestone.	9.2 km N	Yes	Unlikely: habitat not considered to be present
Schoenus griffinianus	P4	September to October	Perennial, sedge	Sandy soils, usually on flats, plains.	4.3 km NE	Yes	Unlikely: suitable habitat not considered to be present
Stylidium longitubum	P4	October to December	Annual, herb	Claypans, sometimes slightly saline.	6.4 km N	No	Unlikely: habitat not considered to be present
Stylidium striatum	P4	October to November	Perennial, herb	Lateritic soils on hill slopes.	6.5 km E	Yes	Unlikely: habitat not considered to be present
Synaphea grandis	P4	October to November	Perennial, shrub	Low rises with laterite gravel and boulders, grey-brown-yellow sandy soil.	7 km SE	Yes	Unlikely: habitat not considered to be present
***Tripterococcus* sp. Brachylobus (A.S. George 14234)**	P4	February to April, October to December	Perennial, herb	Winter damp flat, depressions, wetlands with grey soil. Plains. Peaty sand over clay.	8.7 km W (Astron)	Yes	Unlikely: suitable habitat not considered to be present
Verticordia lindleyi* subsp. *lindleyi	P4	May or November to January	Perennial, shrub	Sand, sandy clay. Winter-wet depressions.	5.6 km SE	Yes	Unlikely: suitable habitat not considered to be present

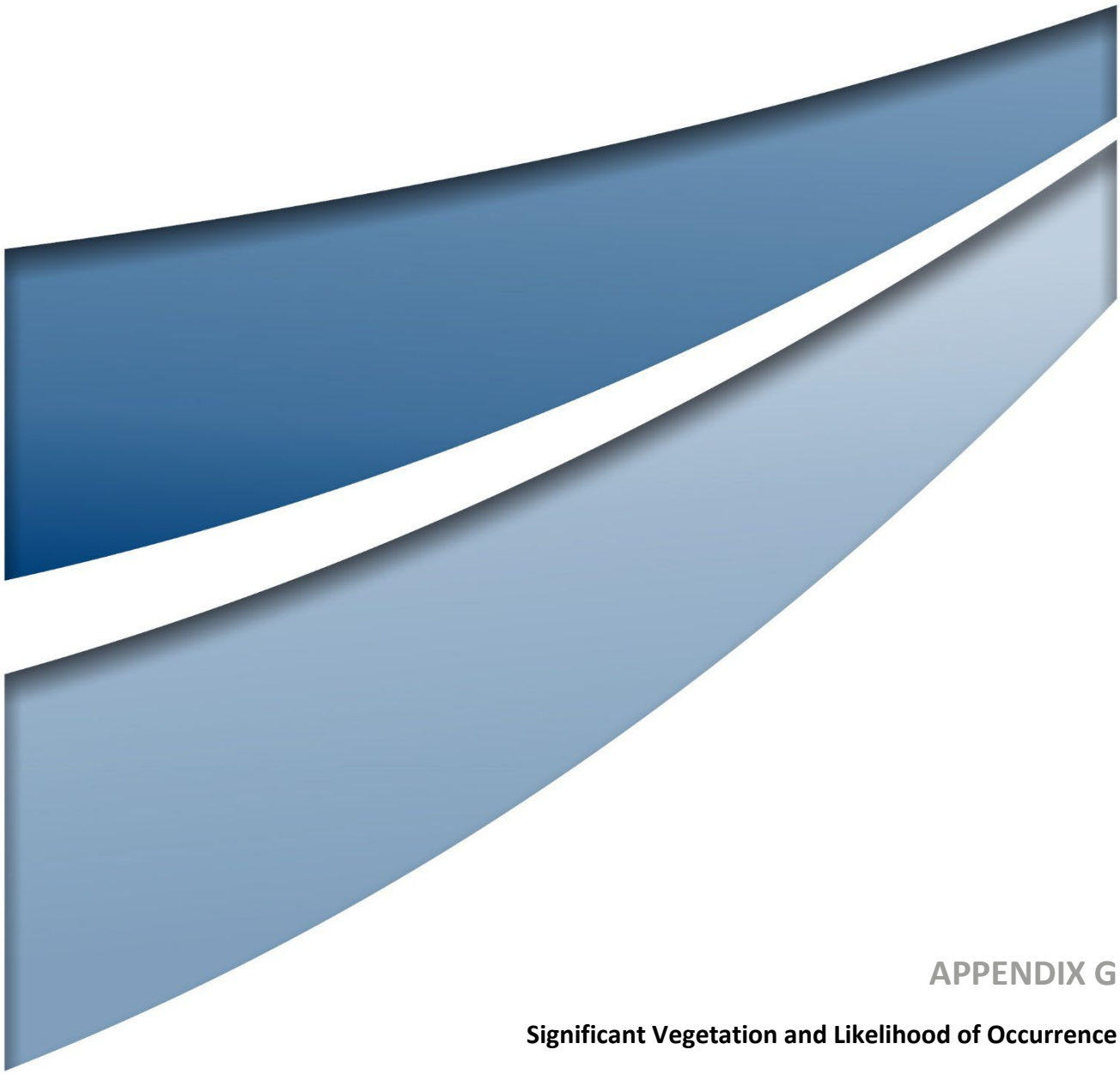
Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
EPW	Eucalyptus Planted Woodland	Variable mix of planted Eucalypt (*_E. botryoides_, _E. camaldulensis_ subsp. _obtusa_, _E. caesia_, _E. maculata_, _E. macrandra_, _E. urna_, and _E. gomphocephala_) open woodland to woodland over variable mix of *_Ehrharta longiflora_, *_Arctotheca calendula_, *_Ursinia anthemoides_, *_Zantedeschia aethiopica_ grassland/herbland.	Very Degraded. Entirely cleared pasture lands dominated by ground stratum weeds with rehabilitative Eucalypt plantings. An anthropogenic vegetation association with almost no original flora remaining.	2012, 2013
EPEtOW	Eucalyptus Plantings in _Eucalyptus todtiana_ Open Woodland	Planted _Eucalyptus camaldulensis_ subsp. _obtusa_ amongst scattered remnant _Eucalyptus todtiana_ Open Woodland over _Xanthrohoea priesii_ sparse shrubland over *_Ehrharta longiflora_ grassland.	Degraded. A dispersed remnant stand of _Eucalyptus todtiana_ woodland now dominated by planted _E. camaldulensis_ subsp. _obtusa_ and numerous single specimens of planted mid stratum species. Ground stratum dominated by weeds.	2012
EPBW	Eucalyptus Plantings in Banksia Woodland	Variably distributed mixed Eucalypt plantings (_E. botryoides_, _E. conferruminata_, _E. camaldulensis_ subsp. _obtusa_), _Banksia attentuata_, _B. menziesii_ Woodland over occasional _Xanthorhoea priesii_ shrubs over *_Ehrharta longiflora_, *_Arctotheca calendula_, (with *_Briza maxima_ and *_Ehrharta calycina_ along northern strip of southern polygon) grassland/herbland.	Degraded to Very Degraded. An anthropogenic vegetation association dominated by mixed Eucalypt plantings within degraded remnant Banksia woodland. Ground stratum composed of weeds.	2012, 2013
MpAfPW	_Melaleuca preissiana_ and _Agonis flexuosa_ Planted Woodland	Lakeside planting of _Melaleuca preissiana_ and _Agonis flexuosa_ woodland over occasional _Melaleuca_ aff. _quinquenervia_, _Callistemon phoeniceus_, _Juncus kraussii_, over *_Ehrharta longiflora_, and *_Cotula coronopifolia_ grassland (above water line).	Very Degraded. An anthropogenic vegetation association bordering artificial lakes. However, appears to robustly protect lake banks.	2012
CcW	_Corymbia calophylla_ Woodland	_Corymbia calophylla_ open woodland to woodland over _Xanthorrhoea preisii_ and _Acacia saligna_ (senescent) scattered low shrubland over *_Ehrharta longiflora_ dense grassland with occasional _Podotheca gnaphalioides_ and *_Zantedeschia aethiopica_.	Degraded. Remnant woodland highly impacted by past grazing. Upper stratum intact with sparse degraded mid stratum and weed-dominated ground stratum.	2012

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
ErW	*Eucalyptus rudis* Woodland	*Eucalyptus rudis* subsp. *rudis* open woodland to woodland over very occasional *Xanthorrhoea preissii* and *Hypocalymma angustifolia* over **Ehrharta longiflora* grassland with occasional **Arctotheca calendula* and **Zantedeschia aethiopica*.	Degraded to Good. Remnant woodland highly impacted by past grazing, upper stratum intact with sparse degraded mid stratum and a weed-dominated ground stratum.	2012
EtW	*Eucalyptus todtiana* Woodland	*Eucalyptus todtiana* woodland over *Regelia ciliata* scattered low shrubland over **Ehrharta longiflora*, **Hypochaeris glabra*, **Zantedeschia aethiopica* grassland/herbland.	Degraded. Loss of mid stratum with ground stratum composed of weeds.	2012
AsLW	*Acacia saligna* Low Woodland	Senescing *Acacia saligna* low woodland to open woodland over **Ehrharta longiflora*, **Arctotheca calendula*, **Zantedeschia aethiopica*, **Romulea rosea* var. *australis* grassland/herbland.	Degraded to Very Degraded. *Acacia saligna* is senescing (~60% dead), no mid stratum remains, ground stratum composed of weeds.	2012
AsRcT	*Acacia saligna* and *Regelia ciliata* Thicket	*Acacia saligna* thicket over *Regelia ciliata*, *Hypochalymma angustifolia* low heath over variable mix of *Drosera glanduligera*, **Moraea flaccida*, **Ehrharta longiflora*, **Arctotheca calendula* sparse grassland/herbland.	Good. Upper stratum and mid stratum intact though floristically simple, moderate weed density in ground stratum.	2012, 2013
AsBaBmOW	*Acacia saligna*, *Banksia attenuata*, and *Banksia menziesii* Open Woodland	*Acacia saligna* (with scattered *Banksia attenuata* and *B. menziesii*) open woodland over Juncus pallidus scattered sedgeland over **Ehrharta longiflora* (and occasional **Eragrostis curvula*) grassland.	Very Degraded to Degraded. Post-earthworks disturbance vegetation lining the artificial drainage ditch of the south boundary of the southern polygon.	2012, 2013
BmBaRcOW	*Banksia menziesii*, *Banksia attenuata*, *Regelia ciliata* Open Woodland	*Banksia menziesii, Banksia attenuata* open woodland over *Xanthorrhoea preissii*, *Regelia ciliata* scattered shrubland over *Hibbertia vaginata*, *Dasypogon bromeliifolius* scattered dwarf shrubland over **Ehrharta longiflora*, *Podotheca gnaphalioides*, **Hypochaeris glabra*, **Ursinia anthemoides*, and scattered **Zantedeschia aethiopica* grassland/herbland.	Degraded. Upper stratum structure intact, but mid stratum largely removed and floristically simple due to past grazing. Ground stratum dominated by weeds.	2012, 2013

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
BxErMrOW	Mixed Banksia, *Eucalyptus rudis*, and *Melaleuca ryeae* Open Woodland	*Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, (and scattered *Eucalyptus rudis* subsp. *rudis*) open woodland over *Xanthorrhoea preisii*, *Acacia saligna*, *Macrozamia fraseri* scattered shrubland over *Melaleuca ryeae* and *Dasypogon bromeliifolius* scattered dwarf shrubland over variable mixed **Ehrharta longiflora*, *Podotheca gnaphalioides*, **Arctotheca calendula*, and **Hypochaeris glabra* grassland/herbland.	Degraded. Upper stratum structure reasonably intact, but mid stratum largely removed and floristically simple due to past grazing. Ground stratum dominated by weeds. Dead and dying Banksias and *E. rudis* subsp. *rudis* suggest possibility of Dieback (Phytophthora) widespread within this association.	2012, 2013
XpMrLH	*Xanthorrhoea preisii* and *Melaleuca ryeae* Low Heath	*Xanthorrhoea preisii* and *Calitris pyramidalis* open low shrubland over *Melaleuca ryeae* low heath to shrubland over **Ehrharta longiflora* and **Arctotheca calendula* grassland with occasional **Zanthedeschia aethiopica*.	Good. Moderate disturbance to mid stratum probably due to past grazing with a weed dominated ground stratum.	2012
RcLH	*Regelia ciliata* Low Heath	*Melaleuca preissiana*, *Acacia saligna*, *Callitris pyramidalis* scattered shrubland over *Regelia ciliata* low heath over variable mix of *Drosera glanduligera*, **Moraea flaccida*, **Ehrharta longiflora*, **Arctotheca calendula*.	Degraded to Good. Structure reasonably intact but with ground stratum dominated by weeds. Rabbit warrens abundant.	2012, 2013
RcLS	*Regelia ciliata* Low Shrubland	*Regelia ciliata* (variably senescent) with occasional *Kunzea glabrescens* low open shrubland to shrubland over **Ehrharta longiflora*, **Arctotheca calendula*, **Hypochaeris glabra*, **Zantedeschia aethiopica* grassland/herbland.	Degraded. Shrubland composition simple with ground stratum completely dominated by weeds.	2012
EpODS	*Eremaea pauciflora* Open Dwarf Shrubland	Very scattered woodland of *Banksia attenuata*, *B. menziesii,* and planted *Eucalyptus* sp. over *Acacia saligna* (standing and fallen dead) and *Macrozamia fraseri* scattered shrubland over *Eremaea pauciflora* var. *pauciflora* open dwarf shrubland over *Podotheca gnaphalioides*, **Ehrharta longiflora*, **Ursinia anthemoides*, **Arctotheca calendula* herbland.	Degraded. Appears to have been mechanically disturbed in the past, followed by limited plantings of *Eucalyptus* sp. (supportive stakes present) and natural regeneration. Ground stratum dominated by weeds.	2012
PaMH	*Pentameris airoides* Mixed Herbland	Mixed, seasonally wet, open herbland composed of **Pentameris airoides* subsp. *airoides*, *Podotheca gnaphalioides*, **Ursinia anthemoides*, *Crassula colorata* var. *colorata*, **Hypochaeris glabra*, and *Drosera glanduligera*.	Degraded. Herbland dominated by weed species.	2012

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
JpDL	Sparse *Juncus pallidus* Drainage Line	Wet depressions often with anthropogenic drainage lines. Occasional remnant *Melaleuca preissiana* over sparse *Juncus pallidus* sedgeland over **Arctotheca calendula* (30%), **Moraea flaccida* (20%), and **Zantedeschia aethiopica* herbland.	Very Degraded. Dominated by ground layer weed species with no remnant vegetation beside occasional *Melaleuca preissiana* and sparse *Juncus pallidus*.	2012
EPAW	Eucalypt plantings in Acacia Woodland	Variably distributed mixed eucalypt plantings (*Eucalyptus botryoides*, *Eucalyptus conferruminata*, *Eucalyptus dendromorpha*, *Eucalyptus rudis* subsp. *rudis*, *Eucalyptus leucoxylon*) and *Acacia saligna* woodland, over **Ehrharta longiflora* and **Hordeum* sp. low open grassland.	Degraded. Ground stratum dominated by weeds with rehabilitation mixed eucalypt and *Acacia saligna* plantings.	2013
PCqMcS	Planted *Calothamnus quadrifidus* and *Melaleuca cordata* Shrubland	Planted *Calothamnus quadrifidus* and *Melaleuca cordata* tall shrubland, over **Eragrostis curvula* and **Ehrharta longiflora* mid open grassland.	Degraded. Planted upper stratum intact with no mid stratum and a weed dominated ground stratum.	2013
AsCpS	*Acacia saligna* and *Callitris pyramidalis* Shrubland	*Acacia saligna* tall sparse shrubland over *Callitris pyramidalis*, *Hypocalymma angustifolium* and *Melaleuca ryeae* mid closed shrubland, over *Dielsia stenostachya* and **Hordeum* sp. low open sedgeland/grassland.	Good. Upper stratum with many burnt tall shrubs. Mid stratum healthy, with a few weed species in the ground stratum.	2013
MpS	*Melaleuca preissiana* Shrubland	*Melaleuca preissiana* tall open shrubland to shrubland (with variable mix of planted *Eucalyptus grandis* and *Acacia saligna*), over *Regelia ciliata*, *Typha domingensis* and *Juncus pallidus* mid shrubland/tall rushland/sedgeland over **Ehrharta longiflora* low grassland.	Good. Upper and mid strata intact with few weed species within the ground stratum.	2013
XpSS	*Xanthorrhoea preissii* Sparse Shrubland	An area that has been previously partially cleared and planted. *Eucalyptus* sp. (unidentified, planted trees) low isolated trees, over *Xanthorrhoea preissii* mid sparse shrubland, over **Ehrharta longiflora* low open grassland.	Degraded. Large areas of disturbed bare soil. All strata very patchy with no solid cover spanning all three strata. Weeds present in the ground stratum.	2013

Code	Name	Vegetation Description	Vegetation Condition	Western Botanical Survey
CpLH	**Conyza parva* Low Herbland	*Acacia saligna* tall isolated shrubs, over **Conyza parva* low herbland, over **Hordeum* sp. and **Cynodon dactylon* low grassland.	Very Degraded. Upper stratum and mid stratum largely removed. Ground stratum dominated by weeds. Originally completely cleared for powerline access.	2013
CcSH	*Cotula coronopifolia* Sparse Herbland	Area subject to inundation and waterlogging. **Cotula coronopifolia* low sparse herbland, over **Hordeum* sp. and **Polypogon monspeliensis* low open grassland.	Very Degraded. Upper stratum and mid stratum removed. Ground stratum dominated by weeds.	2013
DsLS	*Dielsia stenostachya* Low Sedgeland	**Conyza parva*, *Juncus pallidus* and *Typha domingensis* tall herbland/sedgeland/rushland, over *Dielsia stenostachya* low closed sedgeland.	Very Degraded. Upper and mid strata removed but ground stratum intact, dominated by weeds.	2013
TdR	Typha domingensis Rushland	*Acacia saligna* and *Melaleuca preissiana* tall isolated shrubs, over *Typha domingensis* tall closed rushland, over **Paspalum dilatatum*, **Conyza parva* sparse shrubland/grassland and scattered small clumps of **Zantedeschia aethiopica* (Arum Lily).	Good. Upper stratum scattered but reasonably intact. Mid stratum present. Scattered weeds in the ground stratum. Mostly cleared for powerlines.	2013
TdDL	*Typha domingensis* Drainage Line	Flowing drainage line with isolated *Melaleuca preissiana* and *Acacia saligna* tall shrubs, over *Typha domingensis* tall closed rushland, over **Ehrharta longiflora* low open grassland and scattered **Zantedeschia aethiopica* (Arum Lily).	Good. Upper and mid strata present with scattered weeds throughout the ground stratum.	2013



APPENDIX G

Significant Vegetation and Likelihood of Occurrence

Ecological Community	Status	Description	Likelihood of Occurrence
***Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. 1994)**	Commonwealth – EN, WA - CR	The community has been recorded from sands near Koondoola and Banksia Grove, and at the base of the Darling Scarp between Wannamal and Maddington. This community is generally very species rich. It is usually dominated by *Banksia attenuata* (slender banksia), occasionally with *Eucalyptus marginata* (jarrah) with *Bossiaea eriocarpa* (common brown pea), *Conostephium pendulum* (pearl flower), *Hibbertia huegelii*, *Hibbertia hypericoides* (yellow buttercups), *Petrophile linearis* (pixie mops), *Scaevola repens*, *Stirlingia latifolia* (blueboy), *Mesomelaena pseudostygia* and *Alexgeorgea nitens* being common in the understorey. The community is also known as 'floristic community type 20a' as originally described in 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 the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	**Not Considered to be Present**: The nearest buffer of this TEC is located 4 km NW of the Survey Area. *Banksia attenuata* was recorded in VT BW within the Survey Area by the survey. Prior to disturbances, this VT may have been this TEC but removal of the mid to ground stratum has led to almost complete loss of the mid and lower strata. Structurally, the TEC will often have a highly species-rich understorey of sclerophyllous shrubs and a herbaceous ground layer which is not present at this location. As patches of this TEC must meet at least the Good Condition category threshold, this TEC is not considered to be present in the Survey Area.
Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands	WA – P2	Species-rich Banksia woodlands on deep yellow-red sands that appear restricted to the western Dandaragan Plateau. The vegetation is described as scattered *Eucalyptus todtiana* and *Eucalyptus calophylla* over *Banksia menziesii* and *Banksia attenuata* low open woodland over *Jacksonia sternbergiana* and *Adenanthos cygnorum* high open shrubland over *Allocasuarina humilis* and *Chamelaucium lullfitzii* (DRF) open shrubland over *Eremaea pauciflora* and *Astroloma xerophyllum* low shrubland over *Mesomelaena pseudostygia* open sedgeland.	**Not Considered to be Present**: The nearest buffer of this TEC is located 2 km N-NW of the Survey Area. *Eucalyptus todtiana*, *Corymbia calophylla*, *Banksia attenuata*, *Banksia menziesii, Eremaea pauciflora* and *Jacksonia sternbergiana* were recorded by Western Botanical and/or Umwelt however vegetation units described and mapped do not otherwise match this description. Soil landscape mapping unit mapping within the Survey Area is dominated by deep white and pale yellow sands, yellowish brown duplex and poorly structured clay soils, yellowish brown and grey sandy duplex soils which may have a gravelly matrix and humic and peaty sands. Surveys conducted in and adjacent to the Survey Area have not recorded yellow to orange sands.

Ecological Community	Status	Description	Likelihood of Occurrence
Banksia Woodlands of the Swan Coastal Plain ecological community	Commonwealth - EN, WA - P3	Canopy is most commonly dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*. Other Banksia species that can dominate in the community are *B. prionotes* or *B.ilicifolia*. It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands; it is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau and, in other less common scenarios. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community.	**Not Considered to be Present**: Numerous buffers occur within 10 km of the Survey Area with the nearest buffer of this TEC located 0.7 km N of the Survey Area. *Banksia attenuata*, *B. ilicifolia* and *B. menziesii* have been within the Survey Area by in VT BW. The vegetation condition has been mapped as Degraded. Prior to historical clearing and other disturbances, this VT would have represented this TEC. As patches of this TEC must meet at least the Good Condition category threshold, this TEC is not considered to be present in the Survey Area. There is an area of Banksia Woodland immediately north of the northern patch of VT BW which may be considered to be in Good condition (outside of the Survey Area). However, this does not meet the minimum patch size and condition requirements stipulated in the conservation advice(DoEE, 2016) as discussed in **Section 5.2.8.2**.
Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Commonwealth - EN, WA - CR	The community occurs in tumulus springs (organic mound springs) on the Swan Coastal Plain. The habitat of the mound springs is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats, with a high level of heterogeneity of invertebrate fauna assemblages between sites. Groups commonly represented include Ostracoda, Nematoda, Cladocera, Copepoda, Oligochaeta, Tardigrada, Turbellaria and Insecta. Typical and common native vascular plant species associated with the tumulus springs are the trees *Banksia littoralis* (swamp banksia), *Melaleuca preissiana* (moonah) and *Eucalyptus rudis* (flooded gum), and the shrubs *Taxandria linearifolia* (swamp peppermint), *Pteridium esculentum* (bracken fern), *Astartea scoparia* (common astartea) and *Cyclosorus interruptus* (swamp shield-fern).	**Not Considered to be Present:** The nearest buffer of this TEC is located 3.5 km S of the Survey Area. *Melaleuca preissiana*, *Eucalyptus rudis* and *Astartia scoparia* were recorded within the Survey Area by the survey including artificial lakes and in Degraded condition. Artificial wetlands occur within and adjacent to the Survey Area but there is no evidence of mound springs or raised areas of peat. This TEC is not considered to be present in the Survey Area.

Ecological Community	Status	Description	Likelihood of Occurrence
Perth to Gingin Ironstone Association	Commonwealth - EN, WA - CR	The community occurs on ironstone soils in the Perth area and is characterised by massed everlastings. Many of the plant species present are specifically adapted to shallow seasonal inundation, specifically the rich herb layer present in late winter and early spring which is a major distinguishing characteristic of the community. The daisies *Rhodanthe manglesii*, *Rhodanthe spicata* and *Myriocephalus helichrysoides* dominate. Other common herbs include *Tribonanthes variabilis* (southern tiurndin), *Stylidium longitubum* (jumping jacks) (priority 4) and *Isotropis cuneifolia* subsp. glabra (priority 3). A very open shrub layer is typical with common shrubs *Melaleuca viminea* (mohan), *Banksia sessilis* (parrot bush), *Acacia saligna* (orange wattle), *Jacksonia furcellata* (grey stinkwood), *Grevillea curviloba* (endangered) and *Kunzea recurva*.	**Not Considered to be Present**: The nearest buffer of this TEC is located 6 km NW of the Survey Area. No ironstone soils occur within the Survey Area and the Survey Area does not contain areas that are species rich in herbs. This TEC is not considered to be present in the Survey Area.
Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	Commonwealth & WA - EN	The community occurs on the heavy soils of the eastern side of the Swan Coastal Plain and has been recorded between Beermullah and Wokalup. Known patches include wetland and well-drained habitats, in a variety of landforms. It is defined on the basis of substrates with a limestone influence. Many of the species are commonly associated with the limestone soils that occur on the coast, and do not generally occur further inland. Typical and common native species in areas of best developed limestone are: the tree *Casuarina obesa* (swamp sheoak); the mallees *Eucalyptus decipiens* (redheart) and *Eucalyptus foecunda* (narrow-leaved red mallee); the shrubs *Melaleuca huegelii* (chenille honey-myrtle), *Alyogyne huegelii* (lilac hibiscus), *Grevillea curviloba* (endangered), *Grevillea evanescens* (priority 1) and *Melaleuca systena* (coastal honeymyrtle); and the herb *Thysanotus arenarius* (sand-dune fringed lily). Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as clay content, with the presence of calcicoles such as *Thysanotus arenarius*, *Gahnia trifida* (coast saw-sedge), *Eremophila glabra* (tar bush) and *Melaleuca brevifolia* (mallee honey-myrtle) providing evidence of the limestone	**Not Considered to be Present**: The nearest buffer of this TEC is located 3.5 km S of the Survey Area. No substrates with a limestone influence are known to occur in the Survey Area or were otherwise recorded during the survey. Flora assemblages and species common to this TEC have not been recorded within the Survey Area by Western Botanical (2012, 2013) or by the current survey. This TEC is not considered to be present in the Survey Area.

Ecological Community	Status	Description	Likelihood of Occurrence
		influence. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands and *Melaleuca brevifolia*, *Melaleuca systena* or *Melaleuca viminea* shrublands have been recorded on Muchea Limestone.	
Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa* woodlands (floristic community type 25)	WA - P3	Woodlands of *Eucalyptus gomphocephala - Agonis flexuosa* south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including *Corymbia calophylla* at Paganoni block and *Eucalyptus decipiens* at Kemerton. Banksias found in this community include *Banksia attenuata*, *B. grandis* and *B. littoralis*. Tuart formed the overstorey nearby however.	**Not Considered to be Present**: The nearest buffer of this TEC is located 4.9 km S of the Survey Area. Western Botanical (2012) and Umwelt recorded *Eucalyptus gomphocephala* and *Agonis flexuosa* at Chandala, both of which have been planted. The Survey Area is outside of the natural range of both of these taxa. None of the vegetation associations mapped by Western Botanical or by the current survey contained a dominant overstorey layer of Tuart. This PEC is not considered to be present in the Survey Area.
Swan Coastal Plain *Banksia attenuata - Banksia menziesii* woodlands ('floristic community type 23b')	Commonwealth - EN, WA - P3	These woodlands occur in the Bassendean system, from Melaleuca Park to Gingin. Occurs in reasonably extensive Banksia woodlands north of Perth. FCT 23b (Gibson et al., 1994) - Typical or common trees in the community are *Banksia attenuata* and *Banksia menziesii* Common shrub layers include *Bossiaea eriocarpa*, *Calytrix flavescens*, *Eremaea pauciflora*, *Petrophile linearis*, *Philotheca spicata* and sedges and herbs *Alexgeorgea nitens*, *Anigozanthos humilis*, *Burchardia congesta*, *Lomandra hermaphrodita*, *Lyginia barbata*, *Patersonia occidentalis*, *Schoenus curvifolius*, *Stylidium repens* and *Xanthosia huegelii*.	**Not Considered to be Present**: Five buffers occur within 10 km of the Survey Area with the nearest buffer of this TEC located 2.5 km E of the Survey Area. *Banksia attenuata* and *B. menziesii* have been recorded adjacent to the Survey Area by Western Botanical (2012) and the current survey, in Degraded condition. Prior to disturbances, these VTs may have represented this TEC however floristic composition has been lost. As patches of this TEC must meet at least the Good Condition category threshold, this PEC is not considered to be present in the Survey Area.
Wooded wetlands which support colonial waterbird nesting areas	WA - P2	Chandala, Booragoon Lake, unnamed wetland near Pinjarra, McCarleys Swamp. This type differs from the listed 'Perched wetlands of the Wheatbelt region with extensive stands of *Casuarina obesa* and *Melaleuca strobophylla*' ('Toolibin-type' wetlands) in that the Wheatbelt type is Casuarina, rather than Melaleuca dominated. Also, Toolobin Lake type is now brackish-saline (formerly fresh-brackish), whereas this type are currently fresh-brackish.	**Not Considered to be Present**: The nearest buffer of this TEC is located 2.1 km N of the Survey Area. Wetlands within and immediately adjacent to the Survey Area are artificial / man-made and the vegetation is Degraded to Completely Degraded. No VTs dominated by *Casuarina obesa* or *Melaleuca strobophylla* were mapped within the Survey Area. This PEC is not considered to be present in the Survey Area.



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