Prepared for
CBH Group Pty Ltd
ABN: 29 256 604 947

Konnongorring - Flora and Vegetation Assessment

19-Jun-2023
Doc No. 60697745_0+

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Konnongorring - Flora and Vegetation Assessment

Client: CBH Group Pty Ltd

ABN: 29 256 604 947

Prepared by

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A	14-Mar-2023	Draft Report	Floora de Wit Team Leader - Natural Resources	
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Executive Summary

AECOM Australia Pty Ltd (AECOM) were engaged by the CBH Group (CBH) to undertake a detailed flora and vegetation assessment of a defined survey area within the agricultural locality of Konnongorring.

A desktop assessment was conducted to identify potential significant environmental values within the survey area that required specific consideration. The desktop assessment identified:

- The Eucalypt Woodlands of the WA Wheatbelt Threatened Ecological Community (TEC) listed as Critically Endangered under the *Environment Protection, Biodiversity and Conservation Act 1999* (EPBC Act) and Priority 3 by Department of Biodiversity Conservation and Attractions (DBCA) was considered likely to occur. Three Priority 3 PECs were identified as occurring within 20 km of the survey area.
- 118 significant flora species are known from 20 km of the survey area. Of these three were considered likely to occur and one was known to occur (*Jacksonia debilis* listed as P1 by DBCA).

The field survey was conducted by botanist Floora de Wit and environmental scientist Adam Fenton on 21 November 2022. Floristic data was recorded from two non-permanent quadrats and on relevé. Targeted flora searches were undertaken in areas of native vegetation including roadside and one patch behind the church along Northam-Pithara Road.

The survey area comprises 77.70 ha, of which 3.50 ha represents native vegetation and 4.51 ha represents Trees and Planted. The remaining 69.69 ha is cleared for agriculture and infrastructure. All areas of native vegetation were assessed for the presence of the Eucalypt Woodlands of the WA Wheatbelt TEC using the key diagnostic characteristics as presented in the Conservation Advice (DotE, 2015). None of the patches met the criteria to represent the federally protected TEC. No Priority Ecological Communities were recorded.

No Threatened flora listed under the EPBC Act, *Biodiversity Conservation Act 2016* (BC Act) or by DBCA)was recorded. The known location of *Jacksonia debilis* was visited and targeted searches undertaken but no individuals were found at this location. The species may not have persisted at this location, with the known occurrence dating back to 1992.

Following the field survey, the three significant flora species considered likely to occur were reduced to having a 'low' likelihood. They were all perennial shrubs that would have been detected during the survey.

The survey was undertaken with no significant limitations. There was no access to trees north of the CBH infrastructure due to construction works and harvest season. This is not considered to have significantly influenced the outcome of the survey.

1.0 Introduction

1.1 Background

Cooperative Bulk Handling Group (CBH) is planning to expand its operations over the next 10 years, with planned infrastructure upgrades and the development of new sites within the distribution network. As part of this expansion, CBH is required to undertake a suite of ecological surveys to ensure the works are undertaken in accordance with business values and Regulatory and Legal requirements.

AECOM Australia Pty Ltd (AECOM) has been engaged to undertake an assessment of flora and vegetation within the Perenjori Survey Area to support the environmental assessment and approval process.

1.2 Location

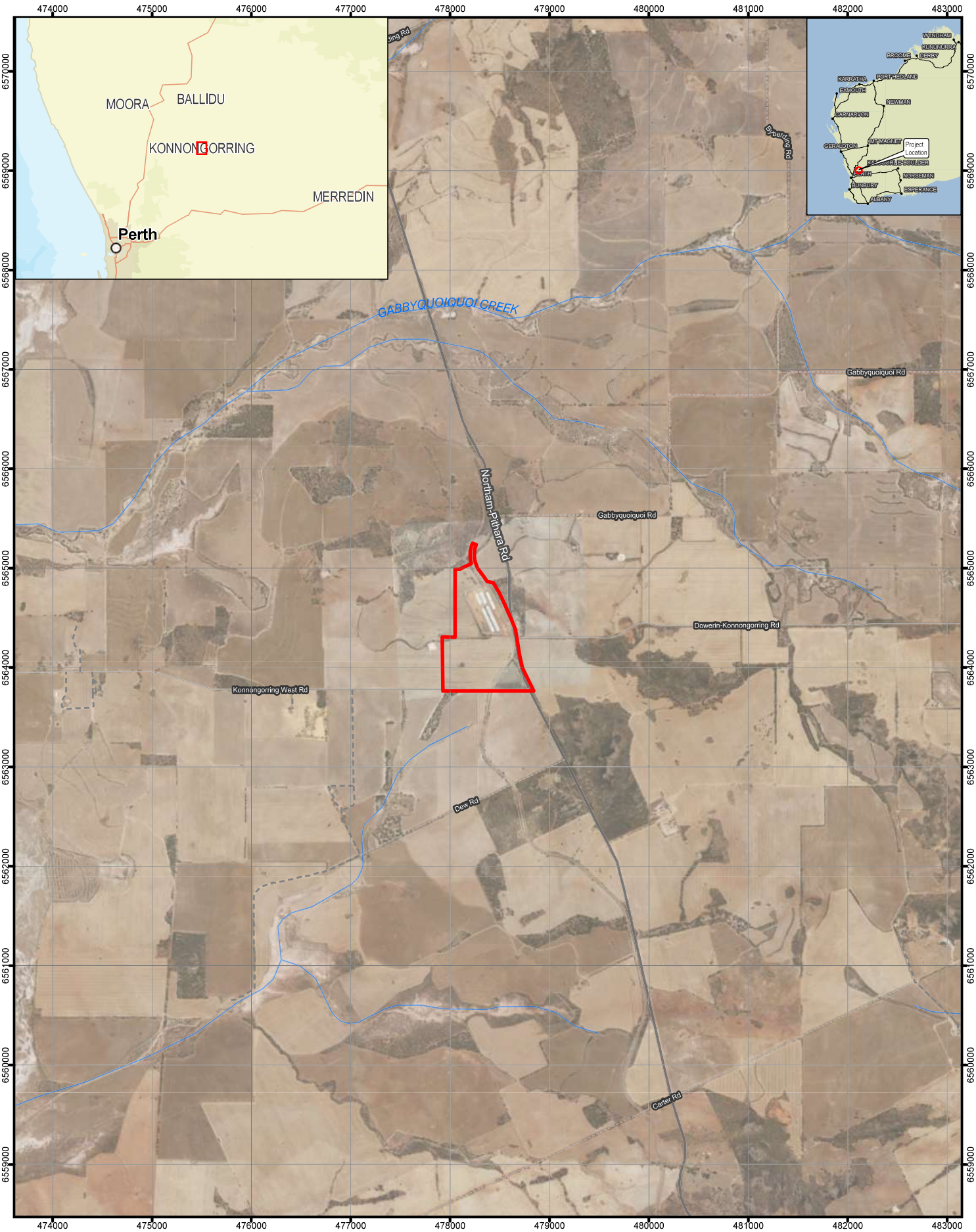
The Survey Area is located approximately 0.2 km northwest from the township of Konnongorring – a small agricultural locality in the Wheatbelt region of Western Australia, approximately 130 km north of Perth (Figure 1). Konnongorring is located within the Shire of Goomalling and is a receival site for a CBH facility which serves as a logistical hub for grain receival and distribution within the region.

The areas surrounding the Survey Area can be characterised as agricultural, predominantly producing wheat and other cereal crops. Native vegetation in the surrounding areas has largely been cleared to make way for primary production.

1.3 Objectives

The objective of this scope of work was to carry out a flora and vegetation survey of the Konnongorring Survey Area. The purpose of the field survey was to characterise floristic diversity, identify and map occurrences of conservation significant flora, significance of any Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), and to classify and assess the condition of native vegetation within the Survey Area.

This report describes results of the flora and vegetation desktop assessment and field survey undertaken at the Konnongorring site on 21 November 2022.



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LEGEND
Survey Area

Survey Area

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

Figure
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2.0 Conservation Codes

2.1 Flora

Species at risk of extinction are recognised at a Commonwealth level under the *Environment Protection, Biodiversity and Conservation Act 1999* (EPBC Act) and are categorised as outlined in Table 1.

Table 1 Categories of Species Listed Under Schedule 179 of the EPBC Act

Code	Category
Ex	**Extinct Taxa** which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild Taxa** which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered Taxa** which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered Taxa** which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable Taxa** which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent Taxa** which at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered the following subparagraphs are satisfied: the species is a species of fish the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised the plan of management is in force under a law of the Commonwealth or of a State or Territory cessation of the plan of management would adversely affect the conservation status of the species.
Mi	The EPBC Act also requires the compilation of a list of **migratory species** that are recognised under international treaties including the: Japan Australia Migratory Bird Agreement 1981 (JAMBA) China Australia Migratory Bird Agreement 1998 (CAMBA) Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA) Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals). All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as a MNES under the EPBC Act.
Ma	Species established under s248 of the EPBC Act.

Flora and fauna species that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Biodiversity Conservation Act 2016* (BC Act). These categories are defined in Table 2.

Table 2 Conservation Codes for WA Flora Listed Under the BC Act (DBCA, 2019)

Code	Category
CR	**Critically Endangered Species** Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	**Endangered Species** Threatened species considered to be facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
VU	**Vulnerable Species** Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EX	**Extinct Species** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to a Priority List as Priority 1, 2 or 3 by the State Minister for Environment. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are listed as Priority 4. Categories and definitions of Priority Flora species are provided in Table 3.

Table 3 Conservation Codes for WA Flora as Listed By DBCA and Endorsed by the Minister for Environment

Code	Category
P1	**Priority One – Poorly Known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority Two – Poorly Known Species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority Three – Poorly Known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

2.2 Vegetation Communities

TECs are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both State and Commonwealth legislation.

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. Categories of EPBC Act listed TECs are described in Table 4.

Table 4 Categories of TECs that are Listed Under the EPBC Act

Code	Category
CE	**Critically Endangered** If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	**Endangered** If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	**Vulnerable** If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. TECs are listed under the BC Act in one of four categories defined in Table 5.

The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as PECs under Priorities 1, 2 and 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation Dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 6.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

Table 5 Conservation Codes for State Listed Ecological Communities

Code	Category
PD	*Presumed Totally Destroyed*
CR	*Critically Endangered*
EN	*Endangered*
VU	*Vulnerable*

Table 6 Categories for Priority Ecological Communities

Code	Category
P1	**Priority One**: poorly-known ecological communities
P2	**Priority Two**: poorly-known ecological communities
P3	**Priority Three**: poorly known ecological communities
P4	**Priority Four**: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	**Priority-Five**: Conservation Dependant ecological communities.

3.0 Existing Environment

3.1 Climate

The climate of Konnongorring can be characterised by hot and dry summers, long and cold winters, and is typically windy and mostly clear year-round. Over the course of the year, the temperature typically varies from 7°C to 37°C.

The closest weather station with recent rainfall observations is the Konnongorring Station (ID 10076) located approximately 4.7 km from the township of Konnongorring and the Survey Area. Rainfall was significantly higher than the long-term average in March and August of 2022. There was low rainfall experienced in the summer (December 2021 through to February 2022) preceding the survey compared to the long-term average. The total rainfall in the 12 months preceding the survey was 73.7 mm higher than the long-term average Figure 2).

The closest weather station with recent temperature observations is the Wongan Hills (ID 008137) located approximately 33 km from the township of Konnongorring. The mean maximum temperature was notably higher than the long-term average through December 2021 to February 2022; returning to resume the long-term average for the remainder of 2022.

The mean minimum monthly temperature in the 12 months preceding the survey closely resembled the long-term average (1966 – 2023).

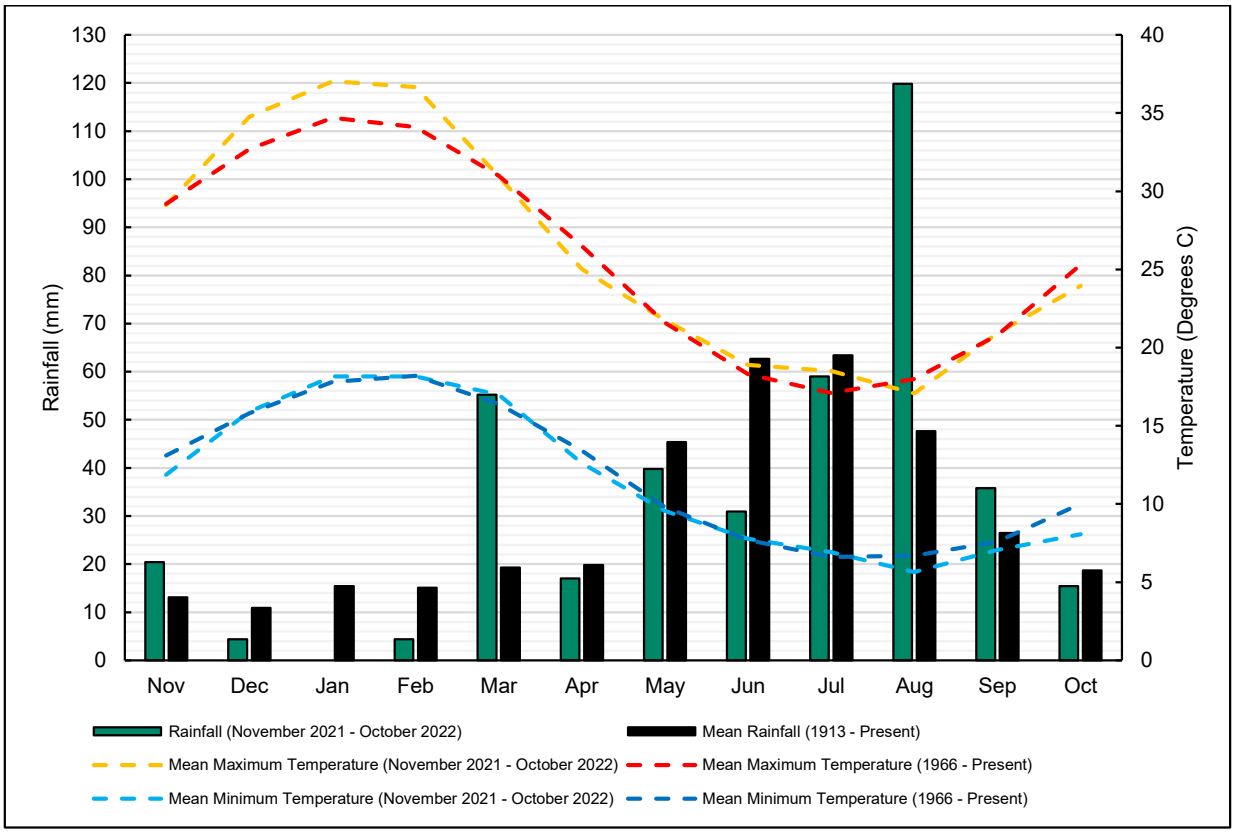


Figure 2 Climate Statistics and Rainfall and Weather Observations (BOM, 2023)

3.2 Interim Biogeographical Region of Australia Regions

The largest regional vegetation classification scheme recognised by Environmental Protection Authority (EPA) is the Interim Biogeographical Region of Australia (IBRA). The IBRA regions provide the planning framework for the systematic development of a comprehensive, adequate and representative (CAR) national reserve system. There are 89 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (IBRA7, 2012).

Konnongorring is situated in the Avon Wheatbelt IBRA region, which is characterised by gently undulating landscape with low relief. It lies on the Yilgarn Craton, an ancient block of crystalline rock, which was uplifted in the Tertiary and dissected by rivers. The craton is overlain by laterite deposits, which in places have decomposed into yellow sandplains, particularly on low hills. Steep-sided erosional gullies, known as breakaways, are common. The bioregion has a semi-arid Mediterranean climate, with hot, dry summers and mild winters, with most rainfall occurring in the winter months.

The Survey Area is situated in the Merredin IBRA subregion of the Avon Wheatbelt, where there is no connected drainage. In this subregion, streams are remnants of ancient drainage systems, flow only during wet years to chains of salt lakes.

3.3 Geology and Landforms

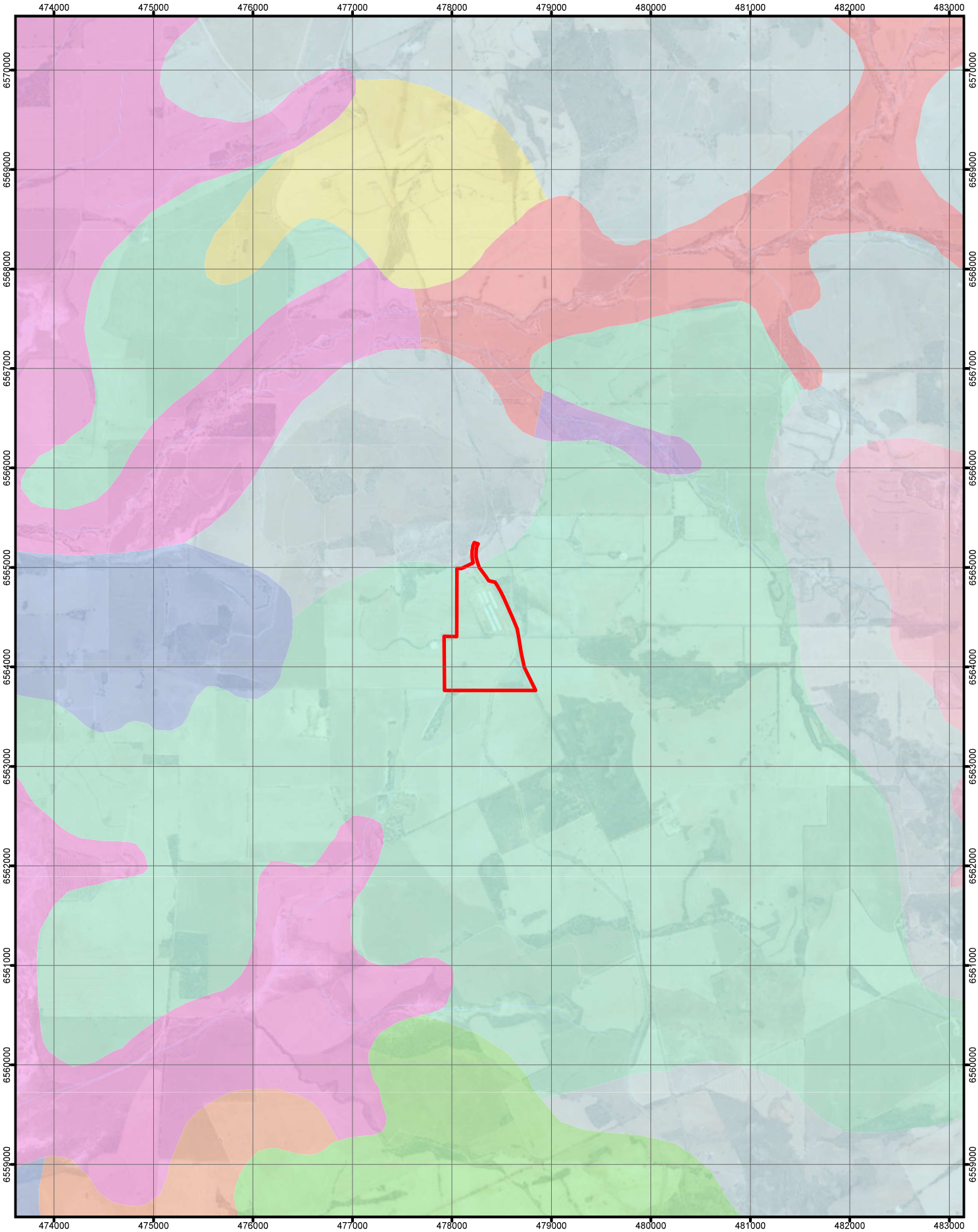
The Survey Area is situated across three lands systems as mapped and described in DPIRD (2022) (Figure 3).

The majority of the Survey Area (>95%) is situated on the Morbinning System, which is characterised by undulating sandplain remnants, breakaways and slopes, with grey deep sandy duplex (often alkaline), pale deep sand and yellow sandy earth. Vegetation usually comprises Wandoo-Jam-Salmon Gum Woodland and Heath (DPIRD, 2022).

The northern extent of the Survey Area is situated on the Wongan Hills System, which includes undulating sandplain with occasional low rock hills, sand and laterite over granitic and metamorphic rocks. Soils are yellow deep sands, loamy and shallow gravels, brown loamy earths and loamy duplexes. Vegetation is characterised by mixed heaths with Tammar and Salmon Gums (DPIRD, 2022).

Two geological units have been defined across the Survey Area (Stewart et al., 2008) (Figure 3):

- Agl - Syenogranite, alkali-feldspar granite, monzogranite; in places recrystallised; some mixed granite and country rock assemblages; low-Ca granite.
- Czs – sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, aeolian sand.



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LEGEND

- Survey Area

Soil Landscape Mapping - Best Available (DPIRD-027)

- Ewarts 1 phase
- Goomalling system
- Greenhills Ewarts phase 1
- Greenhills York 3 phase
- Greenhills York 4 phase
- Greenhills York subsystem
- Kwolyin, Kwelkan 2 phase
- Morbinning 4 subsystem
- Wongan Hills 1 subsystem
- Wongan Hills Goomalling subsystem

Geology and Land Systems

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

Figure 3.1

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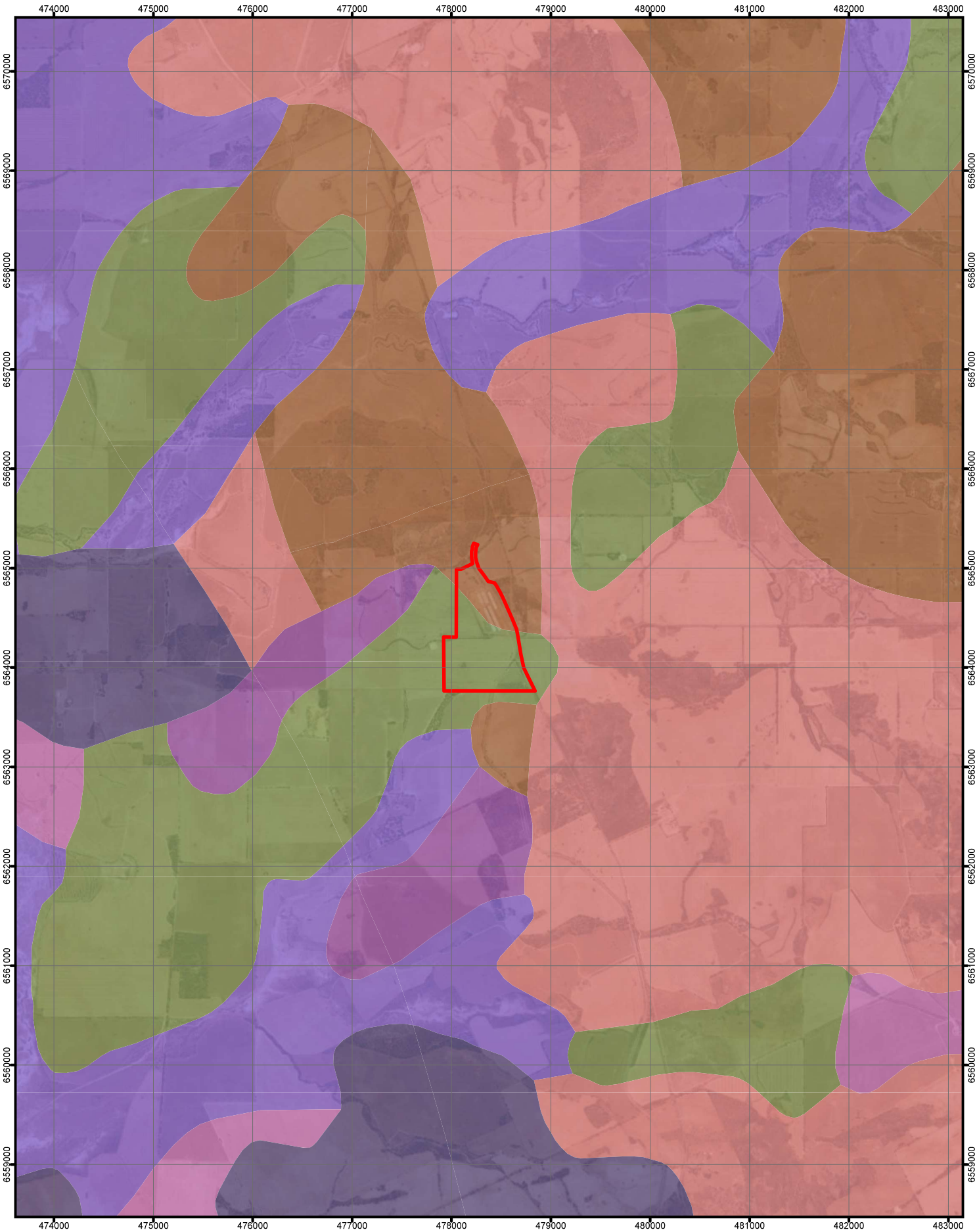

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LEGEND

Survey Area

Surface geology of Australia 1:1,000,000 scale, Western Australia (Geoscience Australia)

QUATERNARY
- Qa
- Qrc

CENOZOIC
- Czl
- Czs

ARCHEAN
- Ag
- Agl
- An

Geology and Land Systems

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

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3.2

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3.4 Vegetation

Beard et al. (2013) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. Pre-European vegetation, utilising Beard et al., (2013) mapping is depicted on (Figure 4). One vegetation association is recorded across the survey area. Vegetation Association 1024 is described as shrublands; mallee & casuarina thicket. Vegetation Association 1024 has been largely cleared within Western Australia, the Avon Wheatbelt IBRA Regions, and the Shire of Konnongorring (Table 7).

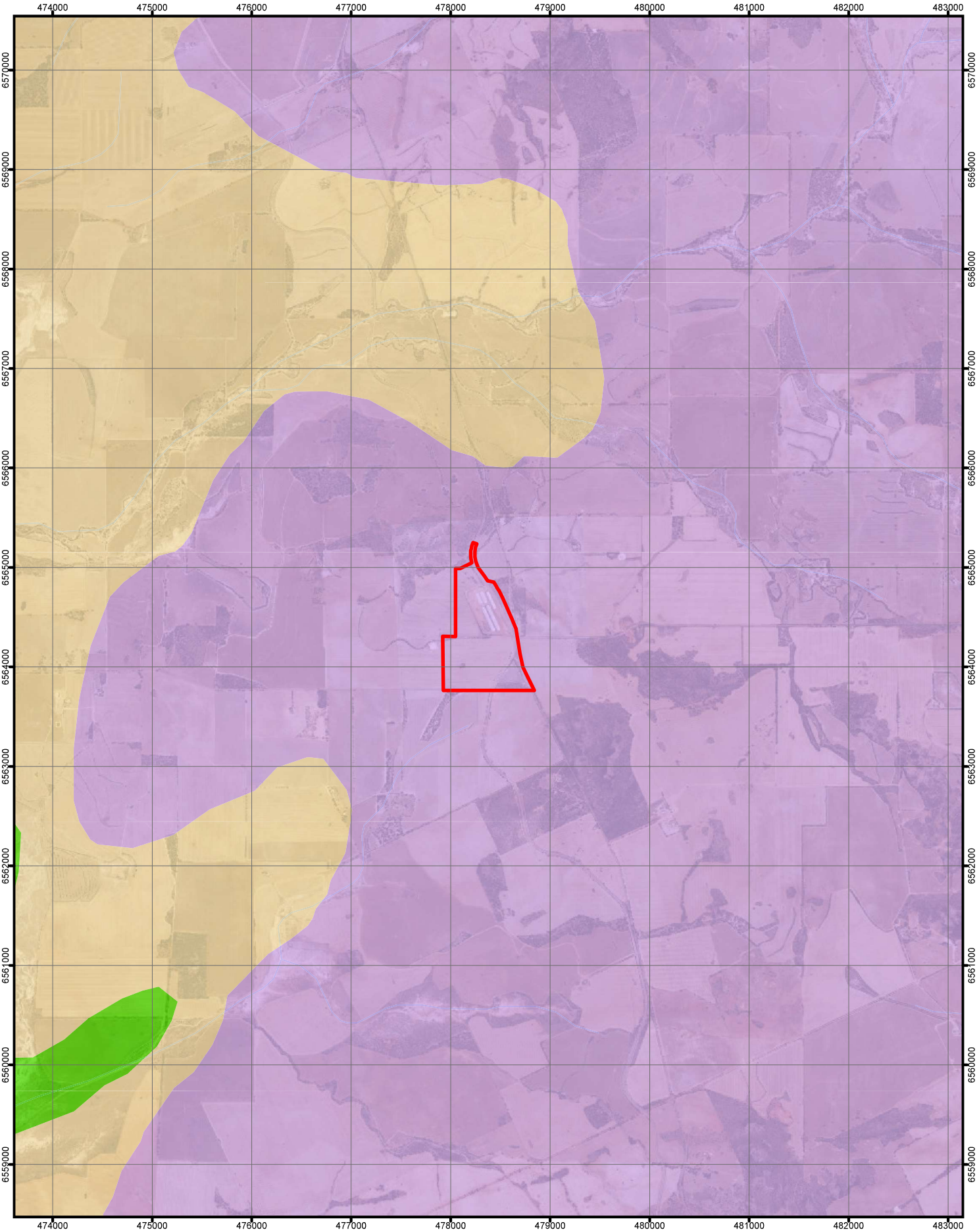
There are patches of remnant vegetation within the vicinity of the Survey Area, however native vegetation has largely been cleared to make way for primary production.

Table 7 Beard et al. (2013) Vegetation Associations and Percent Remaining (Govt. of WA, 2019)

Vegetation Association	Description	Percentage Remaining (%)		
		Western Australia	Avon Wheatbelt IBRA Region	Shire of Goomalling
1024	Shrublands; mallee & casuarina thicket	11.74	11.45	12.00

3.5 Conservation Reserves and Environmentally Sensitive Areas

No conservation reserves or Environmentally Sensitive Areas (ESAs) are located within the survey area. The closest conservation reserve, Lake Ninan Nature Reserve, is located 14.92 km north-west of the survey area (Figure 5).



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LEGEND

- Survey Area
- 988,*Tecticornia* spp. with *Melaleuca* spp. *Acacia* spp
- 1024,Wattle, *casuarina* and teatree *acacia-allocasuarina-melaleuca* alliance.
- 1049,Wheatbelt; York gum, salmon gum etc. *Eucalyptus loxophleba, E. salmonophloia.* Goldfields; gimlet, redwood etc. *E. salubris, E. oleosa.* Riverine; rivergum *E. camaldulensis.* Tropical; *messmate, woolyb*

Pre-European Vegetation

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

Figure
4

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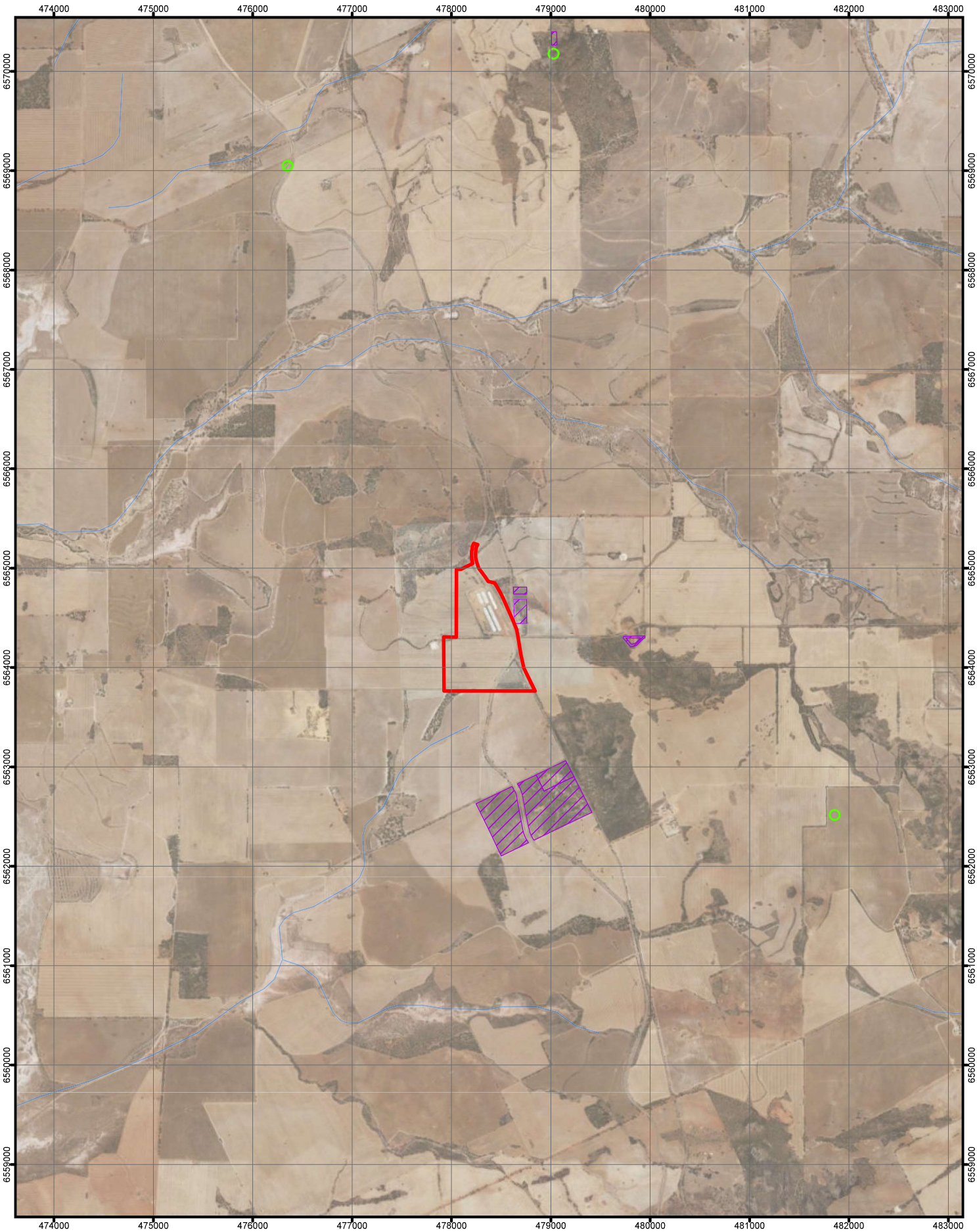

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WMS:

LEGEND

- Survey Area
- Reserves (LGATE-227)
- Clearing Regulations - Environmentally Sensitive Areas (DWER-046)

ESAs, Reserves and Conservation Estates

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

Figure 5

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4.0 Methodology

4.1 Desktop Assessment

A comprehensive desktop assessment was undertaken prior to the field survey to identify significant environmental values likely to be present in the Survey Area, including flora and vegetation communities. Desktop database searches were requested from the following government databases (including a variable radius):

- DBCA Threatened Species and Communities database including Threatened and Priority flora (20 km buffer from Survey Area), and communities (25 km buffer from Survey Area).
- Western Australian Herbarium (WAH, 1998) records.
- EPBC Act Protected Matters Search Tool (PMST).

Significant flora species likelihood of occurrence was assessed systematically using a point-based system which takes into account proximity (<5 km) and date (<20 years) of known records, presence within the Local Government Area (LGA) and habitat suitability (Table 8).

The likelihood of significant ecological communities occurring depends on the presence of suitable landforms, land systems, known occurrences and distance of known occurrences.

Table 8 Categories of Likelihood of Occurrence for Flora Species

Likelihood of Occurrence	Score	Definition
Known	6	Species is known to occur in the Survey Area.
High (Likely)	5	Not known to occur in the Survey Area however there are records nearby and suitable habitat for the species is known or likely to be present within the Survey Area.
Moderate (Possible)	4 (if suitable habitat may be present within the Survey Area) 3 (if suitable habitat is known to be, or likely to be present)	Species is not known to occur within the Survey Area however there are nearby records AND/OR recent records OR records within the LGA AND suitable habitat for the species is known or likely to be present within the Survey Area. OR Not known to occur within the Survey Area but there are records nearby AND recent records AND records within the LGA, and suitable habitat for the species may be present (marginal habitat).
Low (Unlikely)	2,3	Species is not known to occur within the Survey Area but there are records nearby OR recent records OR within the LGA AND suitable habitat for the species may be present (marginal habitat).
Negligible (Suitable Habitat not Present)	1,2,3	Despite records nearby OR being present within the LGA OR recent records, no suitable habitat is present within the Survey Area and therefore the likelihood of the species occurring is negligible.

4.2 Flora and Vegetation Assessment

A detailed flora and vegetation assessment was undertaken utilising methods outlined in the *Flora Survey Technical Guide* (EPA, 2016). The field surveys were undertaken by Floora De Wit (collection permit FB62000137) and Adam Fenton (collection permit FB62000488). Floora has 14 years' experience undertaking flora and vegetation assessments. Floora completed a Bachelor of Science in Environmental Biology (Environmental Restoration) and completed a Postgraduate Diploma in Environmental Management and Impact Assessment. Adam has five years' experience in environmental and ecological assessment. Adam completed a Bachelor of Biological Science and Master of Environmental Science.

The survey was undertaken on 21 November 2022. Data was collected from three 10x10 m quadrats delineated with a measuring tape. The dataset was supplemented by observation points. Data collected included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance.

Each site was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- sample site type and size
- photograph (north-west corner)
- soil details (type, colour, moisture)
- landform
- vegetation condition
- fire history
- species list including:
  - estimated height
  - estimated percentage cover (for trees both percentage within relevé and within community was recorded to enable better description of vegetation community).

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH (1998).

4.2.1 Vegetation Mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were based on the Association Level V in accordance with the National Vegetation Information System (NVIS) Framework (DotEE, 2017a). Delineation of vegetation communities was supported by analysing floristic data collected within quadrats.

Vegetation condition was determined using the Keighery (1994) vegetation condition scale as recommended in the *Flora Survey Technical Guide* (EPA, 2016).

Table 9 Bushland Condition Ratings

Vegetation Condition	Southwest and Interzone Botanical Provinces (Keighery, 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Vegetation Condition	Southwest and Interzone Botanical Provinces (Keighery, 1994)
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Poor	N/A
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance of vegetation structure caused by very frequent fires, the presence of very aggressive weeds, 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 or shrubs.

4.2.2 Eucalypt Woodlands of the WA Wheatbelt TEC

The survey area is situated in the Avon Wheatbelt region of WA within the known extent of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC (Eucalypt Woodlands TEC). This community was formerly extensive but now occurs as mostly small remnants scattered across the wheatbelt. Many patches are degraded (Commonwealth of Australia, 2016).

The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%. The key dominant or co-dominant species of the tree canopy are species of Eucalyptus trees that typically have a single trunk. Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs (DBCA, 2022).

The Eucalypt Woodlands TEC is nationally listed as Critically Endangered under EPBC Act and is considered a Priority 3 at the State level. National protection applies to patches of Eucalypt Woodlands that are reasonably intact – i.e. they retain native understorey vegetation or important habitat features, such as large trees with hollows. Woodlands in largely undisturbed condition are now rare, especially outside of nature reserves.

Areas within the survey area considered to meet the description of the community were assessed against the key diagnostic characteristics and condition thresholds for the community as defined in the Approved Conservation Advice for the Eucalypt Woodlands of the Western Australian Wheatbelt (DotE, 2015).

4.2.3 Targeted Flora Searches

Targeted searches were undertaken for conservation significant flora species that were known or likely to occur. This included six species that were considered to have a high likelihood of occurrence. A detailed field guide was produced which included photographs and describing morphological features that would assist in identifying the species in the Survey Area.

Where a potential significant species was encountered, the following was recorded:

- location (using a hand-held GPS accuracy 5m)
- the number of individuals in the immediate population, or an estimate of the size (number) of the population with an estimated radius of its spatial extent plant height
- vegetation condition
- associated dominant species
- soil type and colour
- topography
- additional information relevant to the area including key characteristics and landforms

4.3 Limitations

The objective of the reconnaissance flora and vegetation assessment are considered to have been met. No limitations were identified that may influence the results of the survey.

Seven limitations were considered as defined in the EPA Technical Guide (2016). These are discussed in Table 10.

Table 10 Limitations of the Survey

Limitation	Flora and Vegetation Survey
Availability of contextual information on the region	**Not a limitation** Sufficient resources were available to provide contextual information including publicly available datasets for pre-European vegetation mapping, geology, landforms and climate, and DBCA conservation significant flora and communities.
Competency/experience of consultant conducting survey	**Not a limitation** The surveys were led by Floora de Wit who has more than 14 years' experience conducting surveys of similar scope.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Not a limitation** Survey effort was considered suitable for recording and mapping the flora and vegetation values of the survey area.
Completion (is further work needed)	**Not a limitation** The survey area was represented by two quadrats in native vegetation, one relevé and several observations. All areas of native vegetation were traversed on foot and flora species not represented in quadrats were recorded and/or collected for inclusion in the flora species list. This survey effort is considered suitable for the extent of native vegetation present (3.50 ha).
Remoteness and/or access problems	**Minor** Stands of trees west of the railway north of CBH infrastructure was inaccessible. Construction was occurring at the time of the survey as well as harvest season. Observations were made from the other side of the rail corridor.
Timing, weather, season, cycle	**Not a limitation** The survey was undertaken in November 2022 in a year of above average rainfall as demonstrated in Figure 2 of Section 3.1. Survey timing complied with recommendations in the EPA Flora Survey Technical Guide (EPA, 2016).
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	**Not a limitation** No disturbances were observed that would influence the outcome of the survey.

5.0 Desktop Assessment

5.1 Threatened and Priority Ecological Communities

One Threatened Ecological Community, the Eucalypt Woodlands of the Western Australian Wheatbelt (Eucalypt Woodland TEC), is known to occur in the vicinity of the survey area. The Eucalypt Woodland TEC is listed as Critically Endangered under the EPBC Act. The known occurrences pertain to extrapolated mapping from DBCA across the entire Wheatbelt region informed by aerial imagery. All occurrences of the Eucalypt Woodland TEC require verification using the key diagnostic characteristics outlined in Conservation Advice (DotE, 2015).

Four PECs were identified in the desktop study. Three of these are sub-communities of the Eucalypt Woodland TEC. The TEC and PECs are defined in Table 11.

Table 11 Significant Ecological Communities Identified in the Desktop Assessment

Community Name and Description (DBCA, 2021)	Cons. Status[1]	Distance from Survey Area
Eucalypt Woodlands of the Western Australian Wheatbelt The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%. The key dominant or co-dominant species of the tree canopy are species of Eucalyptus trees that typically have a single trunk. Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs (DotE, 2015).	EPBC Act: CE DBCA: P3	2.29 km
York Gum Woodlands of the wheatbelt Part of the Eucalypt Woodlands of the WA Wheatbelt. No further information available.	EPBC Act: CE DBCA: P3	820 m
Gimlet Woodlands of the wheatbelt The structure of the ecological community is a woodland in which the floristic diversity and density has a 'U'-shaped trend, likely due to dominant tree and shrub species achieving maximum cover over an intermediate period, which competitively excludes other plant species.	DBCA: P3	3.71 km
Salmon Gum Woodlands of the wheatbelt The structure of the ecological community is broadly described as Tall *Eucalyptus salmonophloia* woodlands on fertile valley floors with brown to red-brown sandy loams overlying a pallid zone (clay) at 90 cm, sometimes with lime concentrations in the profile.	EPBC Act: CE DBCA: P3	5.64 km

1. EPBC Act CE Critically Endangered, DBCA P=Priority

5.2 Conservation Significant Flora

A total of 118 significant flora species were identified in the desktop study. Of these, 39 are listed as Threatened under the EPBC Act and BC Act. A review of habitat, distance of known record, and age of known record have led to the following results:

- one species is known to occur, *Jacksonia debilis* listed as Priority 1.
- three significant species have a high likelihood of occurring including two listed as Threatened under the EPBC Act and BC Act.
- 28 species have a 'moderate' likelihood.
- 86 species have a 'low' or 'negligible' likelihood.

Species were considered to have a 'low' or 'negligible' likelihood of occurring was attributed to the absence of significant landforms including breakaways, granite outcrops, salt lakes and major rivers within the survey area.

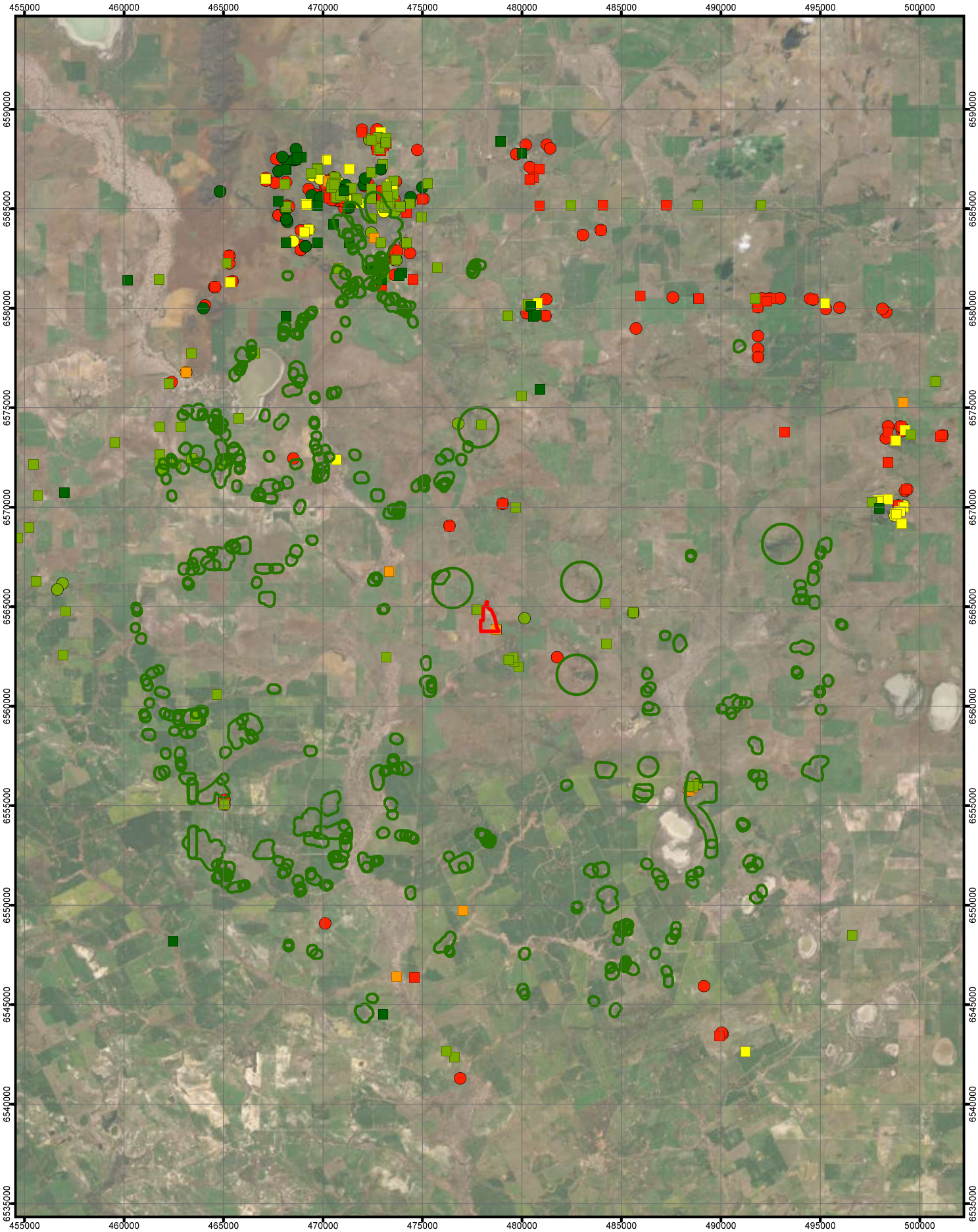
The one known species and three likely species are described in Table 12. The desktop results are presented in Figure 6 and the comprehensive assessment is presented in Appendix A.

Table 12 Conservation Significant Flora Species that are Known and/or Likely to Occur

Species	Cons. Code[1]		Habitat[2]
	EPBC Act	BC Act / DBCA	
Acacia cochlocarpa subsp. *cochlocarpa*	E	CR	Clayey, sandy, often gravelly soils.
Daviesia euphorbioides	E	CR	Clayey sand, sandy gravel. Flats, sandplains.
Guichenotia impudica		P3	Laterite.
Jacksonia debilis		P1	White or grey clayey sand.

1. Conservation codes E Endangered, CR Critically Endangered, P Priority

2. Habitat derived from WAH (1998) Florabase



PROJECT ID 60697745
CREATED BY MCDONNELLG
APPROVED BY CS
LAST MODIFIED 21 FEB 2023

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Datum: GDA2020 MGA Zone 50
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km

Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010)
Service Layer Credits: World Imagery: Earthstar Geographics

LEGEND

Survey Area
TEC / PEC
Priority 3

WA Herbarium database (WAHERB)
- Threatened
- P1
- P2
- P3
- P4

Threatened and Priority Flora database (TPFL)
- Threatened
- P1
- P2
- P3
- Priorty 4

Conservation Significant Flora Desktop Results

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Figure 6

A4 size

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6.0 Field Survey Results

6.1 Vegetation

No Threatened or Priority ecological communities (TECs or PECs) were recorded. Two native shrubland communities were defined and mapped for 3.50 ha. One Tall Open Shrubland AcAe was recorded near the church in the south of the survey area. A second Tall Open Shrubland GpAb restricted to roadside vegetation with scattered native shrubs and occasional tree over weeds.

Two significant altered communities were mapped for 4.51 ha:

- Trees – comprising of stands of native trees over pasture weeds.
- Planted – planted tree and shrub species.

The remaining 69.69 ha was mapped as ‘cleared’.

Descriptions of the communities are presented in Table 13 and mapped on Figure 7.

Table 13 Vegetation Community Descriptions and Photographs

Description	Additional Detail	Photograph
AcAe *Allocasuarina campestris*, *Leptospermum erubescens* and *Grevillea paniculata* tall open shrubland over *Austrostipa elegantissima*, *Dianella revoluta* and *Waitzia acuminata* var. *acuminata* mixed low sparse grassland and herbland. Remnant native vegetation behind church. Edge effects are apparent and groundcover is sparse. Occurs on slope with yellow loam/sand soils.	Survey effort: Q2, Q3 Species richness: 34 native and four weed species Extent: 1.81 ha	
GpAb *Grevillea paniculata*, *Acacia acuminata* and *Acacia acuaria* tall open shrubland over **Avena barbata*, *Austrostipa elegantissima* and **Ursinia anthemoides* mixed mid open grassland and herbland. Restricted to degraded roadside that includes scattered native shrubs with tall grasses. No tree overstorey present. Likely to represent regenerated vegetation following historical clearing.	Survey effort: R1 Species richness: 12 native and two weed species Extent: 1.69 ha	

Description	Additional Detail	Photograph
Other Cleared – 69.69 ha Planted – 1.24 ha Trees – 3.27 ha	Extent: 74.20 ha	

6.2 Significant Vegetation

The WA Wheatbelt Woodland TEC was considered to possibly occur based on the DBCA significant communities mapping. All areas mapped as 'Trees' represent native species over paddock weeds (Plate 1). These stands are considered Completely Degraded and do not meet the condition threshold to represent the federally protected TEC.

One patch of native vegetation behind the church, represented by AcAe, is a shrubland that is devoid of Eucalypt trees and was therefore excluded for consideration. All roadside vegetation comprised of Degraded or Completely Degraded sparse shrublands generally lacking native Eucalypt trees. These were also excluded.

No areas representing the federally listed Eucalypt Woodlands TEC were recorded.

Plate 1 Stands of Eucalyptus Trees Within the Survey Area

6.3 Vegetation Condition

Prolonged historical disturbance was evident throughout much of the survey area, with majority of the survey area representing Cleared areas or Completely Degraded vegetation. The two native vegetation communities ranged from Degraded to Very Good, with edge effects from weed invasion evident towards the outskirts of the native vegetation.

Areas mapped as Completely Degraded represent paddocks, planted vegetation and patches devoid of native understorey species.

Extent of vegetation condition categories are presented in Table 14 and mapped in Figure 8.

Table 14 Vegetation Condition Extent

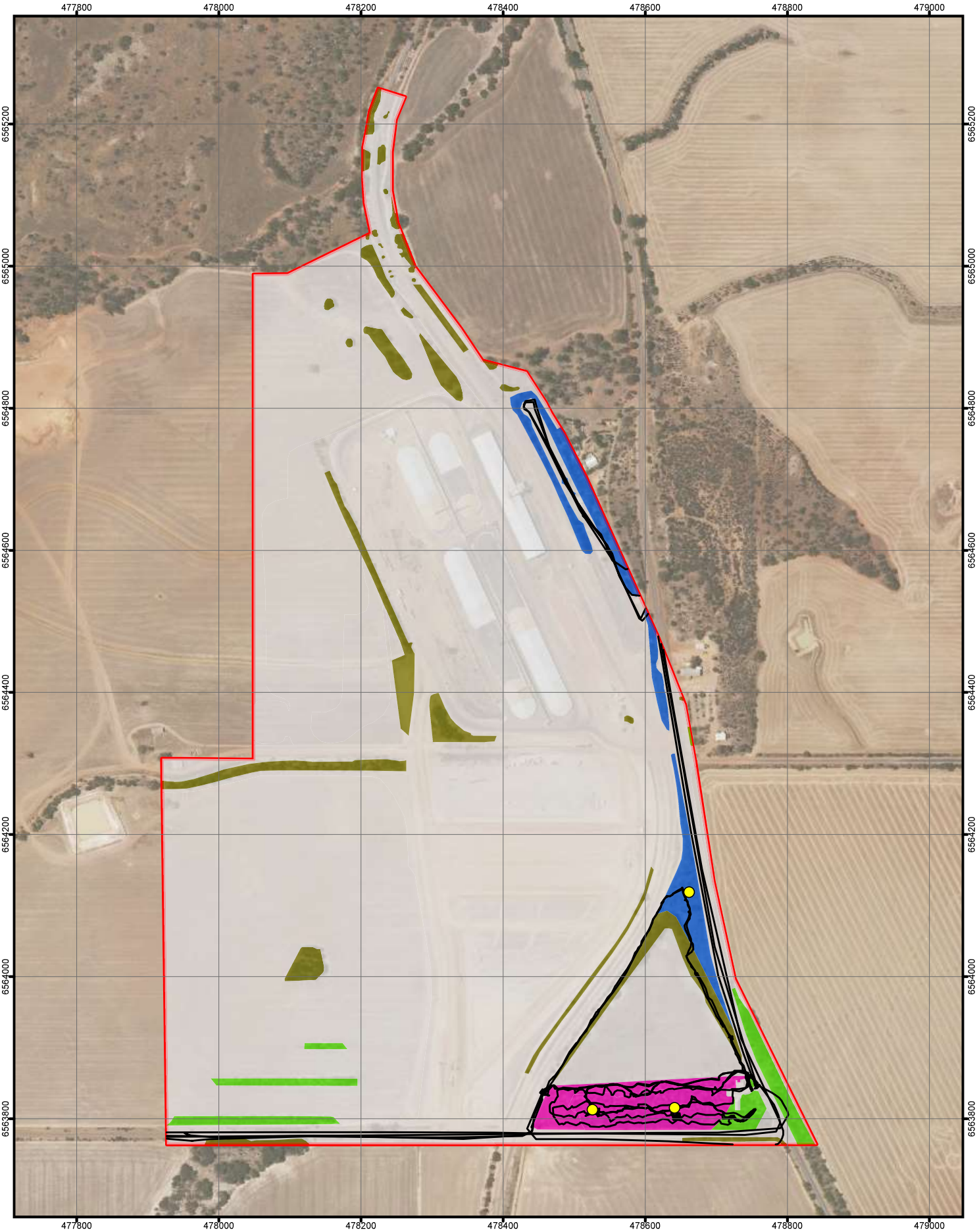
Condition Rating	Extent (ha)	Percent of Total Area (ha)
Very Good	1.16	1
Degraded	2.34	3
Completely Degraded	4.51	6
Cleared	69.69	90
Total	**77.70**	**100.00**

6.4 Flora

No significant flora listed under the EPBC Act, BC Act or by DBCA was recorded. A total of 46 native and six weed species were recorded. Families with the highest representation of native species were Poaceae (grasses, six species), Myrtaceae (four species) and Fabaceae (four species).

Six weed species were recorded. More weed species were present however no effort was made to compile a complete list of weed species. Instead, weeds of significance were targeted.

A comprehensive species list, organised by family and the community they occur in, is presented in Appendix B. Quadrat data is presented in Appendix C.



PROJECT ID	60697745
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APPROVED BY	CS
LAST MODIFIED	13 MAR 2023

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metres

Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010)
Service Layer Credits: WMS Landgate_Subscription_Imagery\WA_Regional

LEGEND

- Survey Area
- Survey Sites
- Tracklog

Vegetation Communities

- AcAe
- Cleared
- GpAb
- Planted
- Trees

Vegetation Communities

CBH

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KONNONGORRING

Figure 7

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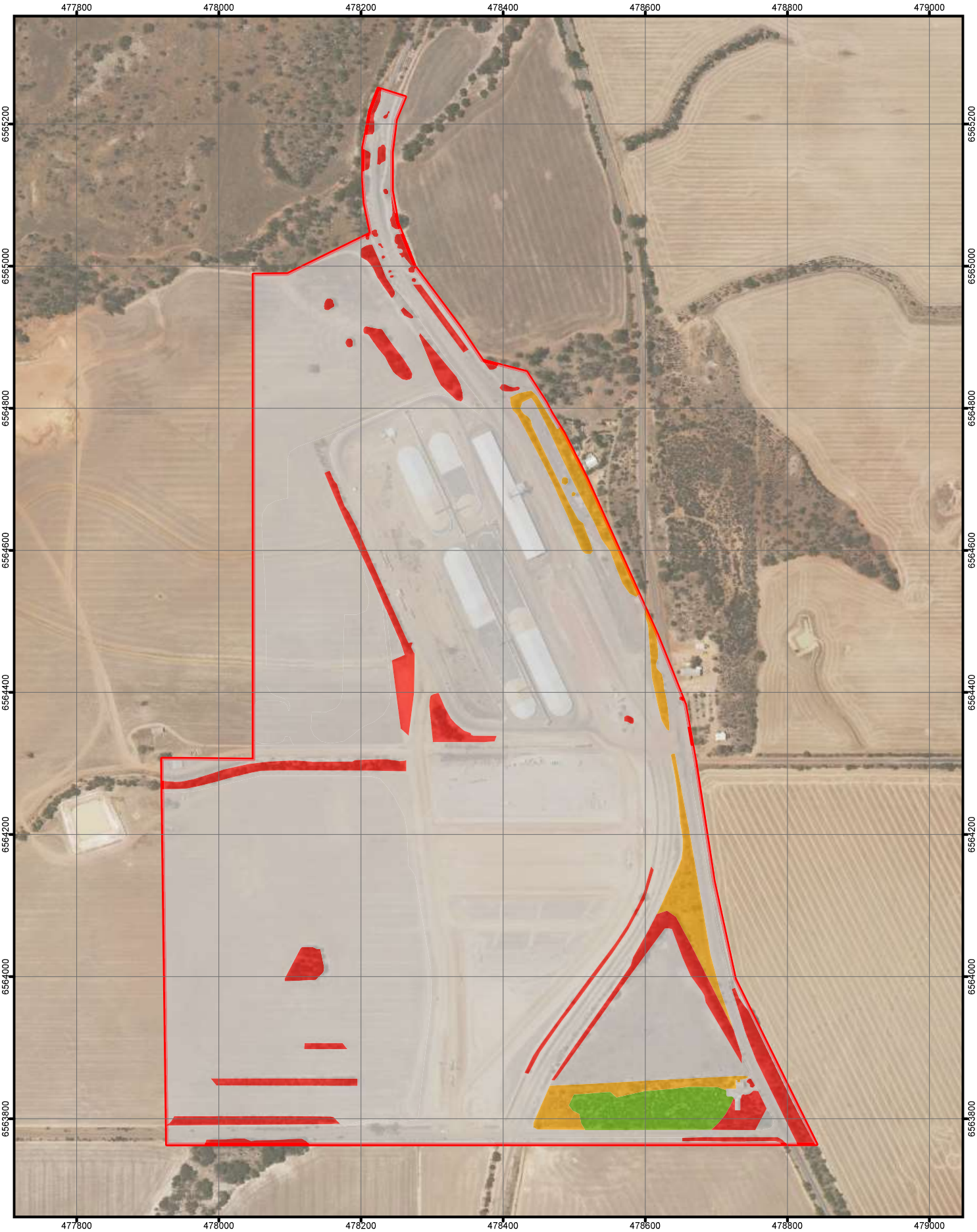

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Data sources:
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Service Layer Credits: WMS: Landgate_Subscription_Imagery/WA_Regional

LEGEND
- Survey Area

Vegetation Condition
- Very Good
- Degraded
- Completely Degraded
- Cleared

Vegetation Condition

CBH

KONNONGORRING – FLORA AND VEGETATION ASSESSMENT

KONNONGORRING

Figure 8

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7.0 Discussion

7.1 Vegetation

Two native vegetation communities were described and mapped, representing 3.50 ha. The majority of the survey area has been historically cleared for infrastructure and farming, with the exception of vegetation community AcEc behind the church building. Corridors of planted and native trees follow fences and road reserves.

Due to this historical clearing, most of the survey area was mapped as Cleared (41.78 ha, 54%) or Completely Degraded (32.42 ha, 42%). Only a small portion was mapped as Very Good (1.16 ha, 1%) representing the intact native vegetation.

Weeds dominate the survey area in paddocks and roadsides. They are invading the patch of native vegetation and displace most understorey species.

The WA Wheatbelt Woodland TEC was not recorded in the survey area. The native vegetation represents shrublands lacking an overstorey of trees. The areas mapped as Trees lack understorey and do not meet the condition thresholds for the federally protected TEC.

7.2 Flora

No Threatened or Priority flora species were recorded. Flora diversity was low, with only 46 native species recorded. The historical disturbance (clearing) of the area has influenced the low diversity. The native vegetation within the survey area does not connect to any other significant patch of native vegetation. The significant species that were known (one) and likely (three) to occur are discussed below.

The desktop assessment identified one Priority species, *Jacksonia debilis* (P1), that was known to occur within the survey area according to WA Herbarium records. This record is not on the Threatened and Priority Flora List and therefore is not verified by DBCA. The record (representing three records on the database) were from 5 September 1992 described as being “behind church at corner”. This location was visited and a systematic targeted search was undertaken walking 10 m apart. No individuals were recorded. It is possible that the survey in late November was too late for ideal detection of the species. It is known to flower between September and October. The occurrence near Konnongorring represents the northern extent of this species (see Plate 2). It is possible that the species has not survived at this location since 1992.

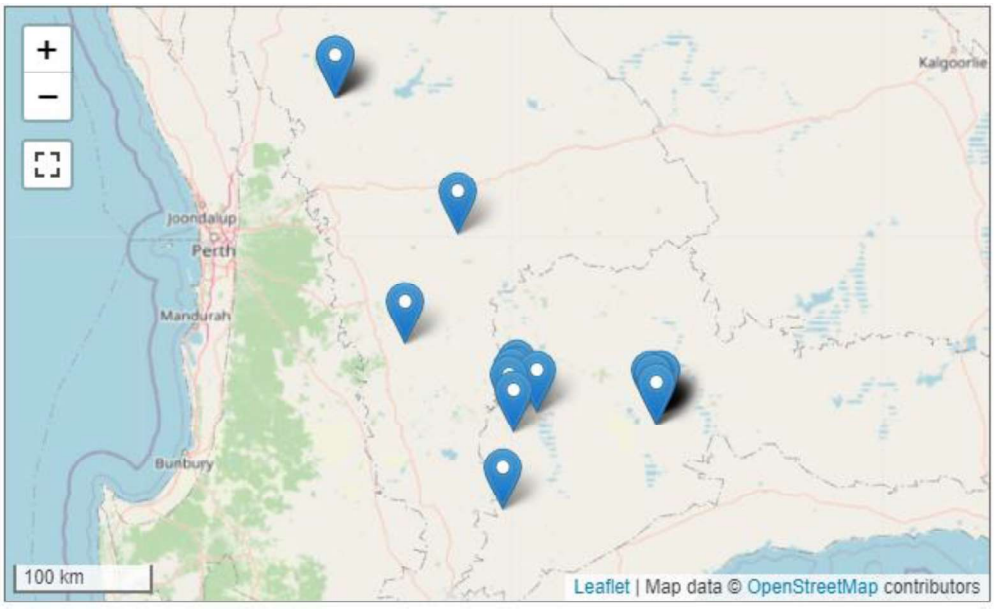

Plate 2 Distribution of *Jacksonia debilis* (P1) (source: WAH, 1998)

Acacia cochlocarpa subsp. *cochlocarpa* (Endangered under the EPBC Act and Critically Endangered under the BC Act) is a sprawling shrub often found on gravelly clay or sand (WA Herb, 1998). There are two records of the species 4 km from the survey area that represent verified population #6. The species was recorded in open shrubland with *Acacia acuminata, Dianella revoluta, Austrostipa elegantissima* and *Allocasuarina campestris* within the rail reserve. It is restricted to roadsides (DCCEEW, 2022). Suitable habitat for the species is present in the survey area, however no individuals were identified during targeted surveys. It is a perennial species with high detectability and therefore considered unlikely to occur following the field survey.

There are 20 records of *Daviesia euphorbioides* (Endangered under the EPBC Act and Critically Endangered under the BC Act) within 25 km of the survey area, 14 of which are verified populations. The closest record is 3.2 km south-east of the survey area (population #14) and was recorded in a revegetation corridor in 2012. *D. euphorbioides* is endemic to the Merredin District and occurs on sandplain habitat with heath dominated by *Casuarina* and *Actinostrobus* species. No suitable habitat according to the description in the Conservation Advice (TSSC, 2016) was present in the survey area. It's likelihood has therefore been reduced to ‘low’.

Guichenotia impudica (P3) is a perennial shrub that grows on laterite (WAH, 1998). Lateritic sandy soils were recorded near the church associated with Shrubland AcEc. There are 16 records of the species within 25 km, of which three are verified (i.e. are on the Threatened and Priority Flora List). The closest record is 0.3 km from the survey area in paddock from 1992, described as being on lateritic soil 1.5 km east along Dowerin-Konnongorring Road. This location is east of the survey area. No laterite soils were observed in areas of remnant native vegetation and no other species from the Malvaceae family were recorded. This species likelihood has been reduced to ‘low’.

8.0 Conclusion

A detailed flora and vegetation survey was undertaken for the CBH Konnongorring survey area. Areas of native vegetation was traversed on foot and floristic data was collected from two non-permanent quadrats and one relevé. A summary of results is below:

- The desktop assessment determined:
  - The Eucalypt Woodlands of the WA Wheatbelt TEC listed as Critically Endangered under the EPBC Act and Priority 3 by DBCA was considered likely to occur. Three Priority 3 PECs were identified as occurring within 20 km of the survey area.
  - 118 significant flora species are known from 20 km of the survey area. Of these three were considered likely to occur and one was known to occur (*Jacksonia debilis* listed as P1 by DBCA).
- The field survey confirmed:
  - None of the patches of native vegetation represent the Eucalypt Woodlands of the WA Wheatbelt, or any of the PECs.
  - Two native vegetation communities were defined and mapped for 3.50 ha representing Shrublands, another two significantly altered vegetation communities were mapped for 4.51 ha representing Trees over weeds and Planted vegetation. The remaining 69.69 ha is cleared.
  - No Threatened or Priority flora were recorded during the survey. The *Jacksonia debilis* location was visited and systematic searches undertaken in the patch of native vegetation at this location, but no individuals were recorded. The species is a perennial that should have been detectable in November even if this was after its flowering period.
  - Flora species diversity was low, attributed to the historical disturbance and extensive clearing of the survey area.

The survey area was undertaken with no significant limitations identified that may influence the results of the survey.

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Appendix A

Significant Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance from Survey Area		Date of Record		PMST	Likelihood Assessment					Total Score	Likelihood	
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known nearby (5km)	Recent Record (Last 20 years)	Known within LGA	Presence of suitable habitat (0,1,2)		Pre-Survey	Post-Survey
Acacia ataxiphylla subsp. *magna*	Sandy soils. Lateritic ironstone rises, flats.	E	EN	15.6	15.6	1/07/2010	1/07/2010	Yes	0	0	1	1	1	3	Moderate (Possible)	Negligible
Acacia botrydion	Gravelly lateritic soils. Hillslopes.		P4	17.7	-	11/12/1980			0	0	0	0	2	2	Low (Unlikely)	Negligible
Acacia campylophylla	Lateritic gravelly soils.		P3	15.6	-	1/07/2010			0	0	1	1	2	4	Moderate (Possible)	Negligible
Acacia cochlocarpa subsp. *cochlocarpa*	Associated with disturbed roadsides on gravelly, clayey sand over laterite. Vegetation is low open scrub with *Allocasuarina campestris, Hakea scoparia* and other *Acacia* spp. (DCCEEW, 2022).	E	CR	4.2	4.3	17/08/2007	9/12/2015	Yes	0	1	1	1	2	5	High (Likely)	Low (Unlikely). Perennial species not detected during survey.
Acacia cochlocarpa subsp. *velutinosa*	Sandy clay or laterite.	CE	CR	20.9	21.2	23/11/2011	3/07/2017	Yes	0	0	1	0	1	2	Low (Unlikely)	Negligible
Acacia congesta subsp. wonganensis	Rocky clay, laterite.		P2	17.7	-	15/09/1983			0	0	0	0	1	1	Negligible	Negligible
Acacia denticulosa	Sand, loam, clay. Granite outcrops, rarely on sandplains.	V	VU	24.0	17.9	7/10/1903	27/08/2019		0	0	1	0	1	2	Low (Unlikely)	Negligible
Acacia drewiana subsp. *minor*	Sandy & gravelly soils.		P2	17.0	20.3	21/06/2007	26/07/2001		0	0	1	0	2	3	Moderate (Possible)	Negligible
Acacia dura	Sand, sandy loam, laterite.		P2	20.6	-	7/09/1991			0	0	0	0	2	2	Low (Unlikely)	Negligible
Acacia filifolia	Yellow sand, gravelly lateritic sand. Sandplains.		P3	17.0	20.7	20/06/2007	20/06/2007		0	0	1	0	2	3	Moderate (Possible)	Negligible
Acacia phaeocalyx	Yellow or white sand, often over laterite. Flats, hillsides.		P3	10.5	21.7	29/04/2009	3/01/2007		0	0	1	0	2	3	Moderate (Possible)	Negligible
Acacia pharangites	Red-brown clay, greenstone. Gullies.	E	CR	18.8	-	24/07/1981		Yes	0	0	0	0	0	0	Negligible	Negligible
Acacia pygmaea	Laterite. In crevices, summit of ridges.	E	EN	24.0	20.0	11/12/1980	26/08/2001	Yes	0	0	0	0	0	0	Negligible	Negligible
Acacia repanda	Loam, sandy or gravelly loam. Near granite outcrops.		P3	17.0	-	0/01/1900			0	0	0	0	0	0	Negligible	Negligible
Acacia scalena	Yellow or yellow gravelly sand, loam.		P3	20.3	-	10/12/2010			0	0	1	0	2	3	Moderate (Possible)	Negligible
Acacia semicircinalis	Gravelly soils, laterite. Hillslopes.		P4	17.0	20.1	15/01/1997	6/02/2002		0	0	1	0	2	3	Moderate (Possible)	Negligible
Acacia trinalis	Brown sand, clay loam. Salt lakes & flats, swampy areas.		P1	5.1	-	7/10/2009			0	0	1	1	0	2	Negligible	Negligible
Acacia vassalii	Grey/brown or yellow sand, sandy loam.	E	CR	16.6	17.1	21/08/2008	24/06/2015	Yes	0	0	1	1	2	4	Moderate (Possible)	Negligible
Acacia volubilis	Gravelly sand, sandy clay.	E	CR	-	-			Yes	0	0	0	0	2	2	Low (Unlikely)	Negligible
Andersonia gracilis	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	E	VU	-	-			Yes	0	0	0	0	0	0	Negligible	Negligible
Androcalva fragifolia	Flat. Rail reserve, high in landscape with white / grey soil and laterite. Recruitment burn 2007.		P1	22.6	-	14/02/2008			0	0	1	0	0	1	Negligible	Negligible
Angianthus micropodioides	Saline sandy soils. River edges, saline depressions, claypans.		P3	23.1	-	22/10/1945			0	0	0	0	0	0	Negligible	Negligible

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		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known nearby (5km)	Recent Record (Last 20 years)	Known within LGA	Presence of suitable habitat (0,1,2)		Pre-Survey	Post-Survey
Anigozanthos humilis subsp. chrysanthus	Grey or yellow sand.		P4	21.8	-	4/09/1958			0	0	0	0	2	2	Low (Unlikely)	Negligible
Banksia bella	Gravelly lateritic clay, laterite.		P4	17.0	-	10/11/2002			0	0	1	0	1	2	Low (Unlikely)	Negligible
Banksia comosa	Clay, laterite, gravel.		P4	17.7	-	15/09/1990			0	0	0	0	1	1	Negligible	Negligible
Banksia horrida	Sand, sometimes with gravel.		P3	5.4	-	22/06/1996			0	0	0	1	2	3	Moderate (Possible)	Negligible
Banksia wonganensis	Gravelly loam. Lateritic rises.		P4	21.6	-	4/08/1986			0	0	0	0	2	2	Low (Unlikely)	Negligible
Boronia ericifolia	Sandy loam, clay, laterite. Low-lying spots.		P2	17.0	21.0	27/08/1976	18/08/1985		0	0	0	0	2	2	Low (Unlikely)	Negligible
Bossiaea atrata	White sand or sandy loam over laterite or clay, quartzite sand, clay.		P3	25.1	-	9/09/2010			0	0	1	0	1	2	Low (Unlikely)	Negligible
Caladenia drakeoides	Grey clayey sand, red sandy loam, in damp situations. Margins of salt lakes.	E	CR	17.7	19.3	25/09/1984	30/08/2020	Yes	0	0	1	1	0	2	Low (Unlikely)	Negligible
Caladenia huegelii	Grey or brown sand, clay loam.	E	CR	-	-			Yes	1	1	0	0	1	3	Moderate (Possible)	Negligible
Calandrinia uncinella	Landform: saline river flats. Soil colour: grey/brown. Soil type: silty loam.		P1	19.0	19.0	16/09/2003	16/09/2003		0	0	1	0	0	1	Negligible	Negligible
Calandrinia wilsonii	Small rise above saline river flats. Brown clayey sand.		P2	10.4	-	6/11/2015			0	0	1	1	0	2	Low (Unlikely)	Negligible
Calothamnus quadrifidus subsp. *asper*	No habitat information available - records from Wongan Hills		P2	17.0	-	29/09/1985			0	0	0	0	0	0	Negligible	Negligible
Calytrix calingiri	White sand over laterite. Gravely soil		P3	13.6	-	6/10/2018			0	0	1	1	1	3	Moderate (Possible)	Negligible
Chamelaucium sp. Wongan Hills (B.H. Smith 1140)	Gently undulating terrain, loamy sand with lateritic gravel.		P3	17.7	-	19/11/2006			0	0	1	0	2	3	Moderate (Possible)	Negligible
Chorizema humile	Sandy clay or loam. Plains.	E	CR	-	-			Yes	1	1	0	0	1	3	Moderate (Possible)	Negligible
Conospermum densiflorum subsp. *unicephalatum*	Clay soils. Low-lying areas.	E	EN	-	-			Yes	1	1	0	0	0	2	Negligible	Negligible
Conostephium wonganense	Upland. Dry, bare yellow sandy loam.		P1	6.8	-	13/09/2005			0	0	1	1	2	4	Moderate (Possible)	Negligible
Conostylis wonganensis	Yellow sand, sandy clay.	E	EN	18.8	20.4	4/11/2009	26/08/2019	Yes	0	0	1	0	2	3	Moderate (Possible)	Negligible
Dampiera glabrescens	White or grey/yellow sand. Gravel pits, roadsides.		P1	21.6	-	4/10/2020			0	0	1	0	2	3	Moderate (Possible)	Negligible
Dasymalla axillaris	Sandy soils, disturbance opportunist.	CE	CR	16.7	-	9/09/1971		Yes	0	0	0	0	2	2	Low (Unlikely)	Negligible
Daviesia dielsii	Sandy, often gravelly soils.	E	EN	-	-			Yes	0	0	0	0	2	2	Low (Unlikely)	Negligible

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Daviesia euphorbioides	Endemic to the Merredin District and occurs on sandplain habitat with heath dominated by *Casuarina* and *Actinostrobus* species. The species is often found growing with *Hemigenia viscida* . Other associated species include *Conospermum brownii, Boronia coerulescens, Glischrocaryon aureum, Lysinema ciliatum, Verticordia chrysantha* and *Calytrix* species (TSSC, 2016).	E	CR	21.7	3.2	23/11/2011	15/12/2020	Yes	0	1	1	1	2	5	High (Likely)	Low (Unlikely). Perennial species not detected during survey.
Daviesia nudiflora subsp. *drummondii*	White or grey sand. Undulating low rises.		P3	17.7	-	20/06/1986			0	0	0	0	2	2	Low (Unlikely)	Negligible
Daviesia spiralis	Gravelly lateritic clay & sand.		P4	17.0	20.1	6/09/2013	10/11/2002		0	0	1	0	1	2	Low (Unlikely)	Negligible
Dicrastylis reticulata	Sandy soils, often over granite. Amongst granite rock, hills, flats.		P3	22.8	-	15/10/2009			0	0	1	0	0	1	Negligible	Negligible
Dicrastylis velutina	Sandy soils, gravelly loam.		P3	17.7	-	13/09/2012			0	0	1	0	2	3	Moderate (Possible)	Negligible
Eremophila resinosa	Clay loam, gravelly sandy clay. Road verges.	E	EN	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Eremophila sargentii	Laterite, sandy loam. Sandplains, hills.		P2	17.0	-	5/10/1903			0	0	0	0	2	2	Low (Unlikely)	Negligible
Eremophila ternifolia	Red clay. Between breakaways.	E	VU	17.0	20.6	14/10/2009	14/10/2009	Yes	0	0	1	0	0	1	Negligible	Negligible
Eremophila viscida	Granitic soils, sandy loam. Stony gullies, sandplains.	E	EN	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Eucalyptus caesia subsp. *caesia*	Granite outcrops.		P4	11.0	-	2/07/2002			0	0	1	0	0	1	Negligible	Negligible
Eucalyptus caesia subsp. *magna*	Loam. Granite outcrops.		P4	14.6	-	2/11/2014			0	0	1	0	0	1	Negligible	Negligible
Eucalyptus macrocarpa x pyriformis	Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains.		P3	16.5	9.1	10/12/1986	15/09/1996		0	0	0	0	0	0	Negligible	Negligible
Eucalyptus recta	Sandy laterite.	E	VU	24.2	-	24/12/2014		Yes	0	0	1	0	2	3	Moderate (Possible)	Negligible
Eucalyptus sargentii subsp. *onesis*	In flat sandy depression.		P3	4.9	-	27/03/2010			0	1	1	1	1	4	Moderate (Possible)	Negligible
Eutaxia rubricarina	Gravelly sand, grey to pinkish-white sandy clay, red loam. Flats, slopes, valley floors, road verges.		P3	23.4	-	30/09/2016			0	0	1	0	1	2	Low (Unlikely)	Negligible
Frankenia conferta	The preferred habitat is around the high water mark of lake shorelines to the tops of low mounds within saline pans	E	VU	-	-			Yes	0	0	0	0	0	0	Negligible	Negligible
Frankenia glomerata	White sand. Records found to occur on light brown loamy sand.		P4	19.9	-	29/11/2001			0	0	0	1	1	2	Low (Unlikely)	Negligible
Gastrolobium appressum	Occurs on slopes or crowns of small hills as well as on sand plains. It grows in quartz gravel and white or yellow sand, in vegetation associations that include thicket, open low scrub over	V	VU	-	-			Yes	0	0	0	0	0	0	Negligible	Negligible
Gastrolobium glaucum	Sandy, often gravelly soils over laterite. Slopes, breakaways.	E	CR	14.7	14.7	16/09/2009	10/12/2010	Yes	0	0	1	0	0	1	Negligible	Negligible
Gastrolobium hamulosum	Sandy, often gravelly soils or clay. Flats, slopes, ridges.	E	CR	17.0	23.4	18/09/2006	3/09/2015	Yes	0	0	1	0	1	2	Low (Unlikely)	Negligible
Gastrolobium rotundifolium	Heavy clay or loam soils, granite, sandstone, quartzite. Low rises, breakaways.		P3	23.7	-	30/08/1971			0	0	0	0	0	0	Negligible	Negligible

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Gnephosis multiflora	Sandy saline soils. River flats, sandy rises.		P3	23.1	-	4/11/1977			0	0	0	0	0	0	Negligible	Negligible
Grevillea asparagoides	Gravelly loam, white or yellow sand.		P3	24.0	-	28/07/1983			0	0	0	0	1	1	Negligible	Negligible
Grevillea christineae	Clay loam, sandy clay, often moist.	E	EN	-	-			Yes	0	0	0	0	0	0	Negligible	Negligible
Grevillea dryandroides subsp. *dryandroides*	Yellow sand & gravel, clay.	E	CR	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Grevillea dryandroides subsp. *hirsuta*	White or yellow sand, laterite.	E	VU	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Grevillea endlicheriana subsp. Wongan Hills (G.J. Keighery 15351)	Edge of granite outcrop with brown sandy loam.		P2	14.6	-	19/10/2013		Yes	0	0	1	0	0	1	Negligible	Negligible
Grevillea kenneallyi	Gravelly loam, laterite.		P2	17.7	20.6	22/08/2008	26/08/2001		0	0	1	0	1	2	Low (Unlikely)	Negligible
Grevillea pythara	Sand or sandy loam with gravel.	E	CR	-	-			Yes	0	0	0	0	2	2	Low (Unlikely)	Negligible
Grevillea sp. Trayning (W. Johnston WJ 071)	Upland. Dry pale brown sandy loam.		P1	14.1	-	15/12/2007			0	0	1	1	2	4	Moderate (Possible)	Negligible
Guichenotia glandulosa	Littered soil. Creek lines.		P2	15.0	20.7	20/08/2017	5/09/2007		0	0	1	0	1	2	Low (Unlikely)	Negligible
Guichenotia impudica	Laterite.		P3	0.3	1.4	3/10/2008	3/10/2008		1	1	1	1	1	5	High (Likely)	Low (Unlikely)
Gyrostemon reticulatus	The Net-veined Gyrostemon grows in dense shrubland in brown/yellow loamy sand on sloping topography.	CE	CR	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Hakea chromatropa	Gravelly loam. In open shrubland.		P1	23.7	-	2/10/2006			0	0	1	0	1	2	Low (Unlikely)	Negligible
Hemiandra coccinea	White or grey, often gravelly sand. Sandplains, gravel pits.		P3	17.0	-	1/12/2006			0	0	1	0	2	3	Moderate (Possible)	Negligible
Hemiandra gardneri	Grey or yellow sand, clayey sand. Sandplains.	E	CR	-	-			Yes	0	0	0	0	1	1	Negligible	Negligible
Hydrocotyle lemnoides	Swamps.		P4	21.9	-	29/10/2008			0	0	1	0	0	1	Negligible	Negligible
Jacksonia debilis	White or grey clayey sand.		P1	0.0	-	5/09/1992			1	1	0	1	2	5	Known	Low (Unlikely)
Lepidosperma sp. Meckering (R. Davis WW 27-32)	Hill. Brown sandy clay.		P3	5.0	-	25/09/2000			0	1	0	1	1	3	Moderate (Possible)	Negligible
Lilaeopsis polyantha	Sandy mud. Lake margins.		P2	21.9	-	24/11/2008			0	0	1	1	0	2	Negligible	Negligible
Loxocarya albipes	Lateritic gravel. Dry heath.		P4	17.5	-	10/09/2012			0	0	1	0	1	2	Low (Unlikely)	Negligible
Lysiosepalum abollatum	Red clay.	CE	CR	17.0	-	1/10/1996		Yes	0	0	0	0	0	0	Negligible	Negligible
Lysiosepalum aromaticum	Brown loam over granite. Slopes, moist area at foot of outcrops.		P2	24.5	-	23/08/2020			0	0	1	1	0	2	Negligible	Negligible

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Melaleuca sciotostyla	Orange clayey sand with lateritic pebbles. Scree slopes.	E	EN	20.5	21.8	23/09/2008	23/09/2008	Yes	0	0	1	0	0	1	Negligible	Negligible
Melaleuca sclerophylla	Gravelly sand, clayey sand. Granite outcrops, rises.		P3	17.7	21.1	14/10/2009	8/09/1994		0	0	1	0	0	1	Negligible	Negligible
Microcorys eremophiloides	Shallow soils over massive laterite, granite.	V	VU	5.0	5.0	12/09/2012	8/10/2019	Yes	0	1	1	1	1	4	Moderate (Possible)	Low (Unlikely)
Microcorys tenuifolia	Red/brown sand, lateritic gravelly soils. Undulating plains.		P3	23.3	-	15/01/1997			0	0	0	0	1	1	Negligible	Negligible
Papistylus grandiflorus	Brown, brown-red or yellow sandy clay, yellow-brown rocky sand, granite. Hillslopes, plains.		P2	17.7	-	13/09/1947			0	0	0	0	2	2	Low (Unlikely)	Negligible
Persoonia chapmaniana	White sandy clay, yellow sand. Vicinity of salt lakes.		P3	12.3	-	25/10/1999			0	0	0	1	0	1	Negligible	Negligible
Persoonia pungens	White or yellow sand, often over laterite.		P3	17.0	17.6	19/11/2006	19/11/2006		0	0	1	0	2	3	Moderate (Possible)	Negligible
Phebalium brachycalyx	Sand, gravelly soils. Lateritic uplands, hills.		P3	17.7	-	9/08/1959			0	0	0	0	1	1	Negligible	Negligible
Philotheca wonganensis	Red sandy soils.	E	EN	-	-			Yes	0	0	0	0	2	2	Low (Unlikely)	Negligible
Podotheca pritzelii	Sand. Sand ridges in salt flats.		P3	17.1	-	25/10/1983			0	0	0	0	2	2	Low (Unlikely)	Negligible
Rhagodia acicularis	Red lateritic gravel. Slopes.	V	VU	20.0	20.5	14/10/2009	14/10/2009	Yes	0	0	1	0	1	2	Low (Unlikely)	Negligible
Roycea pycnophylloides	Sandy soils, clay. Saline flats.	E	VU	-	-			Yes	0	0	0	0	0	0	Negligible	Negligible
Scaevola tortuosa	Sandy clay. Margins of salt lakes.		P1	12.5	12.5	25/10/1999	25/10/1999		0	0	0	1	0	1	Negligible	Negligible
Schoenus capillifolius	Brown mud. Claypans.		P3	12.6	12.6	25/10/1999	25/10/1999		0	0	0	1	0	1	Negligible	Negligible
Schoenus griffinianus	White sand.		P4	22.4	22.4	11/10/1985	24/10/1984		0	0	0	0	2	2	Low (Unlikely)	Negligible
Schoenus natans	Winter-wet depressions.		P4	21.9	-	29/10/2008			0	0	1	0	0	1	Negligible	Negligible
Schoenus pennisetis	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.		P3	17.7	-	9/08/1949			0	0	0	0	0	0	Negligible	Negligible
Scholtzia halophila subsp. *mortlockensis*	Beige sand on river flat.		P3	21.4	-	21/10/1997			0	0	0	1	0	1	Negligible	Negligible
Stylidium coroniforme subsp. *coroniforme*	Shallow sand over laterite. Upland habitats. Allocasuarina and Dryandra shrubland, mallee woodland.	E	EN	21.7	20.5	14/10/2009	14/10/2009	Yes	0	0	1	0	2	3	Moderate (Possible)	Negligible
Stylidium periscelianthum	Loamy clay, moist soils pockets. Wet flats, low granitic hills.		P3	8.9	-	27/09/2001			0	0	0	0	0	0	Negligible	Negligible
Stylidium sacculatum	Clayey sand or sand. Lower slopes and flats. Open Wandoo or Marri woodland, Allocasuarina shrubland.		P3	14.9	-	20/10/1975			0	0	0	0	1	1	Negligible	Negligible
Styphelia caudata	Plain. High in landscape. White/grey sand/loam.		P3	6.8	6.8	12/06/2008	4/07/2007		0	0	1	1	2	4	Moderate (Possible)	Negligible

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Styphelia tamminensis	Hillslope. On light yellow brown sand.		P3	6.8	-	10/04/2005			0	0	1	1	2	4	Moderate (Possible)	Negligible
Synaphea constricta	Sand or sandy clay-loam over laterite.		P3	19.3	21.1	10/09/1997	8/07/1988		0	0	0	0	1	1	Negligible	Negligible
Tetratheca retrorsa	Lateritic breakaways.		P3	14.4	-	16/09/2009			0	0	1	0	0	1	Negligible	Negligible
Thomasia tenuivestita	Granite, loam.		P3	0.3	-	12/09/2007			0	1	1	1	1	4	Moderate (Possible)	Low (Unlikely)
Thysanotus tenuis	Clay, sandy clay, sand.		P3	20.1	-	27/09/1991			0	0	0	0	2	2	Low (Unlikely)	Negligible
Verticordia huegelii var. *tridens*	Sandy or gravelly loam. Winter-wet areas, low hills.		P3	23.3	-	30/09/1985			0	0	0	0	2	2	Low (Unlikely)	Negligible
Verticordia mitchelliana subsp. *mitchelliana*	Grows on light sandy soil		P3	19.8	-	0/01/1900			0	0	0	0	2	2	Low (Unlikely)	Negligible
Verticordia staminosa subsp. *staminosa*	Soil pockets. Granite outcrops.	E	CR	17.0	22.0	18/07/2007	31/10/2014	Yes	0	0	1	0	0	1	Negligible	Negligible
Verticordia venusta	Yellow sand, sandy gravel. Sandplains.		P3	15.5	-	7/11/1991			0	0	0	0	2	2	Low (Unlikely)	Negligible
Verticordia wonganensis	Yellow or white sand.		P2	17.7	-	7/11/1991			0	0	0	0	2	2	Low (Unlikely)	Negligible

Appendix B

Flora by Family by Site Matrix

Appendix B Flora by Family by Community List

Family	Species	GpAb	AcAe		Opportunistic
		1	2	3	
Amaranthaceae					
	Ptilotus exaltatus				x
	Ptilotus polystachyus	x		x	
Asparagaceae					
	Thysanotus manglesianus		x		
Asteraceae					
	Calocephalus multiflorus		x	x	
	* *Hypochaeris glabra*		x	x	
	Trachymene pilosa		x	x	
	* *Ursinia anthemoides*	x		x	
	Waitzia acuminata var. *acuminata*		x	x	
Casuarinaceae					
	Allocasuarina campestris		x	x	
Chenopodiaceae					
	Chenopodium gaudichaudianum			x	
	Enchylaena tomentosa var. *tomentosa*			x	x
Crassulaceae					
	Crassula colorata		x		
Cyperaceae					
	Ericomyrtus serpyllifolia	x			
	Lepidosperma asperatum		x		
	Lepidosperma costale				x
Dilleniaceae					
	Hibbertia aurea		x		
	Hibbertia subvaginata		x	x	
Ericaceae					
	Styphelia serratifolia			x	
Fabaceae					
	Acacia acuaria	x			
	Acacia acuminata	x		x	
	Acacia burkittii			x	
	Acacia restiacea	x			
	Acacia saligna	x			
Goodeniaceae					
	Dampiera lavandulacea			x	x
	Goodenia rosea		x		
Haemodoraceae					
	Conostylis androstemma		x		
Hemerocallidaceae					
	Dianella revoluta	x	x	x	
Myoporaceae					
	Eremophila drummondii		x		
Myrtaceae					
	Eucalyptus camaldulensis				x
	Eucalyptus loxophleba subsp. *loxophleba*			x	
	Leptospermum erubescens			x	
	Verticordia chrysantha		x		
Poaceae					
	Amphipogon amphipogonoides		x	x	
	Austrostipa elegantissima	x	x	x	
	Austrostipa eremophila	x		x	
	Austrostipa sp.		x	x	
	* *Avena barbata*	x			
	* *Cenchrus setaceus*				x
	* *Ehrharta calycina*		x		

Appendix B Flora by Family by Community List

Family	Species	GpAb	AcAe		Opportunistic
		1	2	3	
Poaceae cont.					
	* *Pentameris airoides*			x	
	Rytidosperma sp.		x		
	Thyridolepis multiculmis	x			
Polygalaceae					
	Comesperma scoparium				x
	Comesperma volubile			x	
Proteaceae					
	Grevillea paniculata	x		x	
	Grevillea paradoxa		x		
	Hakea francisiana				x
	Hakea meisneriana		x		
Rhamnaceae					
	Stenanthemum pomaderroides		x		
Sapindaceae					
	Dodonaea pinifolia		x		
Solanaceae					
	Solanum hoplopetalum				x
		x			
	SUBMIT lpo smother	x			

Appendix C

Site Data

Appendix C Site Data

Site No: R1	**Date**: 21/11/2022	**Longitude:** 116.776352	**Latitude**: -31.056463

Type: Relevé
Soil Types: Clay loam
Topography: Flat
Surface: 25% leaves, 10% bare
Fire: 10 +
Vegetation Condition: Degraded
Vegetation Type: Acacia Shrubland
Condition Notes: Roadside, weeds, historical clearing.
Description: Scattered native shrubs over weeds

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
FdW221121-239		*Acacia acuaria*	200	4
		Acacia acuminata	400	5
		Acacia restiacea	80	2
		Acacia saligna	400	1
		Austrostipa elegantissima	100	4
		Austrostipa eremophila	50	2
	*	*Avena barbata*	100	25

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
		Dianella revoluta	50	0.1
		Ericomyrtus serpyllifolia	80	0.1
FdW221121-238		*Grevillea paniculata*	200	20
		Ptilotus polystachyus	50	0.5
		SUBMIT Grass furry 65	50	1
		SUBMIT Ipo smother	0	0.1
	*	*Ursinia anthemoides*	20	4

Site No: Q2	**Date**: 21/11/2022	**Longitude:** 116.7761311	**Latitude**: -31.05920226

Type: Quadrat
Soil Types: Hard gravel / laterite
Topography: Slope
Surface: 50% bare
Fire: 10 +
Vegetation Condition: Very Good
Vegetation Type: Allocasuarina Shrubland
Condition Notes: Remnant native vegetation. No weeds, low diversity, high bare ground.
Description: Mixed shrubland over scattered herbs and grasses.

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
		Allocasuarina campestris	320	40
		Amphipogon amphipogonoides	30	0.1
		Austrostipa elegantissima	30	0.5
		Austrostipa sp.	30	0.1
		Calocephalus multiflorus	5	0.1
FdW221121-243		*Conostylis androstemma*	20	0.1
		Crassula colorata	5	0.1
		Dianella revoluta	50	0.5
FdW221121-240		*Dodonaea pinifolia*	50	0.1

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
	*	*Ehrharta calycina*	5	0.1
FdW221121-242		*Eremophila drummondii*	60	0.1
		Goodenia rosea	5	0.1
		Grevillea paradoxa	240	
		Hakea meisneriana	150	
FdW221121-241		*Hibbertia aurea*	30	1
		Hibbertia subvaginata	40	0.5
	*	*Hypochaeris glabra*	20	0.1
		Lepidosperma asperatum	60	0.1
FdW221121-244		*Rytidosperma sp.*		0.1
		Stenanthemum pomaderroides	60	0.1
		Thysanotus manglesianus	0	0.1
		Trachymene pilosa	5	
		Verticordia chrysantha	60	
		Waitzia acuminata var. *acuminata*	15	0.1

Site No: Q3	**Date**: 21/11/2022	**Longitude:** 116.7739873	**Latitude**: -31.0592251

Type: Quadrat
Soil Types: Sand with gravel, white.
Topography: Slope
Surface: 50% bare
Fire: 10 +
Vegetation Condition: Very Good, on edge of Good
Vegetation Type: Allocasuarina Shrubland
Condition Notes: Remnant native vegetation. No weeds, low diversity, high bare ground.
Description: Mixed shrubland over scattered herbs and grasses. Occasional Eucalypt.

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
		Acacia acuminata	500	
		Acacia burkittii	200	
		Allocasuarina campestris	250	10
		Amphipogon amphipogonoides	20	0.1
		Austrostipa elegantissima	30	2
		Austrostipa eremophila	30	0.1
		Austrostipa sp.	30	0.1
		Calocephalus multiflorus	20	0.5
		Chenopodium gaudichaudianum	70	1

Coll	Cons. Status	Taxon	Height (cm)	Foliage (%)
		Comesperma volubile	0	0.5
		Dianella revoluta	0	2
		Enchylaena tomentosa var. *tomentosa*	10	0.1
		Eucalyptus loxophleba subsp. *loxophleba*	600	1
		Grevillea paniculata	70	2
		Hibbertia subvaginata	30	0.5
	*	*Hypochaeris glabra*	10	0.1
		Leptospermum erubescens	70	8
	*	*Pentameris airoides*	10	0.1
		Ptilotus polystachyus	30	0.1
		Styphelia serratifolia	30	0.1
		Dampiera lavandulaceae	20	
		Trachymene pilosa	30	0.1
	*	*Ursinia anthemoides*	10	0.5
		Waitzia acuminata var. *acuminata*	20	1

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