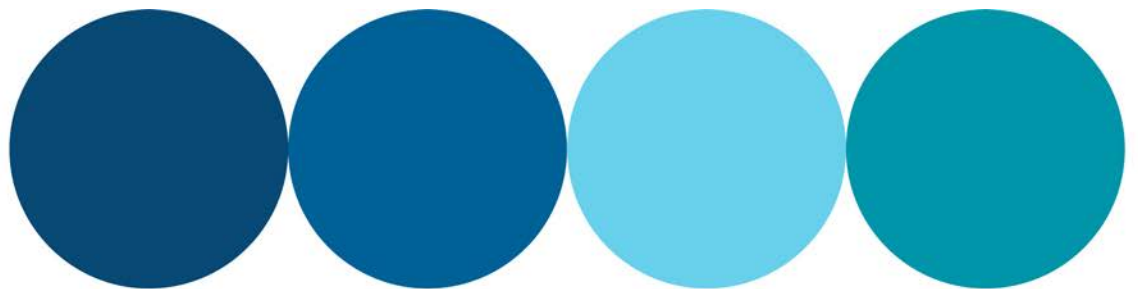


Environmental Offset Proposal

CW00860 Greenbushes to Kirup Link





Document Information

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2	9/1/2018	G. Tribbick	DWER	
3	30/01/2019	G. Tribbick	D. Hill I. Bierman D. Stevens	Minor update with the addition of an extra 2ha of offset site.



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1. Introduction

1.1. Purpose of this Document

The purpose of this document is to provide details on the offsets proposed for the Greenbushes to Kirup Link project in accordance with the requirements of the Department of Water and Environmental Regulation (DWER) Clearing Permit process and the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999 bilateral assessment process.

This document has been prepared for the DWER Chief Executive Officer's (CEO) consideration and approval, as well as the approval of the Minister for the Environment and Energy (or a delegate thereof) as a part of a bilateral assessment.

1.2. Project Overview

The Water Corporation proposes to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, as a component of the broader Warren Blackwood Water Supply Scheme (the project). The project will construct approximately 13 km of pipeline and associated works to create a single water supply scheme which will deliver water from a storage facility in Greenbushes to the towns of Balingup, Mullalyup and Kirup.

The infrastructure associated with the project includes (Figure 1, Appendix A):

- Approximately 16 km of 150 mm nominal diameter water supply main from the Greenbushes summit tank to the Mullalyup Tank.
- A pump station to Kirup and associated site work at the Mullalyup tank site (no clearing).
- A 66 m, 125 mm nominal diameter bypass main near Kirup Dam site (Kirup Bypass).

Construction of the infrastructure will involve the clearing of small amounts of native vegetation and fauna habitat.

1.3. Proponent

The Water Corporation has an obligation to provide sustainable management of water services, including the supply of water, and the treatment and disposal of wastewater within Western Australia. The Water Corporation is the proponent for the proposed project.

Proponent Details

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2. Environmental Offset Policies

This offset proposal has been developed in accordance with the Western Australian Government's Environmental Offset Policy (EPA, 2011) as well as the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (SEWPAC, 2012).

2.1. WA Environmental Offsets Principles

The following principles from the WA Government offsets policy have been considered:

- Environmental offsets will only be considered after avoidance and mitigation options have been pursued.
- Environmental offsets are not appropriate for all projects.
- Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted.
- Environmental offsets will be based on sound environmental information and knowledge.
- Environmental offsets will be applied within a framework of adaptive management.
- Environmental offsets will be focussed on longer term strategic outcomes.

2.2. Federal Offset Requirements

Consideration has also been given to the following requirements of the Federal Offsets Policy:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter.
- Suitable offsets must be built around direct offsets but may include other compensatory measures.
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding.
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs.
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.



3. Clearing Area

The proposed clearing area is 5.8 ha and is shown in overview in Figure 1, Appendix A. The total Project area is 15.3 ha; the remaining 9.5 ha are existing cleared areas.

3.1. Biological Assessments

A spring flora, vegetation and fauna survey was undertaken in 2013 by Astron Environmental Services (Astron, 2013). The vegetation and flora field survey was undertaken in accordance with the, then current, requirements of a Level 2 assessment outlined in the EPA's Position Statement 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (2002) and Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2004). A Level 1 fauna survey was undertaken in conjunction with the vegetation and flora survey.. The fauna survey included a targeted Black Cockatoo habitat assessment and a targeted Western Ringtail Possum assessment.

In 2017 changes were made to the alignment due to change of infrastructure requirements and a specific effort to avoid identified Black Cockatoo habitat trees. Due to this change an additional Flora, Vegetation and Fauna Survey (with targeted Black Cockatoo Habitat Assessment) was undertaken by GHD to cover those areas that now differed from those covered in the Astron survey. Additionally GHD was engaged to revisit the areas previously surveyed by Astron and repeat the Black Cockatoo Habitat Assessment in these locations to ensure consistency in methodology and completeness of results.

An additional flora, vegetation and fauna survey, with black cockatoo habitat assessment, was undertaken in spring 2018. This survey was undertaken due to the addition of an extra 3km of pipeline added to the scope of project works. This survey was undertaken by GHD.

A dieback survey of the proposed project footprint was undertaken by Glevan consulting in 2017. It is proposed that a dieback survey will be undertaken again in 2019 to verify the currency of previous findings.

A copy of all biological surveys undertaken is included in Appendix B.

3.2. Hierarchy of avoidance, minimisation, rectification and mitigation

Potential impacts to Black Cockatoo habitat trees (which are a MNES) have been specifically considered during project design and minimised as far as practical. The Project area has been designed to avoid potential breeding trees as much as possible. Approximately 763 potential Black Cockatoo habitat trees were recorded during the combined GHD Black Cockatoo habitat assessments (some of which were recorded just outside the survey boundary). The final refined Project Area intersects 93 potential Black Cockatoo habitat trees, with 64 requiring removal, whilst 763 within the survey area have been successfully avoided. It should be noted that the 2017 and 2018 surveys commissioned were for a narrow width of 10--20m to cover the proposed project footprint, it is likely that the surrounding vegetation to this survey area contains large numbers of potential black cockatoo breeding habitat trees.

Water Corporation will implement a number of management plans during the Project, including a Construction Environmental Management Plan (CEMP) which will be prepared by the Contractor in accordance with the Construction Environmental Management Framework (CEMF) that has been prepared by the Water Corporation. The CEMF identifies the key objectives and outcomes that the CEMP will be required to meet. Environmental management actions that will be addressed will include (but not be limited to):



- Minimise vegetation clearing and the area of disturbance on the ground by utilising existing cleared areas where possible.
- Retention, where possible, of potential black cockatoo habitat trees (particularly hollow-bearing trees). A pre-clearance survey will be undertaken to flag the potential black cockatoo trees within the project footprint (using distinctive flagging for those with hollows) to allow contractors to see which trees should be avoided where possible.
- A pre-clearing inspection of trees to be cleared will be undertaken to ensure there are no breeding activities present in the trees. If breeding activities are identified clearing is to be avoided until such time nestlings have left the nest without human intervention.
- All vegetation proposed to be cleared will be clearly demarcated on site prior to the commencement of project activities.
- Clearing of vegetation shall not exceed the limits of permitted clearing.
- All staff and contractors involved in clearing activities will be inducted on the potential impacts to fauna and advised to stop works in the vicinity of any injured or shocked animals that are encountered.
- In the event that sick, injured or orphaned native wildlife are located on the project site, the WILDCARE Helpline ((08) 9474 9055) will be contacted for assistance.
- Millable timber will be identified, salvaged for re-use and made available to the Forest Products Commission.
- No pets, traps or firearms are allowed within the project area.
- Fauna are not to be fed or intentionally harmed or killed.
- Restrict movement of machines and other vehicles to the limits of the areas cleared.
- Identify areas to undertake weed control to stop spread of weeds.
- Control/spray identified significant weeds species within the Project area prior to construction to limit the amount of propagative material that may be spread during disturbance.
- Remove or kill any other weeds growing in project area that are likely to spread and result in environmental harm to adjacent areas of native vegetation that are in good or better condition

A specific Dieback Management Plan will be prepared by Glevan consulting, implementation of this plan will be a requirement of and referred to in the CEMF and subsequent CEMP. The Dieback Management Plan will outline the dieback management controls that will be implemented during the construction phase of the Project in line with the findings of the Dieback Survey results. It will include controls such as cleaning earth moving machinery of soil and vegetation prior to entry and departure to avoid the introduction and/or spread of weeds and Dieback.



3.3. Summary of Assessment against the Environmental Protection Act (WA) Ten Clearing Principles

DWER have yet to undertake their assessment of the proposed clearing against the ten clearing principles, however an assessment undertaken by GHD on Water Corporation's behalf has indicated that the proposed clearing may be at variance to principles B and F as detailed below.

Principle B - Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia

Four (4) broad fauna habitat types have been identified across the project area: mixed Eucalypt woodlands (jarrah/marri/blackbutt), creeklines and minor drainage lines with flooded gum (*E. rudis*) woodland, planted/introduced vegetation and cleared areas. The majority of the habitat types within the project area are well-connected at both a local and regional scale to other areas of remnant and contiguous vegetation. However given the majority of the clearing is likely to occur adjacent to existing roads/tracks, it is not expected to create new barriers or significant exacerbate existing barriers, particularly given the relatively narrow width of the corridor.

Fauna surveys undertaken in the project area identified the presence of five fauna species of conservation significance: Carnaby's Black Cockatoo (Endangered), Baudin's Black Cockatoo (Vulnerable), Forest Red-tailed Black Cockatoo (Vulnerable), Eastern Great Egret (Migratory) and Quenda (Priority 4) (Astron 2013, GHD 2017a, GHD 2018). An additional ten conservation significant fauna were identified as likely to occur in the project area based on previous records and suitability of habitat.

The vegetation within the project area was identified as suitable foraging habitat and potential breeding and roosting habitat for the three threatened species of Black Cockatoo. All three species were recorded within the project area.

763 potential habitat trees were identified within the larger survey areas by Astron (2013) and GHD (2017a,b) and GHD (2018) (some records were located just outside of the survey areas). The project area has since been refined to reduce the amount of clearing required and in particular retain as many potential black cockatoo habitat trees as possible. As a result, a total of 93 potentially Black Cockatoo breeding trees (Jarrah, Marri, Blackbutt and Flooded Gum) are located within the project area, with a total of 64 requiring removal (29 will be retained). Of these, 15 are hollow-bearing, although none of these trees had evidence of current or previous Black Cockatoo use (i.e. old chew marks). Old and fresh Black Cockatoo foraging evidence was recorded scattered throughout the project area (on Marri nuts) and there are 5.8 ha of suitable foraging habitat.

The majority of the habitats recorded in the project area are well represented in the immediate vicinity of the project area and in the broader Blackwood district (particularly in the conservation areas and State Forest) and would be utilised by all the conservation significant species known or likely to occur in the area. Furthermore, there is no habitat within the survey area that would be considered specific to or solely relied upon by any of the conservation significant species known or likely to occur within the area. Given the relatively small area to be cleared, the thin linear nature of the project area, the extent of suitable habitat within the immediate vicinity and the existing disturbances within the project area, it is unlikely the proposed clearing represents a core habitat for any of the conservation significant fauna identified as present or likely to occur. The proposed clearing is not expected to have a significant impact upon these fauna species of conservation significance.

Principle F - Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland

There are no regionally significant wetlands or watercourses with permanent water within the project area.

The alignment intersects three creeks – Spring Creek, Balingup Brook and Mullalyup Brook – and a few minor drainage lines. Of these water courses only one was still vegetated with native vegetation (Spring



Creek – Very Good condition), which was identified as marri-jarrah-flooded gum (*Eucalyptus rudis*) woodland. There may be a small amount of riparian vegetation clearing required however the pipeline will be designed along the existing track crossing at Spring Creek, where possible.

Due to the linear nature of the construction footprint, the existence of vehicle tracks at the locality and the limited clearing required, the impact to the riparian vegetation is unlikely to be significant.

3.4. Summary of Impact to Matters of National Environmental Significance (MNES)

The proposal has been determined to be a controlled action by the Federal Department of the Environment and Energy (DoEE) (Decision Notice dated 6th November 2017 - EPBC 2017/8059). The DoEE has determined that the proposed action is likely to have a significant impact on the following matters protected by the EPBC Act:

- Listed threatened species and communities (section 18 & section 18A).

Specifically, it was identified that the proposed action is likely to have a significant impact on, but not limited to, the vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), the vulnerable Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and the endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*).



4. Direct Offset

The direct offset that is proposed for this project is the allocation of a portion of an Advanced Offset site that has been agreed to, for use as future project offsets, between DWER and Water Corporation. The site is known as Rocky Gully, and the strategic land banking of this site for future offsets was agreed to in 2016. The proposed offset site is located approximately 110km to the south west of the Project Area (shown in Figure 2, Appendix A). It is put forward that 26 ha of this site be allocated for use as an offset for this project (the Greenbushes – Kirup Link Project) and its respective proposed clearing activities. The proposed allocated portion of the greater Rocky Gully site is shown in Figure 3, Appendix A.

Following the agreement, the land was transferred to the Western Australian Department of Biodiversity Conservation and Attractions (DBCA) in June 2017 (then Department of Parks and Wildlife) and is now identified as Reserve 52970. Prior to this the site was zoned for 'Public Purposes – Water Reserve' in the Shire of Plantagenet Local Planning Scheme 3 and did not have any active management measures in place for the protection of its environmental qualities. Vesting part of the reserve in the Conservation and Parks Commission has therefore significantly increased the level of protection in place, due to formal protection under the *Conservation and Land Management Act*, and has also allowed for the management of the land by DBCA.

4.1. Biological Survey

AECOM conducted a Level 1 Flora, Vegetation and Fauna survey including a Black Cockatoo and riparian assessment of the Rocky Gully Reserve (currently owned by the Water Corporation) in July 2016 to determine its environmental value for use as an offset site.

Please refer to Appendix C for a copy of the survey report.



4.2. Appropriateness

4.2.1. Like for Like

The following table shows a comparison of the key environmental factors and characteristics of the proposed Clearing area and the proposed offset site (Rocky Gully Reserve) to demonstrate the relevance and proportionality of the proposed offset:

Table 1 Comparison table of Environmental Characteristics

Characteristic/Factor	Proposed Clearing Area	Rocky Gully Reserve (offset area)
IBRA Region	Jarrah Forest IBRA	Jarrah Forest IBRA
IBRA Sub-region	Southern Jarrah Forest Bioregion	Southern Jarrah Forest Bioregion
Vegetation type	<p>Seven vegetation types were mapped by GHD (GHD, 2017) and described for the survey area. Six vegetation types were variations in <i>Eucalyptus</i> dominated woodlands; five of these were Jarrah-Marri woodlands differentiated by mid and lower storey species and one was a small pocket of Flooded Gum woodland. The seventh vegetation type consisted of isolated stands of native and planted trees with scattered natives over weedy grasses. The vegetation types identified by GHD, 2017 are as follows:</p> <ul style="list-style-type: none"> Jarrah-Marri woodland over <i>Hibbertia</i> shrubland - (VT01) - <i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> open forest <i>Hibbertia hypericoides</i> <i>Hakea lissocarpha</i> shrubland <i>Patersonia occidentalis</i> <i>Lepidosperma leptostachyum</i> open herbland Marri-Jarrah woodland over <i>Taxandria</i> shrubland (VT02) - <i>Corymbia calophylla</i> <i>Eucalyptus marginata</i> open forest <i>Banksia grandis</i> isolated trees <i>Taxandria parviceps</i> <i>Hibbertia hypericoides</i> <i>Podocarpus drouynianus</i> shrubland <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open herbland Jarrah-Marri woodland over <i>Bossiaea</i> shrubland (VT03) - <i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> <i>Banksia grandis</i> open forest <i>Bossiaea linophylla</i> shrubland <i>Pteridium esculentum</i> <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open fernland/herbland. 	<p>The three vegetation types mapped as occurring within the Rocky Gully Reserve (Aecom 2016) are (Figure 4, Appendix A):</p> <ul style="list-style-type: none"> <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> mid open forest (2000 cm, 50%) over <i>Agonis theiformis</i>, <i>Bossiaea linophylla</i> and <i>Xanthorrhoea preissii</i> (200 cm, 30%) mid to tall shrubland over <i>Anarthria prolifera</i>, <i>Cheilanthes austrotenuifolia</i> and <i>Bossiaea ornata</i> mid to low open mixed sedge/shrub and forbland. Occasional <i>Banksia grandis</i> were observed, usually in poor condition with numerous dead and fallen trees. High diversity of other forbs and shrubs in this community including <i>Leucopogon</i> species, Fabaceae (pea) species, and <i>Lomandra</i>. <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> mid open forest over <i>Bossiaea linophylla</i>, <i>Leucopogon obovatus</i> subsp. <i>revolutus</i> and <i>Hakea lissocarpha</i> mid open shrubland over <i>Hypocalymma angustifolium</i>, <i>Cyathochaeta avenacea</i> and <i>Astroloma pallidum</i> mid to low open mixed rush/shrubland. The most notable difference between EmBIHa and EmAtAp is the lack of tall shrubs of <i>Agonis theiformis</i> which has led to a more diverse low shrub and forb understory. Encompassed in this community are small bare areas of white sand and exposed granite, too small to map as separate communities for the purposes of this



	<ul style="list-style-type: none"> Jarrah-Marri woodland over blackberry (VT04) - <i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> *<i>Pinus radiata</i> open forest <i>xanthorrhoea preissii</i> isolated shrubs *<i>Rubus ulmifolius</i> shrubland Flooded gum woodland over blackberry (VT05) - <i>Eucalyptus rudis</i> open woodland <i>Xanthorrhoea preissii</i> isolated shrubs *<i>Rubus ulmifolius</i> shrubland. Jarrah-Marri woodland over Bugle Lily (VT06) - <i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> *<i>Pinus radiata</i> woodland <i>Xanthorrhoea preissii</i> isolated shrubs <i>Watsonia meriana</i> var. <i>bulbillifera</i> herbland <i>Eucalyptus</i> spp.- Marri-Pine isolated trees (VT07) - <i>Eucalyptus</i> spp. <i>Corymbia calophylla</i> * <i>Pinus radiata</i> isolated trees <p>A total of 5.8 ha of vegetation is proposed to be cleared.</p>	<p>assessment.</p> <ul style="list-style-type: none"> <i>Melaleuca preissiana</i>, <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and occasional <i>Eucalyptus rudis</i> low to mid woodland to open woodland over <i>Astartea scoparia</i>, <i>Taxandria parviceps</i> and <i>Melaleuca viminea</i> subsp. <i>viminea</i> tall shrubland over <i>Cyathochaeta avenacea</i>, <i>Leptocarpus kraussii</i> and <i>Philydrella drummondii</i> low sedgeland. The tall shrubland stratum occurs as a mosaic, with often only one of these species occurring as thickets at various locations. <i>Hypocalymma angustifolium</i> observed within ecotone between riparian vegetation and adjacent Jarrah Forest. Contains occasional <i>Juncus kraussii</i>. <p>A total of 26 ha of vegetation is proposed to be allocated as an offset for this project.</p>
Dominant Species	Jarrah and Marri	Jarrah and Marri
Condition	The vegetation condition within the Project area ranged from Very Good to Completely Degraded condition, with the majority of the Project area in Degraded to Completely Degraded condition (Astron 2013).	99% of the vegetation within the Rocky Gully reserve is considered to be of “excellent” condition (Aecom 2016) (Figure 5, Appendix A). The proposed offset area to be used for the project is entirely within the ‘Excellent’ condition rating.
Fauna habitat	<p>The Flora and Fauna surveys undertaken by Astron and GHD noted that the vegetation within the proposed clearing area (5.8ha) would potentially be used for foraging, breeding and roosting for all three conservation significant Black Cockatoo species.</p> <p>The targeted black cockatoo habitat assessment undertaken by GHD identified a total of total of 64 potential black cockatoo habitat trees (DBH >500 mm) within the proposed clearing area that will be potentially removed. Of these, 15 trees were identified to have hollows, although none were observed or known to be actively used by black cockatoos for</p>	<p>The Flora and Fauna survey carried out by AECOM, noted that the Rocky Gully area is comprised of ‘quality’ habitat for the three conservation significant species of Black Cockatoos.</p> <p>The AECOM survey estimated that approximately 54 possible breeding trees per hectare are present within the Rocky Gully Reserve, with the area also containing foraging and roosting habitat for Black Cockatoos. No signs of roosting were observed during the survey, however the site is extensive and a detailed search for signs of roosting was outside of the survey’s scope.</p> <p>Numerous occurrences of Baudin’s Black Cockatoos were noted during the survey.</p> <p>The proposed offset site of 26 ha could therefore provide as many</p>



	<p>breeding or roosting. This total number equates to an average of approximately 14 potential breeding trees per hectare.</p> <p>5.8 ha of black cockatoo foraging habitat will be removed.</p>	<p>as 1400 potential breeding trees (estimate only) and will provide 26 ha of suitable foraging habitat for all three conservation significant Black Cockatoo species.</p>
Ecological Communities	No TECs or PECs were identified within the proposed Clearing Area.	No TECs or PECs occur within the Rocky Gully Reserve.
Riparian Vegetation <i>Ratio of offset proposed > 1:16</i>	There are three watercourses that intersect the Project Area: Spring Creek; Balingup Brook, and Mullalyup Brook. Of these water courses only one was still vegetated with native vegetation (Spring Creek – Very Good condition). The proposed impacted area of riparian vegetation within the proposed clearing area is 0.12 ha.	The Rocky Gully reserve contains the Rocky Gully creek-line and associated riparian vegetation. The reserve is located at the headwaters of a tributary to the Frankland river. Within the portion of Rocky Gully reserve proposed for offset for this project there is approx. 3 ha of riparian vegetation in pristine condition.



4.2.2. Long-Term Benefit

As a part of the advanced/strategic offset process, the Water Corporation has already transferred the land tenure to the Conservation and Parks Commission for conservation purposes (refer to the Certificate of Title included as Appendix D). The Water Corporation considers the offset proposed will assist to achieve environmentally beneficial outcomes through the security of the transference of the land into the conservation estate in perpetuity.

4.3. Statutory Requirements Met

The offset meets statutory, planning and regulatory requirements, pursuant to:

- Part V of the *Environmental Protection Act 1986*.
- EPA Guidance Statement No. 19 – Environmental offsets – Biodiversity.
- EPA Position Statement No. 9 – Environmental Offsets;
- EPBC Act Environmental Offsets Policy.

4.4. Offset Documentation and Auditing

The area proposed for clearing and the proposed offset location will be defined and documented within the Clearing Permit as determined by DWER and as such will be auditable in the future according to the conditions of that permit.

4.5. Offsets Ratio and Net Gain

Utilising the recommended Offset Guideline developed and used by the Department of the Environment and Energy (Commonwealth) for MNES, the Water Corporation proposes the following offset outcomes for the projects:

Table 2 Offset Ratio and Net Gain

Impact	Black Cockatoo Foraging and potential Breeding Habitat
Clearing Impact (ha)	5.8 ha
Quantam of Impact (ha)	3.48 ha
Offset Outcome (ha)	22.52 ha

A copy of the calculator outcomes in full is provided as Appendix E.



5. Stakeholder Consultation

The proposed offset site has been transferred to the DBCA (previously DPaW) vested in the Conservation and Parks Commission for protection in perpetuity. During the establishment of the advanced offset site (strategic land banking), consultation was undertaken with the following stakeholders:

- DWER.
- DBCA (previously the Department of Parks and Wildlife).
- Department of Mines, Industry Regulation and Safety (DMIRS) (previously the Department of Mines and Petroleum).
- Department of Planning, Lands and Heritage (DPLH) (previously the Department of Lands).

A copy of the final correspondence with these stakeholders is included in Appendix F.



6. Glossary

Clearing is the killing of, removal of, severing or ringbarking of trunks or stems of, or the doing of any other substantial damage, including draining or flooding land, burning and grazing of stock, to some or all of the native vegetation in an area. (Clearing does not include pruning of native vegetation, to the extent the pruning does not cause substantial damage to the native vegetation).

Clearing principles are the principles for clearing native vegetation set out in Schedule 5 of the EP Act.

Environmental Offsets are beneficial activities undertaken to counterbalance an adverse environmental impact to achieve 'no net environmental loss' or a 'net environmental benefit'.

Environmentally Sensitive Areas (ESAs) are defined areas having significant environmental value which have been declared in Regulation 6 of the Clearing Regulations.

Native vegetation means indigenous aquatic or terrestrial vegetation but does not include vegetation that was intentionally sown, planted or propagated unless:

- (a) that vegetation was sown, planted or propagated as required under the EP Act or another written law; or
- (b) that vegetation is of a class declared by regulation to be included in this definition and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation.



Appendix A

Figures



File: S:\AA_EIA_GIS\1_Projects\Capital\CW00860 - Greenbushes to Kirup Link\ArcMap\Offset Proposal\CW00860 Offset Proposal - Figure 1 - Project Area.mxd

LEGEND

 Project Area



1:70,000 at A3
 0 690 1380 2070 2760
 Metres
 Coordinate System: GDA 1994 MGA Zone 50
 Vertical Datum: AHD

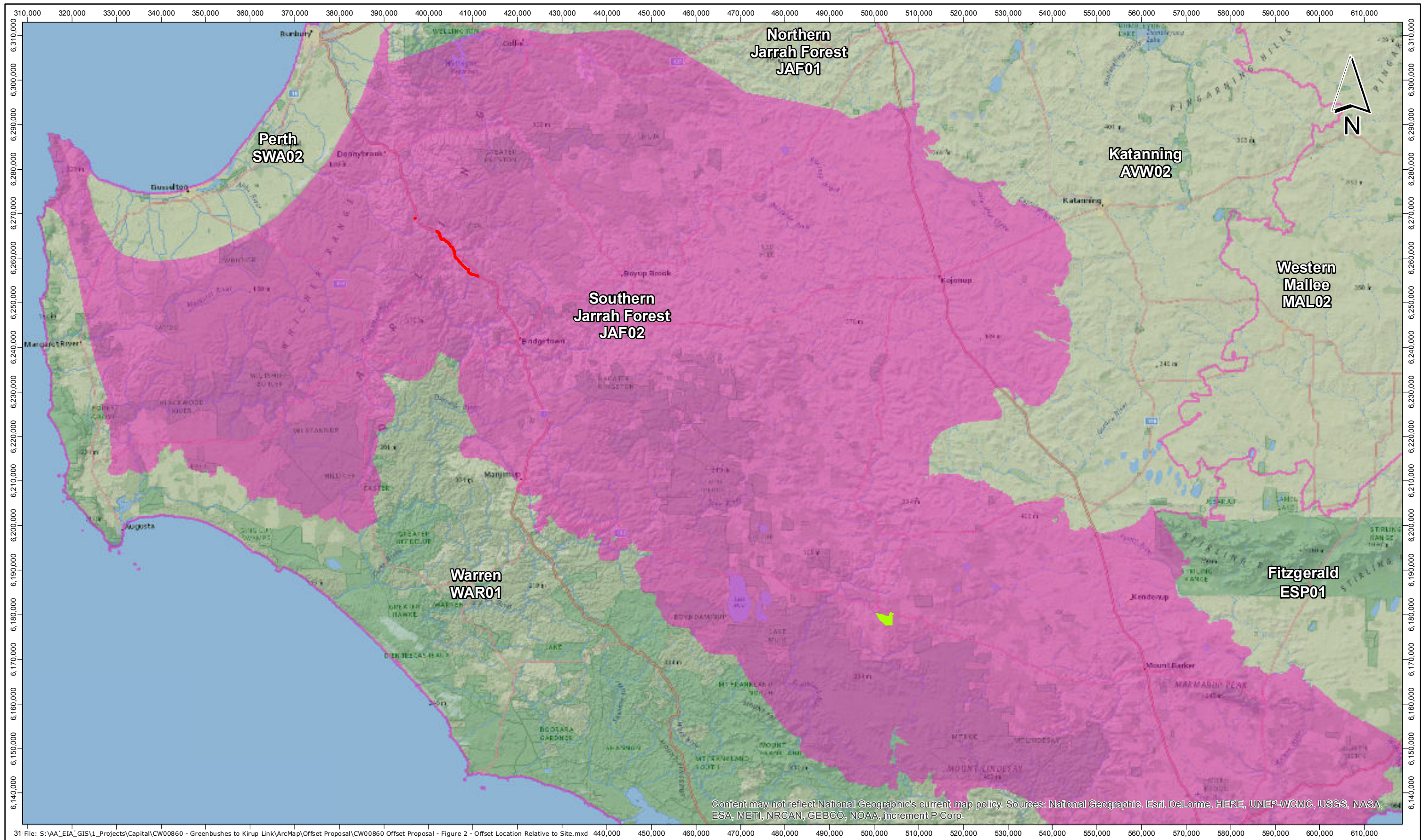
AUTHOR: TRIBBIGO DATE: 30/01/2019
 BRANCH: SEAA

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**Greenbushes - Kirup Link
Project Area**

Figure 1



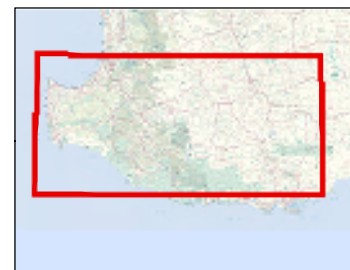
LEGEND

IBRA Sub Regions

- Other Sub-regions
- Southern Jarrah Forest

Rocky Gully Advanced Offset Site (630ha)

- Rocky Gully Advanced Offset Site (630ha)



1:800,000 at A3
 0 7800 15600 23400 31200
 Metres
 Coordinate System: GDA 1994 MGA Zone 50
 Vertical Datum: AHD

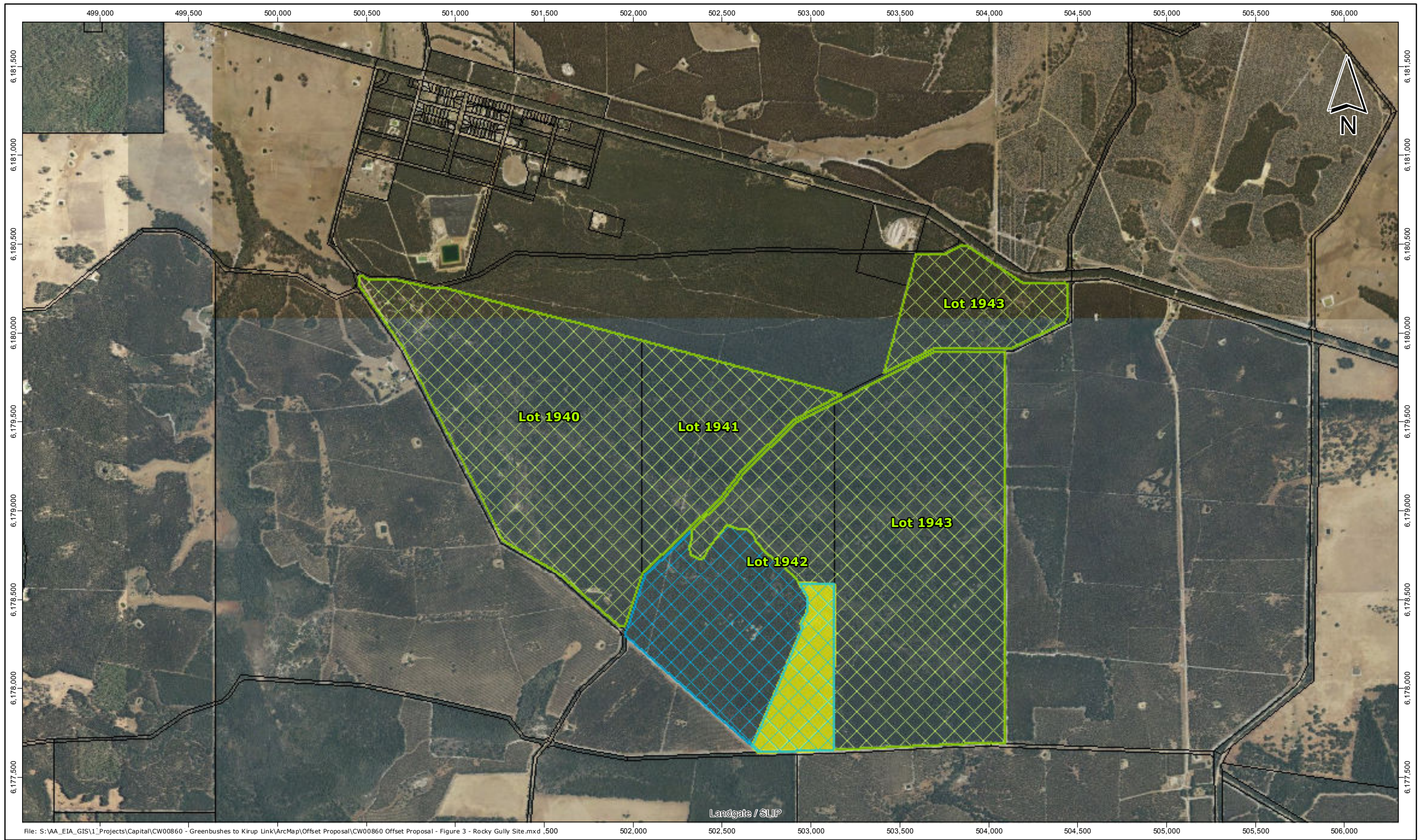
AUTHOR: TRIBBIGO DATE: 30/01/2019
 BRANCH: SEAA

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**Greenbushes - Kirup Link
 Rocky Gully Location**

Figure 2



LEGEND

-  Cadastral Boundary
-  Proposed Offset Allocation (26ha)
- Rocky Gully Advanced Offset Site (630ha)**
-  Reserved for Future Offsets
-  Previously Allocated Offsets



1:20,000 at A3
 0 200 400 600 800
 Metres
 Coordinate System: GDA 1994 MGA Zone 50
 Vertical Datum: AHD

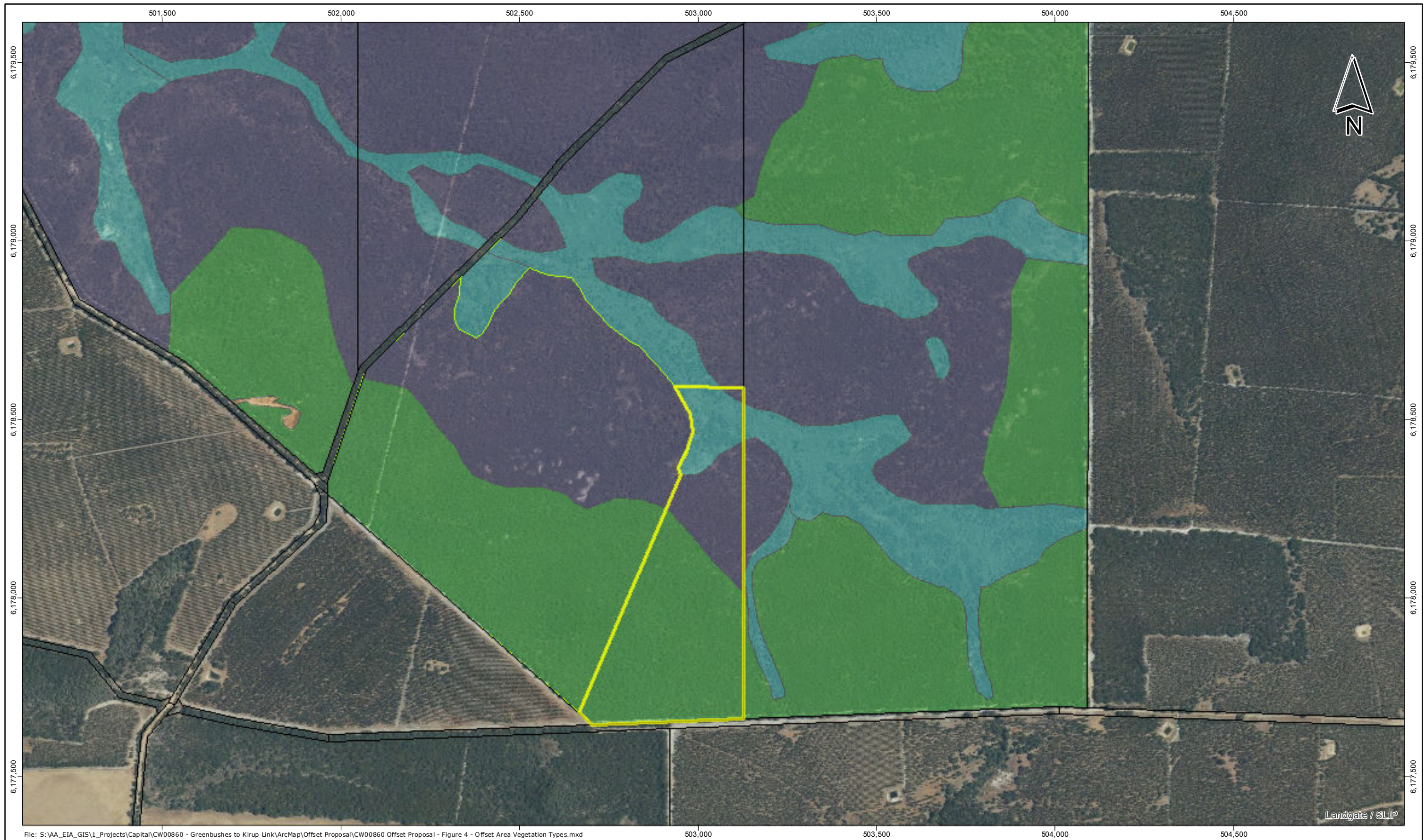
AUTHOR: TRIBBIGO DATE: 30/01/2019
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**Greenbushes - Kirup Link
 Rocky Gully Offset Site**

Figure 3



File: S:\AA_EIA_GIS\1_Projects\Capital\CW00860 - Greenbushes to Kirup Link\ArcMap\Offset Proposal\CW00860 Offset Proposal - Figure 4 - Offset Area Vegetation Types.mxd

LEGEND

- Cadastral Boundary
- Proposed Offset Allocation (26ha)
- Rocky Gully Advanced Offset Site (630ha)

AECOM Vegetation Mapping 2016

- Cleared
- EmAtAp - Jarrah and Marri Forest
- EmBIHa - Jarrah and Marri Forest
- MpAsCa - Wetland and Riparian



1:10,000 at A3
 0 100 200 300 400
 Metres

Coordinate System: GDA 1994 MGA Zone 50
 Vertical Datum: AHD

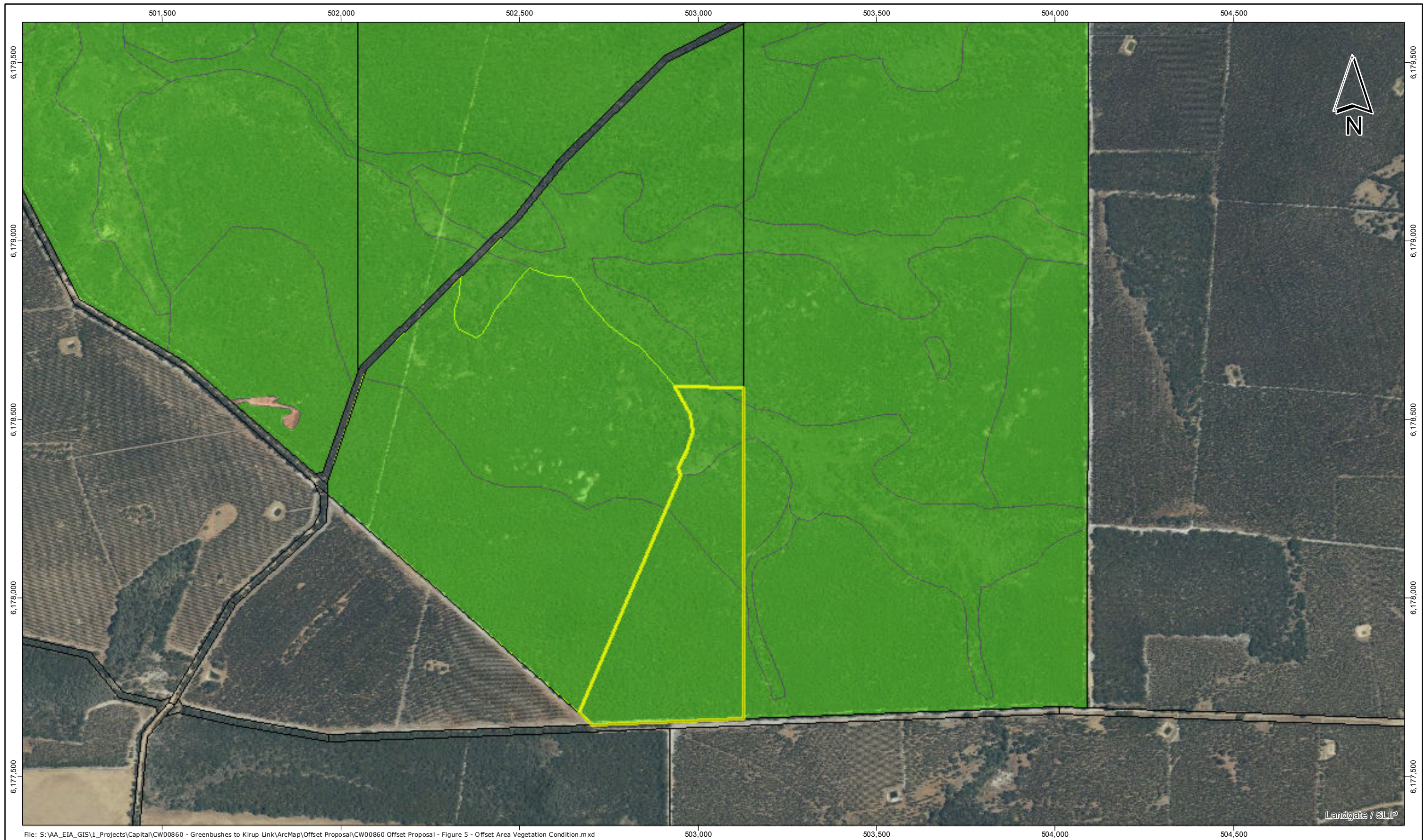
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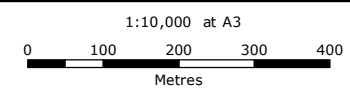
**Greenbushes - Kirup Link
 Rocky Gully Vegetation Mapping**



File: S:\AA_EIA_GIS\1_Projects\Capital\CW00860 - Greenbushes to Kirup Link\ArcMap\Offset Proposal\CW00860 Offset Proposal - Figure 5 - Offset Area Vegetation Condition.mxd

LEGEND

- Cadastral Boundary
 - Proposed Offset Allocation (24ha)
 - Rocky Gully Advanced Offset Site (630ha)
- AECOM Vegetation Mapping 2016**
- Completely Degraded
 - Excellent



1:10,000 at A3
 Coordinate System: GDA 1994 MGA Zone 50
 Vertical Datum: AHD

AUTHOR: TRIBBIGO DATE: 30/01/2019

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**Greenbushes - Kirup Link
 Rocky Gully Vegetation Condition**



Appendix B

Biological Assessment Reports

– Project Area



Water Corporation
Greenbushes to Kirup Link
Additional Flora and Fauna Survey and Targeted
Black Cockatoo Assessment

December 2018

Executive summary

Water Corporation propose to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, and as a component of the broader Warren Blackwood Water Supply Scheme. This new infrastructure will potentially involve the clearing of vegetation and fauna habitat, disturbance of dieback, and management of contaminated material within the location of the proposed works to facilitate construction and installation of this infrastructure.

Water Corporation has recently identified a section of the pipeline which had not been identified during the initial design phase of the project. This section of the alignment has not previously been surveyed and is likely to require clearing of vegetation and fauna habitat.

GHD Pty Ltd (GHD) was commissioned by Water Corporation to undertake a flora, vegetation and fauna survey, including a targeted black cockatoo assessment of the additional section of the alignment. The purpose of the survey is to delineate key flora, vegetation and fauna values of the site. The outcome of the survey and information supplied in this biological survey report will be used to inform the environmental assessment and approvals process.

This report is subject to, and must be read in conjunction with, the limitations, assumptions and qualifications contained within the report.

Key findings

Flora and vegetation

- Four vegetation types were mapped and described for the survey area, excluding cleared or highly degraded areas containing isolated trees and shrubs. The four vegetation types are variations in Eucalyptus dominated woodlands over a highly modified understorey dominated by weeds with the occasional scattered native species.
- The Eucalyptus woodlands ranged from jarrah-marri dominated woodlands, jarrah-marri-blackbutt woodlands, marri-blackbutt-flooded gum woodlands and small pockets of flooded gum woodlands within the drainage areas.
- Although the remnant vegetation within the survey area is highly altered by disturbances the dominant tree species remaining are consistent with the broader vegetation complexes mapped across the survey area by Smith (1974) and Matiske and Havel (1998).
- The vegetation within the survey area was rated from Degraded to Completely Degraded. The survey area is highly modified largely as a result of clearing and the spread of invasive weed species.
- No Commonwealth or State listed Threatened Ecological Communities or Priority Ecological Communities were identified within the survey area.
- A total of 61 flora taxa (including subspecies and varieties) representing 23 families and 51 genera was recorded from the survey area.
- A total of 37 introduced flora taxa (60% of the total flora present) were recorded in the survey area. Of these, two species, Bridal Creeper (*Asparagus asparagoides*) and Blackberry (*Rubus ulmifolius*) are listed as a Declared Pest Plants under the *Biosecurity and Management Act 2007* (BAM Act) and as Weeds of National Significance (WONS).
- No flora of conservation significance was recorded within the project area, and none are considered likely to occur.

Fauna

- The survey area comprised of three broad habitat types including Mixed Eucalypt Woodlands, Flooded Gum Minor Drainage Lines and Cleared/Highly Modified areas. The majority of the survey area consists of a mixed woodland of *Corymbia calophylla* (marri), *Eucalyptus marginata* (jarrah), *E. patens* (Blackbutt) and *E. rudis* (flooded gum) with the occasional scattered introduced *Pinus* (pine) species over introduced herbs and grasses.
- The vegetation remaining within the survey area forms a narrow corridor of remnant vegetation (trees) adjacent to existing roads and tracks, in an area which has been largely cleared for agriculture, pine plantations and Balingup town site.
- A total of 28 fauna species (4 introduced) were recorded within the survey area, including 19 birds, four mammals one reptile and four amphibian species.
- Two conservation significant fauna species were identified during the field survey. They were:
 - Forest red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), listed Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Wildlife Conservation Act 1950* (WC Act) – observed foraging within the survey area and adjacent properties
 - Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), listed as Endangered under the EPBC Act and WC Act – evidence of feeding observed on marri nuts
- In addition to the species identified during the field survey, the likelihood of occurrence assessment identified the likely presence of one additional conservation significant species, the Baudin's Black Cockatoo (*Calyptorhynchus baudinii*).
- The majority of the vegetation within the survey area is considered suitable foraging habitat for Black Cockatoos, including the mixed Eucalypt woodlands of jarrah, marri, blackbutt and flooded gum as well as the scattered Pine trees. There is approximately 4.3 ha of suitable foraging habitat in the survey area.
- The habitat assessment identified 286 potential breeding trees of suitable diameter at breast height (DBH) (jarrah, marri, blackbutt and flooded gum > 500 mm) from within the survey area. Of the 286 trees, 19 contained hollows of which six were identified with potentially suitable hollows for Black Cockatoo nesting.
- No evidence of roosting by Black Cockatoos was observed within the survey area. The survey area provides limited potential roosting habitat due to the narrow, linear nature of the remaining vegetation within the survey area.

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Appendix C – Database search results

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Appendix E – Field results

1. Introduction

1.1 Background

Water Corporation propose to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, and as a component of the broader Warren Blackwood Water Supply Scheme.

This new infrastructure will potentially involve the clearing of vegetation and fauna habitat, disturbance of dieback, and management of contaminated material within the location of the proposed works to facilitate construction and installation of this infrastructure.

Water Corporation has recently identified the need for an additional section of pipeline, not previously considered in the environmental assessments. This section of the alignment is likely to require clearing of vegetation and fauna habitat.

1.2 Purpose of the report

GHD Pty Ltd (GHD) was commissioned by Water Corporation to undertake a flora, vegetation and fauna survey, including a targeted black cockatoo assessment of the additional section of the alignment. The purpose of the survey is to delineate key flora, vegetation and fauna values of the site. The outcome of the survey and information supplied in this biological survey report will be used to inform the environmental assessment and approvals process.

1.3 Project location

1.3.1 Survey area

The survey area is located within the Shires of Donnybrook – Balingup and Bridgetown – Greenbushes. The survey area includes two areas, with the main alignment located at Forrest Street in Balingup town extending approximately 3.5 km south to the Summit Tank site along Old Padbury Road. The alignment ranges from 14 m to 45 m wide, with an average width of 20 m. The other small survey area is located in Mullalyup, and included a 153 m long by 8 m wide section of the alignment. The survey area is 8.82 ha in total. The survey area and local context is shown in Figure 1, Appendix A.

1.3.2 Study area

The study area used for biological based desktop database searches included a 5 km buffer around the survey area extent in order to provide information on the context for the project within the wider area.

1.4 Scope of works

The flora, vegetation and fauna assessment included both desktop and field assessment. The following actions were completed to fulfil the scope:

- A review of relevant databases including the EPBC Act Protected Matters Search Tool (PMST) and the Department of Biodiversity Conservation and Attractions (DBCA) NatureMap and FloraBase
- Development of base maps (aerial photography with cadastre and land system mapping) for the field survey

- The vegetation complex mapping of the area was referenced to determine the pre-European extent remaining to assess the significance of the proposed native vegetation clearing
- A single season biological survey (by an environmental specialist) was conducted in Spring to verify / ground truth the desktop assessment findings through a targeted and detailed flora and vegetation survey and a Level 1 fauna survey (reconnaissance survey), including a targeted black cockatoo assessment
- Conservation significant flora species were actively searched for based on habitat requirements, and the population extents or locations of any potential Threatened flora, Priority flora and any other flora of local or taxonomic significance were mapped where identified
- Ecological community mapping was undertaken according to National Vegetation Information System (NVIS) structural and floristics (Executive Steering Committee for Australian Vegetation Information (ESCAVI) 2003)
- Vegetation types, condition, conservation significant species were mapped where present
- The vegetation types were described and classified to determine their conservation significance based on an analysis of the floristic data collected
- The significance of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC) and any other areas of ecological importance was identified, mapped and discussed based on the results of the field survey
- An inventory of plant taxa (including weed species) was compiled
- An inventory of vertebrate fauna species was compiled through opportunistic recording of species, tracks, scats, bones, diggings and feeding areas
- Potentially occurring significant fauna species (giving specific consideration to Black Cockatoos, Western Ringtail Possum, Chuditch and the Southern Brush-tailed Phascogale) and their habitat were identified, where possible mapped and discussed
- Relevant photograph and figures were included in the reporting, with spatial shapefiles supplied separately

A concise technical report was produced (this document).

1.5 Relevant legislation, conservation codes and background information

In Western Australia (WA) some communities, flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this Project is provided in Appendix B.

1.6 Report limitations and assumptions

This report has been prepared by GHD for Water Corporation and may only be used and relied on by Water Corporation for the purpose agreed between GHD and the Water Corporation as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Water Corporation arising in connection with this report. The services undertaken by GHD in connection with preparing this

report were limited to those specifically detailed in the Contract and are subject to the scope limitations set out in the Contract.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report (including species listings). GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Water Corporation and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

This report has assessed the flora and fauna within the survey area (Figure 1, Appendix A). Should the survey area change or be refined, further assessment may be required.

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information pertaining to the survey area. This included a review of the information presented in GHD (2017) and an updated search of the following:

- DotEE PMST to identify species and communities listed under the EPBC Act potentially occurring within the survey area (DotEE 2018a) (Appendix C)
- The DBCA TEC and PEC database to determine the potential for TECs or PECs to be present within the survey area (DBCA 2018a)
- The DBCA NatureMap database for flora and fauna species previously recorded within the survey area (DBCA 2007–2018) (Appendix C)
- The DBCA Threatened (Declared Rare) and Priority Flora (TPFL) database and the WA Herbarium (WAHerb) database for Threatened flora species listed under the WC Act and listed as Priority by DBCA, previously recorded within the survey area (DBCA 2018b)
- Existing datasets including previous broad vegetation mapping of the survey area (Smith 1974), historical aerial photography, and hydrology information to provide background information on the variability of the environment, likely vegetation units and fauna habitats

2.2 Field survey

2.2.1 Vegetation and flora

GHD ecologist Erin Lynch (flora license no. SL012374) completed a single season, detailed vegetation and flora assessment of the survey area on the 30 and 31 October 2018; accompanied by Water Corporation Senior Advisor – Environment, Gemma Tribbick. The field survey was undertaken to identify and describe the dominant vegetation types, assess vegetation condition, and identify and record vascular flora taxa present at the time of survey. Targeted searches for conservation significant or other significant ecological communities and flora taxa were also undertaken during the field survey.

The survey methodology employed by GHD was undertaken with reference to the Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a).

Data collection

Field survey methods involved traversing the survey area by foot. No quadrats were undertaken within the survey area due to the highly disturbed condition of the vegetation and dominance of introduced species as well as the linear nature of the vegetation. Relevé and/or photo reference sites were conducted along the alignment to describe the vegetation and physical features of the site. Field data at each site was recorded on a pro-forma data sheet and included the parameters detailed in Table 1.

Table 1 Data collected during the field survey

Aspect	Measurement
Collection attributes	Personnel/recorder; date, photograph of the site.
Physical features	Aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.

Aspect	Measurement
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016a) for the South West Botanical Province.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, exploration activities).
Flora	List of dominant flora from each structural layer. List of all species within the quadrat including average height and cover using NVIS.

A flora inventory was compiled from taxa listed in the relevés/photo reference sit and from opportunistic floristic records throughout the survey area.

Vegetation types

Vegetation types were identified and boundaries delineated using a combination of aerial photography, topographical features and field data/observations.

Vegetation types were described based on structure, dominant taxa and cover characteristics as defined by field observations. Vegetation types descriptions are consistent with NVIS Level V (Association), and are grouped within NVIS Level III (Broad Floristic Formation). At Level V up to three taxa per stratum are used to describe the association (ESCAVI 2003).

Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (devised by Keighery (1994) and adapted by EPA (2016a)). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

Flora identification and nomenclature

Species well known to the survey botanist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. Plant species were identified with the use of local and regional flora keys and by comparison with the named species held at the WA Herbarium.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–2018) and the EPBC Act Threatened species database provided by DotEE (2018b). Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium 1998–2018).

2.2.2 Fauna

GHD ecologist Erin Lynch undertook a Level 1 fauna survey (reconnaissance survey) of the survey area in conjunction with the vegetation and flora assessment. The survey area was traversed on foot over the course of the survey to identify and describe the dominant fauna habitat types present and their condition, assess habitat connectivity, and identify and record fauna species within the survey area. An assessment of the likelihood of conservation significant fauna and their habitats occurring within the survey area was also undertaken.

The survey methodology employed by GHD was undertaken with reference to the EPA *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (EPA 2016b) and *Technical Guidance – Terrestrial Fauna Surveys* (EPA 2016c).

Habitat assessment

The survey area was assessed for habitat type, structural complexity, connectivity, disturbance, type and extent of resource availability and value for fauna. Specifically, the assessment included:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, midstorey, understorey, and ground cover)
- Presence/absence of refuge including: fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/breakaways, and the type and extent of each refuge
- Location of the habitat within the survey area in comparison to the habitat within the surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the survey area
- Identification and evaluation of key habitat features and types identified during the desktop assessment relevant to fauna of conservation significance
- Evaluation of the likelihood of occurrence of conservation significant fauna within the habitat (based on presence of suitable habitat)

Opportunistic observations

Opportunistic fauna searches were conducted throughout the survey area and focussed on the following:

- Searching the survey area for tracks, scats, pellets, bones, diggings, feathers, nests and feeding areas indicating the current or recent presence of native and feral fauna
- Searching through microhabitats within the survey area
- Opportunistic observations of species in the survey area, including visual and aural sightings
- Observed fauna were recorded and where conservation significant fauna were identified, photographs, GPS points and habitat data were recorded

Targeted habitat assessment for Black Cockatoo species

A habitat assessment for Black Cockatoo species was conducted with reference to the EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso*, (Department of Sustainability, Environment, Water, Populations, and Communities (DSEWPaC 2012). The assessment included the identification, description and recording of:

- Potential and actual breeding habitat (relevant tree species with a DBH of >500 mm for Jarrah, Marri and Flooded Gum or DBH of >300 mm for Wandoo or Salmon Gum)
- Existing tree hollows and any evidence of use by Black Cockatoos (a suitable nesting hollow currently able to support breeding was defined as a tree hollow with an entrance diameter greater than 100-150 mm which would allow entry of a Black Cockatoo)
- The diameter at breast height (DBH) of trees with existing hollows
- Potential night roosting and foraging habitat

Fauna species identification

Identification of fauna species was made in the field using available field guides and electronic guides (e.g. Morcombe 2014). Where identification was not possible, photographs of specimens were collected to be later identified.

Fauna nomenclature

Nomenclature used in this report follows that used by the WA Museum and the DBCA NatureMap database (DBCA 2007–2018) with the exception of birds, where Christidis & Boles (2008) was used.

2.3 Limitations

2.3.1 Desktop limitations

Desktop investigations use a variety of online resources such as the WA Museum and DBCA NatureMap database and the EPBC Act PMST. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

2.3.2 Field survey limitations

The EPA technical guidance recommend flora and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2 Field survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information	Nil	Adequate information is available for the survey area, this includes broad scale (1:250,000) mapping by Smith (1974) and digitised by Shepherd et al. (2002). Regional biogeography (Hearn et al. 2002). Database searches provide adequate information about Threatened and Priority flora and fauna, TECs and PECs.
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The detailed vegetation and flora survey was undertaken in spring 2018 which is the recommended timing for flora surveys in the region. This timing is considered appropriate due to the high proportion of species able to be identified at the time of the survey and highly disturbed nature of the survey area. The flora recorded from the field survey is detailed in section 5.1.4 and a full flora species list is provided in Appendix E. The reconnaissance fauna survey was also undertaken in spring 2018. The fauna assessment sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings, etc. Many cryptic species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all were identified to species level. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than vertebrate species.
Flora determination	Minor	Flora determination was undertaken by the GHD ecologist in the field and at the WA Herbarium. Eight taxa were only able to be identified to genus level, the remaining 53 taxa were identified to species level. Some species, particularly grasses, sedges and herbs, may have been overlooked due to lack of material. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Nil	Access to the survey area was made by foot, with access along the survey area by road. The survey area was traversed extensively on foot.

Aspect	Constraint	Comment
Mapping reliability	Minor	<p>The vegetation was mapped using high-resolution ESRI aerial imagery obtained from Landgate, topographical features, previous broad scale mapping (Smith 1974) and field data.</p> <p>Data was recorded in the field using hand-held GPS tools (e.g. Samsung tablet and Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ± 5 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain minor inaccuracies.</p>
Timing/weather/ season/cycle	Minor	<p>The field surveys were conducted during spring (30 and 31 October 2018).</p> <p>In the three months prior to the survey (August-October), Donnybrook weather station (No. 009534, BoM 2018) recorded a total of 278 mm of rainfall. This total is approximately 13% lower than the long term average of 314 mm for the same period (BoM 2018).</p> <p>The weather conditions recorded during the field survey were (BoM 2018):</p> <ul style="list-style-type: none"> • Daily maximum temperature of 23 °C • Daily minimum temperature of 10 °C • Daily rainfall 0 mm. <p>The weather conditions recorded during the survey are considered unlikely to have impacted upon the vegetation and flora survey.</p> <p>The timing of the survey (spring) is considered appropriate.</p>
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	<p>The survey area has been subjected to historical disturbance events (e.g. clearing); however, these disturbances did not impact the survey.</p>
Intensity (in retrospect, was the intensity adequate)	Nil	<p>The vascular flora of the survey area was sampled with reference to EPA (2016a) guidance. The terrestrial fauna survey was completed with reference to EPA (2016b) guidance.</p> <p>The survey area was sufficiently covered by the GHD ecologist during the survey.</p>
Resources	Nil	<p>Adequate resources were employed during the field survey. Two person days was spent undertaking the survey using an experienced ecologist.</p>
Access restrictions	Nil	<p>No access problems were encountered during the survey.</p>
Experience levels	Nil	<p>The ecologist who executed the survey is a practitioner suitably qualified and experienced in their respective field. GHD ecologist Erin Lynch has over 10 years' experience undertaking flora and fauna surveys within WA.</p>

3. Desktop assessment

3.1 Regional biogeography

The survey area is situated in the South West Botanical Province of Western Australia (Beard 1990) within the Jarrah Forest bioregion and Southern Jarrah Forest sub-region described by the Interim Biogeographic Region of Western Australia (IBRA) (DotEE 2018c).

Within the Southern Jarrah Forest sub-region, south of Collie the plateau broadens and slopes gently to the south coast. Drainage is still dissected in the west but broadening and levelling of the surface in the east causes poor drainage and large and small wetlands. The ironstone becomes less evident being buried beneath sands. Rainfall is from 1200 mm in the south-west to 500 mm in the east. Vegetation comprises Jarrah – Marri forest in the west grading to Marri and Wandoo woodlands in the east (Hearn et al. 2002).

3.2 Geology, landform and soils

The Department of Agriculture and Food Western Australia (DAFWA) (2007) soil mapping indicates there are four soil types within the survey area as described in Table 3.

Table 3 Description of soil units mapped within the survey area (DAFWA 2007)

Soil Unit	Soil description	Geology	Landform
Kirup gently slopes Phase (255LvKR2)	Duplex sandy gravels, loamy gravels, pale deep sands and yellow deep sands	Lateritic colluvium over conglomerate over granitic rocks	Gentle slopes
Balingup moderate slopes Phase (255LvBL4)	Friable red-brown loamy earths, brown loamy earths, brown deep loamy duplexes and loamy gravels	Colluvium over gneiss and granite	Moderate valley slopes
Balingup footslopes Phase (255LvBLf)	Friable red-brown loamy earths, brown loamy earths, brown deep loamy duplexes and loamy gravels	Colluvium over gneiss and granite	Footslopes
Balingup low slopes Phase (255LvBL3)	Friable red-brown loamy earths, brown loamy earths, brown deep loamy duplexes and loamy gravels	Colluvium over gneiss and granite	Gentle to moderate valley slopes

3.3 Watercourses and wetlands

The EPBC Act PMST did not identify any International significant wetlands within 5 km of the survey area (DotEE 2018a).

There are no permanent watercourses or wetlands within the survey area.

3.4 Land use

3.4.1 Conservation areas and reserves

The southern section of the survey area is located within DBCA managed lands (Figure 1, Appendix A):

- CALM Exec Body Freehold (name: 1489/474) (P102432 909) for the purpose of Conservator of Forests (Freehold)
- CALM Exec Body Freehold (name: 1489/474) (P102431 908) for the purpose of Conservator of Forests (Freehold)
- CALM Exec Body Freehold (name: 1371/170) (P301590 200) for the purpose of Conservator of Forests (Freehold)

3.4.2 Environmentally sensitive areas

There are no Environmentally Sensitive Areas (ESAs) located within or immediately adjacent to the survey area.

3.5 Vegetation and flora

3.5.1 Broad vegetation mapping and extents

Broad scale pre-European vegetation mapping of the area was completed by Smith (1974) at an association level. The mapping indicates one vegetation association is present within the project footprint:

- Medium forest; jarrah-marri (vegetation association 3)

The Smith (1974) pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of the vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update December 2017 – Government of WA (GoWA) 2018). As shown in Table 4, the current extent of vegetation association 3 is greater than 50% of its pre-European extent at all levels (State, IBRA bioregion, IBRA subregion and LGA).

As part of the Regional Forest Agreement, Matiske and Havel (1998) mapped vegetation complexes of the forest regions of south west WA at a scale of 1:50,000. Matiske and Havel (1998) mapping indicates three vegetation complexes are present within the survey area:

- Kirup (KR) Open forest to woodland of *Eucalyptus marginata* subsp. *marginata*-*Corymbia calophylla*-*Banksia attenuata*-*Xylomelum occidentale* on sandy slopes in the humid zone
- Balingup (BL) Open forest of *Eucalyptus marginata* subsp. *marginata*-*Corymbia calophylla* on slopes and woodland of *Eucalyptus rudis* on the valley floor in the humid zone
- Balingup (BLf) Woodland of *Eucalyptus rudis* on valley floors and woodland of *Eucalyptus patens* – *Corymbia calophylla* on footslopes with some *Eucalyptus marginata* subsp. *marginata* on lower slopes in the humid zone

The Local Biodiversity Program (2013) and Molloy *et al.*, (2007) have assessed vegetation complexes described and mapped by Matiske and Havel (1998) against presumed pre-European extents within the Southern Jarrah Forest IBRA subregion. In Table 5 the vegetation extents of the KR complex is shown to be more than 50% of its pre-European extent for the Southern Jarrah Forest region. The BL complex has just under 30% and the BLf complex just less than 10% of its pre-European extents remaining within the Southern Jarrah Forest region.

Recently, Webb *et al.* (2016) reviewed the vegetation complex mapping datasets of the Swan Coastal Plain (Hedde *et al.* 1980) and the South West Forest Region (Matiske and Havel 1998). The reviewed mapping (referred to as GoWA 2018) does not extend to IBRA sub-region boundaries, but can be used for vegetation complex extents within the Local Government Area (Table 6 and 7).

Based on this updated data, vegetation complex BL has 30% of its pre-European extent remaining in the Shire of Donnybrook-Balingup and approximately 22% remaining in the Shire of Bridgetown-Greenbushes. Vegetation complex BLf has less than 8% of its pre-European extent remaining in the Shire of Donnybrook-Balingup and 12% remaining in the Shire of Bridgetown-Greenbushes. Vegetation complex KR has over 50% of its pre-European extent remaining in the Shire of Donnybrook-Balingup and approximately 15% remaining in the Shire of Bridgetown-Greenbushes.

Table 4 Extents of vegetation associations mapped within the survey area (Smith 1974, GoWA 2018)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DBCA managed lands
Jarrah Forest IBRA bioregion		4,506,660.26	2,406,938.58	53.41	69.52
Southern Jarrah Forest IBRA sub-region		2,607,879.53	1,298,973.53	49.81	69.6
3	State: WA	2,661,404.62	1,806,035.91	67.86	81.36
	IBRA bioregion: Jarrah Forest	2,390,591.54	1,606,736.77	67.21	80.85
	IBRA sub-region: Southern Jarrah Forest	1,482,491.85	883,557.83	59.60	78.25
	LGA: Donnybrook-Balingup	93,347.17	61,228.07	65.59	89.96
	LGA: Bridgetown-Greenbushes	121,152.70	68,440.37	56.49	86.65

Table 5 Extent of vegetation complexes in the Southern Jarrah Forest subregion within the survey area (Mattiske and Havel 1998, Local Biodiversity Program 2013)

Vegetation Complex	Pre-European extent (ha)	2013 extent (ha)	% of pre-European extent	% of pre-European extent with formal protection
BL	59446.57	17474.17	29.391	1.49
BLf	2972.50	273.48	9.20	-
KR	3459.19	2037.12	58.89	3.86

Table 6 Extent of vegetation complexes in the Shire of Donnybrook-Balingup within the project area (GoWA 2018)

Vegetation complex	Pre-European total (ha)	Remaining extent total (ha)	Remaining extent (%)	Proportion of the Vegetation Complex within the LGA (%)
BL	42835	13095	30.57	72.06
BLf	2125.51	168.18	7.91	71.51
KR	3423.99	2031.73	59.34	98.98

Table 7 Extent of vegetation complexes in the Shire of Bridgetown-Greenbushes within the project area (GoWA 2018)

Vegetation complex	Pre-European total (ha)	Remaining extent total (ha)	Remaining extent (%)	Proportion of the Vegetation Complex within the LGA (%)
BL	12913	2830	21.92	21.72
BLf	798.99	98.99	12.39	26.88
KR	35.19	5.39	15.31	1.02

3.5.2 Conservation significant ecological communities

The EPBC Act PMST did not identify any federally listed TECs potentially occurring within the study area (DotEE 2017a) (Appendix C). DBCA TEC and PEC data obtained by the Water Corporation did not reveal any TECs or PECs occurring near the survey area. The closest known record of a TEC/PEC is situated over 25 km north-east of the survey area.

3.5.3 Flora diversity

The NatureMap database identified 112 flora taxa, representing 57 families and 86 genera previously recorded within the study area (Appendix C). This total comprised 81 native taxa and 31 naturalised (introduced) taxa. Dominant families recorded include Fabaceae (13 taxa), Myrtaceae (8 taxa) and Poaceae (6 taxa).

3.5.4 Conservation significant flora

The EPBC Act PMST, NatureMap database and DBCA TPFL and WAHERB databases identified the presence/potential presence of six conservation significant flora taxa within the study area (Appendix C). The desktop searches recorded:

- Four taxa listed under the EPBC Act and/or WC Act
- One Priority 3 taxon
- One Priority 4 taxon

3.6 Fauna

3.6.1 Fauna diversity

The NatureMap database identified 115 vertebrate fauna species previously recorded within the study area (Appendix C). This total comprised 103 birds, 3 reptiles, 8 mammals and one amphibian species. Of these, 111 are native species and four are naturalised (introduced) species.

3.6.2 Conservation significant fauna

The EPBC Act PMST and NatureMap database identified the presence/potential presence of 23 conservation significance fauna within the study area. This total does not include those species exclusively marine as no marine habitat is present within the survey area or indirectly impacted by the project. The desktop searches recorded:

- Ten species listed as Threatened under the EPBC Act and/or as Schedule 1-4 (Threatened) under the WC Act
- Two species listed as Schedule 7 (Other specially protected fauna) under the WC Act
- Seven species listed as migratory (Terrestrial and Wetland) under the EPBC Act and/or as Schedule 5 (Migratory birds protected under an international agreement) under the WC Act
- Four species listed as Priority by DBCA

4. Results

4.1 Flora and vegetation

4.1.1 Vegetation types



Four vegetation types were mapped and described for the survey area, excluding cleared or highly degraded areas containing isolated trees and shrubs. The four vegetation types were variations in Eucalyptus dominated woodlands over a highly modified understorey dominated by weeds with the occasional scattered native species.




The Eucalyptus woodlands ranged from jarrah-marri dominated woodlands, jarrah-marri-blackbutt woodlands, marri-blackbutt-flooded gum woodlands and small pockets of flooded gum woodlands within the drainage areas.

Although the remnant vegetation within the survey area is highly altered by disturbances the dominant tree species remaining are consistent with the broad vegetation complexes mapped across the survey area by Smith (1974) and Mattiske and Havel (1998).

A description and representative photo of the vegetation identified within the survey area is presented in Table 8 and mapped in Figure 2, Appendix A.

Table 8 Vegetation types identified within the survey area

Vegetation type	Vegetation description	Extent (ha)	Site photograph
V1. <i>Eucalyptus marginata</i> (jarrah) – <i>Corymbia calophylla</i> (marri) woodland	<i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> woodland over <i>*Rubus ulmifolius</i> and <i>Pteridium esculentum</i> herbland over <i>*Avena barbata</i> , <i>*Briza maxima</i> and <i>*Bromus diandrus</i> open grassland on loamy gravels.	1.58 h	
V2. <i>C. calophylla</i> – <i>E. patens</i> (Blackbutt) – <i>E. rudis</i> (flooded gum) woodland	<i>Corymbia calophylla</i> , <i>Eucalyptus patens</i> and <i>E. rudis</i> woodland over <i>Xanthorrhoea preissii</i> scattered shrubs over <i>*Rubus ulmifolius</i> , <i>*Asparagus asparagaceae</i> , <i>*Watsonia meriana</i> subsp. <i>bulbillifera</i> and <i>Pteridium esculentum</i> closed herbland on loamy gravels.	0.65 ha	

Vegetation type	Vegetation description	Extent (ha)	Site photograph
V3. <i>E. rudis</i> open woodland	<i>Eucalyptus rudis</i> open woodland over <i>Watsonia meriana</i> subsp. <i>bulbillifera</i> , <i>Typha</i> sp. and <i>Juncus pallidus</i> herbland and sedgeland over <i>Cynodon dactylon</i> grassland on low-lying drainage areas.	0.37 ha	
V4. <i>C. calophylla</i> – <i>E. patens</i> woodland	<i>Corymbia calophylla</i> and <i>Eucalyptus patens</i> woodland over <i>Rubus ulmifolius</i> , <i>Asparagus asparagaceae</i> and <i>Pteridium esculentum</i> closed herbland over <i>Avena barbata</i> , <i>Cynodon dactylon</i> and <i>Briza maxima</i> open grassland on loamy gravels.	1.34	
Cleared/Isolated native and/or introduced/planted trees and shrubs	Previously cleared areas (tracks, roads and farmland) where the understorey has been completely cleared of native vegetation. Consists of scattered individual or clumps of trees (mix of native, introduced and planted species) and/or tall shrubs over introduced grasses and herbs. The natural structure of the vegetation is no longer intact.	4.88	

4.1.2 Vegetation condition

The vegetation within the survey area was rated from Degraded to Completely Degraded. The survey area is highly modified largely as a result of clearing and the spread of invasive weed species. The vegetation structure of the areas mapped as Degraded have been significantly altered and lack a native mid and lower understorey and reduced species diversity. The understorey was largely dominated by invasive weeds (i.e. Blackberry) as well as common herbaceous and grassy weed species with the occasional native species.

Areas mapped as Completely Degraded were either completely cleared (roads, tracks, etc.) or parkland cleared with the occasional (scattered) native and/or planted trees and shrubs over weeds.

There is 3.38 ha (38%) of vegetation mapped as Degraded whilst the remaining 5.44 ha (62%) is considered Completely Degraded. Mapping of vegetation condition within the survey area is provided in Figure 3, Appendix A.

4.1.3 Conservation significant ecological communities

No TECs or PECs were identified within the survey area.

4.1.4 Flora diversity

A total of 61 flora taxa (including subspecies and varieties) representing 23 families and 51 genera was recorded from the survey area. This total comprised 24 native taxa and 37 introduced taxa. The dominant families included Fabaceae (10 taxa), Asteraceae (9 taxa) and Poaceae (8 taxa).

The survey area contains low species diversity and is completely dominated by introduced/weed species due to multiple disturbances to the area.

The full list of flora identified within the survey area is provided in Appendix E.

4.1.5 Introduced flora

A total of 37 introduced flora taxa (60% of the total flora present) were recorded in the survey area. Of these, two species, Bridal Creeper (**Asparagus asparagoides*) and Blackberry (**Rubus ulmifolius*) are listed as a Declared Pest Plants under the BAM Act and as WONS. Blackberry and Bridal Creeper were consistently present along the alignment.

4.1.6 Conservation significant flora

No EPBC Act or WC Act listed flora were recorded within the survey area. In addition no DBCA Priority-listed flora or flora of conservation significance, as defined in EPA 2016c, were recorded within the survey area.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment (Appendix D). This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that no conservation significant flora are likely to occur within the survey area due to the lack of suitable habitat and highly modified nature of the survey area.

4.2 Fauna

4.2.1 Fauna habitats

The survey area comprised of three broad habitat types including Mixed Eucalypt Woodlands, Flooded Gum Minor Drainage Lines and Cleared/Highly Modified areas. The majority of the survey area consists of a mixed woodland of *Corymbia calophylla* (marri), *Eucalyptus marginata* (jarrah), *E. patens* (blackbutt) and *E. rudis* (flooded gum) with the occasional scattered introduced *Pinus* (pine) species over introduced herbs and grasses. The structure of the remnant vegetation remaining has been significantly altered with only few scattered natives remaining in the understorey.

Jarrah-marri woodland is well represented in the local area, as well as in the broader region (including throughout the surrounding State Forest). The *Eucalyptus rudis* woodland occurs along watercourses, drainage lines and lower lying areas in the region and therefore is less common at both a local and regional scale.

Parts of the survey area had previously been cleared for tracks and roads which provide very few resources for fauna. Other highly modified areas which had previously been cleared of native vegetation (farmland or within the town site) contained scattered native and planted (introduced species) trees and shrubs. These areas provide some habitat value to fauna species such as foraging and refuge for birds.

4.2.2 Habitat connectivity and linkages

The vegetation remaining within the northern extent of the survey area forms a narrow corridor of remnant vegetation (trees) adjacent to existing roads and tracks, in an area which has been largely cleared for agriculture, pine plantations and Balingup town site. To the south, the survey area connects to large tracts of remnant vegetation (including State Forest).

4.2.3 Fauna diversity

A total of 28 fauna species were recorded within the survey area, including 19 birds, four mammals one reptile and four amphibian species. Of these, four are introduced species.

The list of fauna species identified during the field survey is provided in Appendix E.

4.2.4 Conservation significant fauna

Two conservation significant fauna species were identified during the field survey. They were:

- Forest red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), listed Vulnerable under the EPBC Act and WC Act – observed foraging within the survey area and adjacent properties
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), listed as Endangered under the EPBC Act and WC Act – evidence of feeding observed on marri nuts

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant fauna identified in the desktop assessment (Appendix D). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat.

In addition to the species identified during the field survey, the assessment identified the likely presence of one additional conservation significant species, the Baudin's Black Cockatoo (*Calyptorhynchus baudinii*). The survey area provides suitable foraging habitat and potential breeding and roosting habitat for the Baudin's Black Cockatoo.

The likelihood of occurrence assessment identified that other fauna species of conservation significance could occasionally occur within the habitats of the survey area (e.g. species deemed unlikely). However, it is considered unlikely the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of these species and that these other species may occasionally use the habitats of the survey area for temporary refuge and dispersal between other areas of habitat (i.e. Chuditch, Quenda, Peregrine Falcon).

4.3 Targeted Black Cockatoo assessment

4.3.1 Foraging habitat

The majority of the vegetation within the survey area is considered suitable foraging habitat for Black Cockatoos, including the mixed Eucalypt woodlands of jarrah, marri, blackbutt and flooded gum as well as the scattered Pine trees. There is approximately 4.3 ha of suitable foraging habitat in the survey area. Plentiful old and fresh foraging evidence was observed throughout the survey area (Forest Red-tailed Black Cockatoo and Carnaby's Cockatoos chew marks on marri nuts) (Plate 1). Forest Red-tailed Black Cockatoos were also observed feeding on marri trees during the survey.



Plate 1 Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo feedsign

Black cockatoo foraging habitat within the survey area has been mapped on Figure 4, Appendix A.

4.3.2 Potential breeding habitat

The habitat assessment identified 286 potential breeding trees of suitable DBH (jarrah, marri, blackbutt and flooded gum > 500 mm) from within the survey area (Appendix E). Trees of this size are considered to have nesting potential now, or will develop hollows within 100 years. Of the 286 trees, 19 contained hollows of which six were identified with potentially suitable hollows for Black Cockatoo nesting (with a hollow diameter greater than 100-150 mm, to allow entry of Black Cockatoo). The size of a hollow is an estimate as the assessment was undertaken from ground level, there is the potential for the actual hollow size to be greater than 100 mm. No evidence of recent use of suitable hollows by Black Cockatoos (e.g. chews) was recorded.

List of potential breeding trees recorded within the survey area is provided in Appendix E and mapped in Figure 4, Appendix A.

4.3.3 Roosting habitat

No evidence of roosting by Black Cockatoos was observed within the survey area. The survey area provides limited potential roosting habitat due to the narrow, linear nature of the remaining vegetation within the survey area.

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Appendices

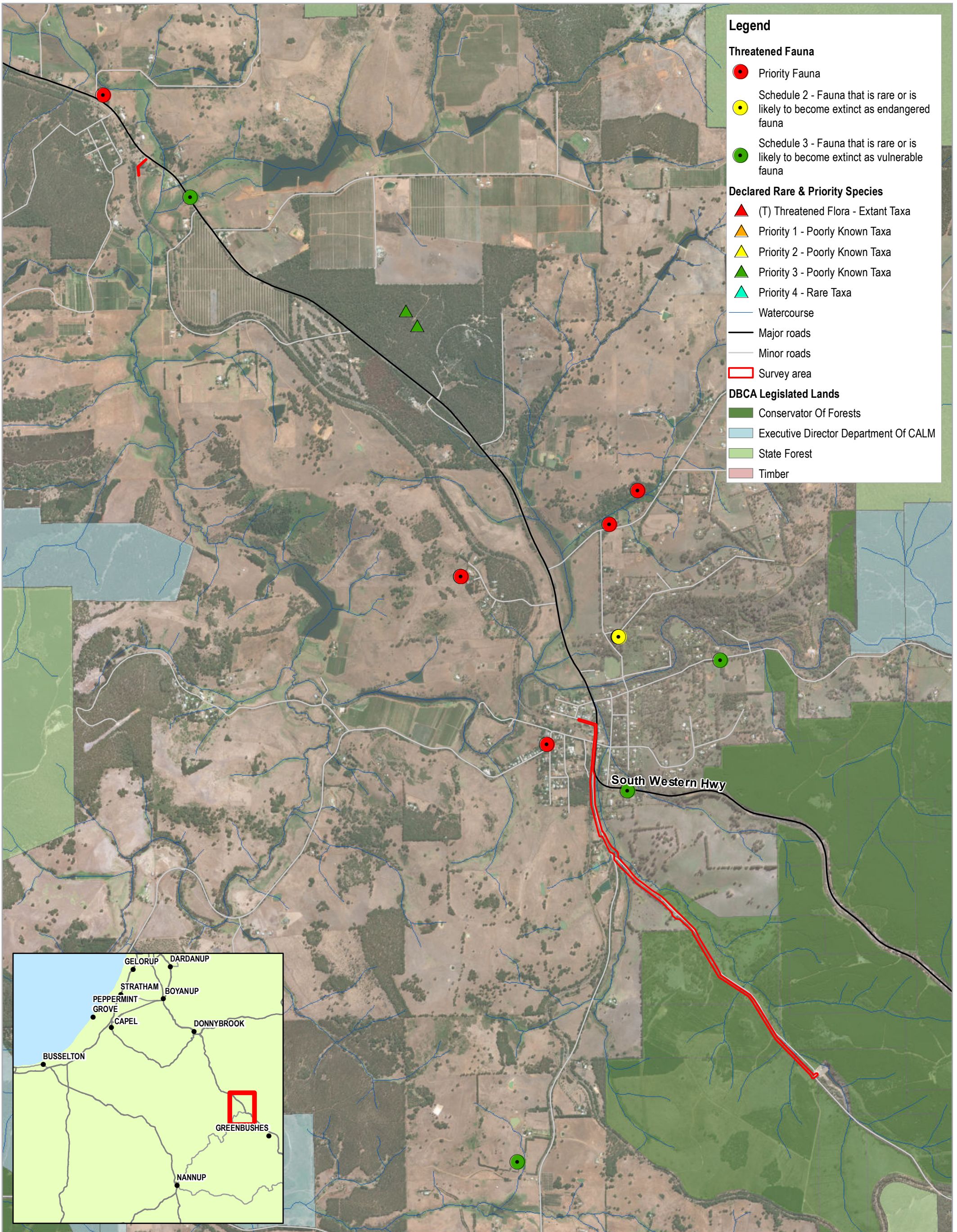
Appendix A – Figures

Figure 1 Locality and environmental constraints

Figure 2 Vegetation type

Figure 3 Vegetation condition

Figure 4 Black Cockatoo habitat



Legend

Threatened Fauna

- Priority Fauna
- Schedule 2 - Fauna that is rare or is likely to become extinct as endangered fauna
- Schedule 3 - Fauna that is rare or is likely to become extinct as vulnerable fauna

Declared Rare & Priority Species

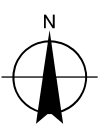
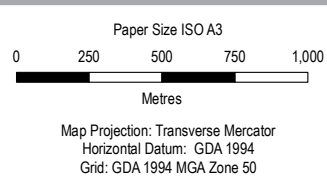
- ▲ (T) Threatened Flora - Extant Taxa
- ▲ Priority 1 - Poorly Known Taxa
- ▲ Priority 2 - Poorly Known Taxa
- ▲ Priority 3 - Poorly Known Taxa
- ▲ Priority 4 - Rare Taxa

— Watercourse
 — Major roads
 — Minor roads

Survey area

DBCA Legislated Lands

- Conservator Of Forests
- Executive Director Department Of CALM
- State Forest
- Timber



Water Corporation
 Greenbushes to Kirup Link EIA & Approvals

Project No. 61-35763
 Revision No. 0
 Date 17/12/2018

Locality & Environmental Constraints

FIGURE 1

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: bjohnes2

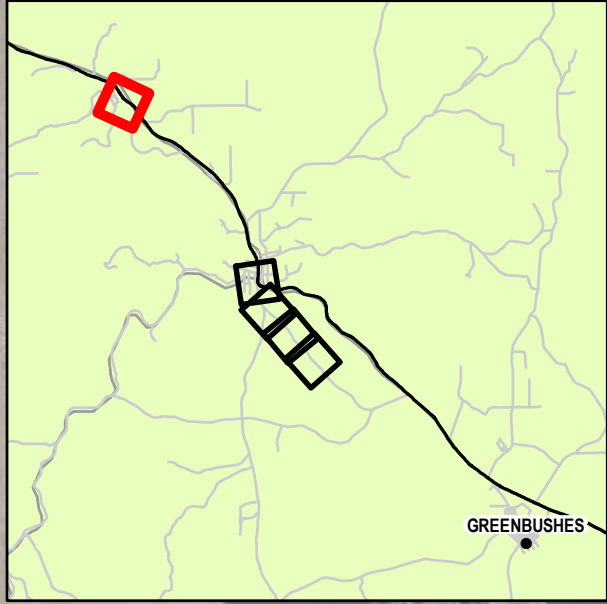


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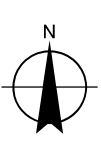
- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation Species

- Cleared/isolated native and/or Introduced/planted trees & shrubs



Paper Size ISO A3
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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



Water Corporation
Greenbushes to Kirup Link EIA & Approvals

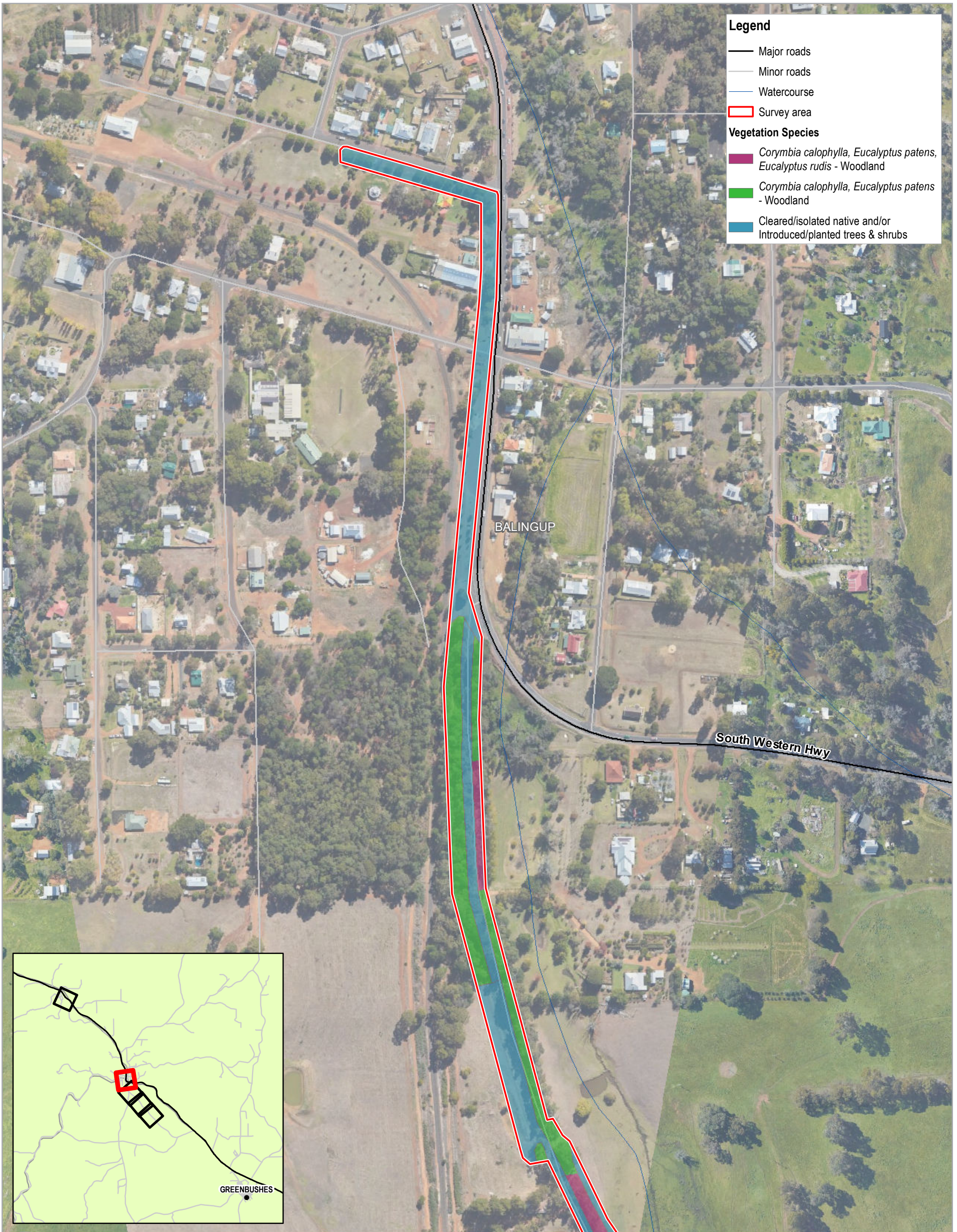
Project No. 61-35763
 Revision No. 0
 Date 17/12/2018

Vegetation mapping

Page 1 of 5
FIGURE 2

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 Print date: 17 Dec 2018 - 17:24

Data source: GHD: Survey area boundary - 20181009; vegetation mapping - 20181205; Landgate: Suburbs - 20180319; Imagery - 20181204; MRWA: Road - 20171211; Geoscience Australia: GeoData Topo 250k Series 3... Created by: bjones2



Legend

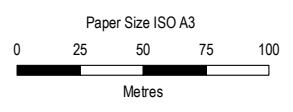
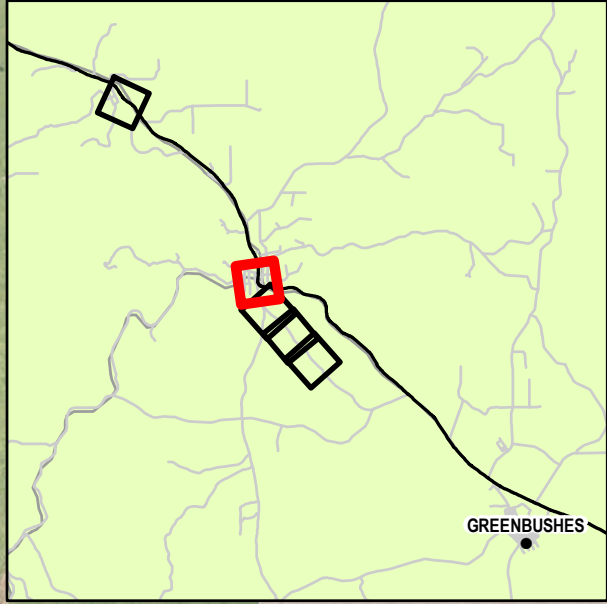
- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation Species

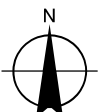
- ▭ *Corymbia calophylla*, *Eucalyptus patens*, *Eucalyptus rudis* - Woodland
- ▭ *Corymbia calophylla*, *Eucalyptus patens* - Woodland
- ▭ Cleared/isolated native and/or introduced/planted trees & shrubs

BALINGUP

South Western Hwy



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

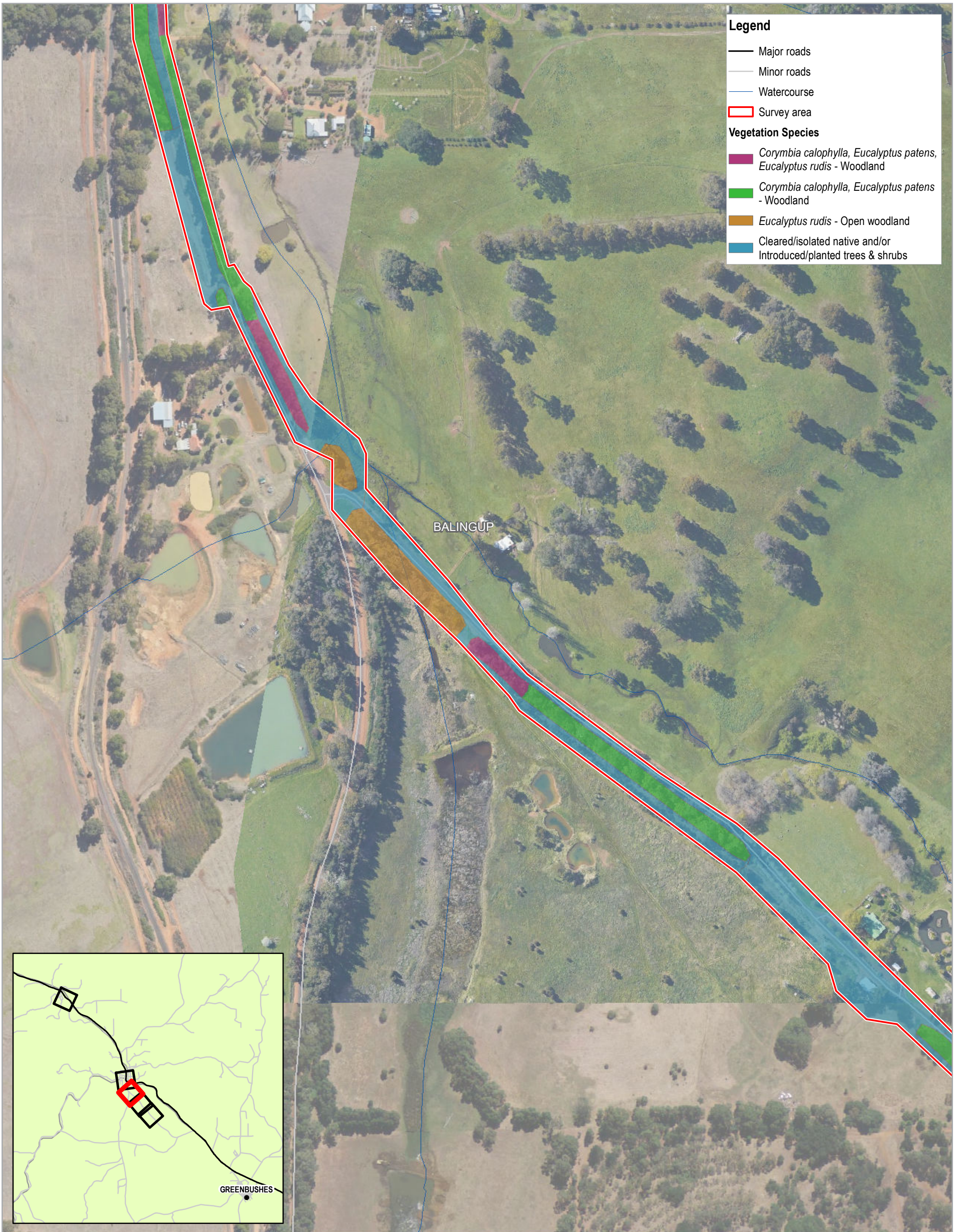


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Greenbushes to Kirup Link EIA & Approvals

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Vegetation mapping

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FIGURE 2



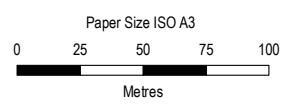
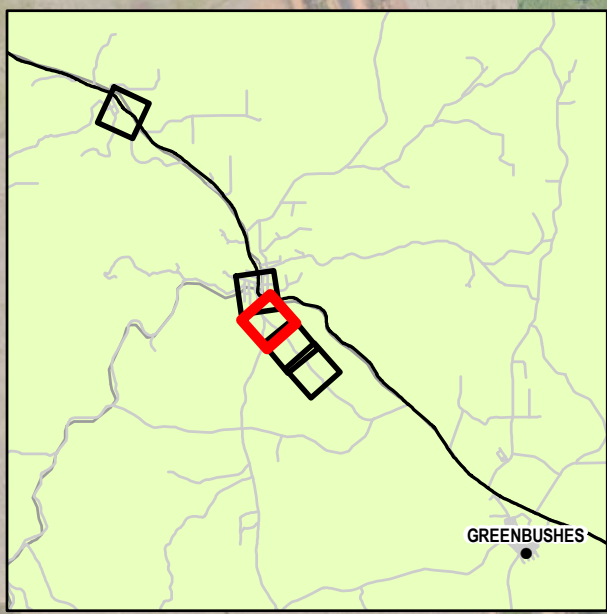
Legend

- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

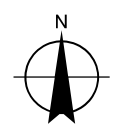
Vegetation Species

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- ▭ *Corymbia calophylla*, *Eucalyptus patens* - Woodland
- ▭ *Eucalyptus rudis* - Open woodland
- ▭ Cleared/isolated native and/or Introduced/planted trees & shrubs

BALINGUP



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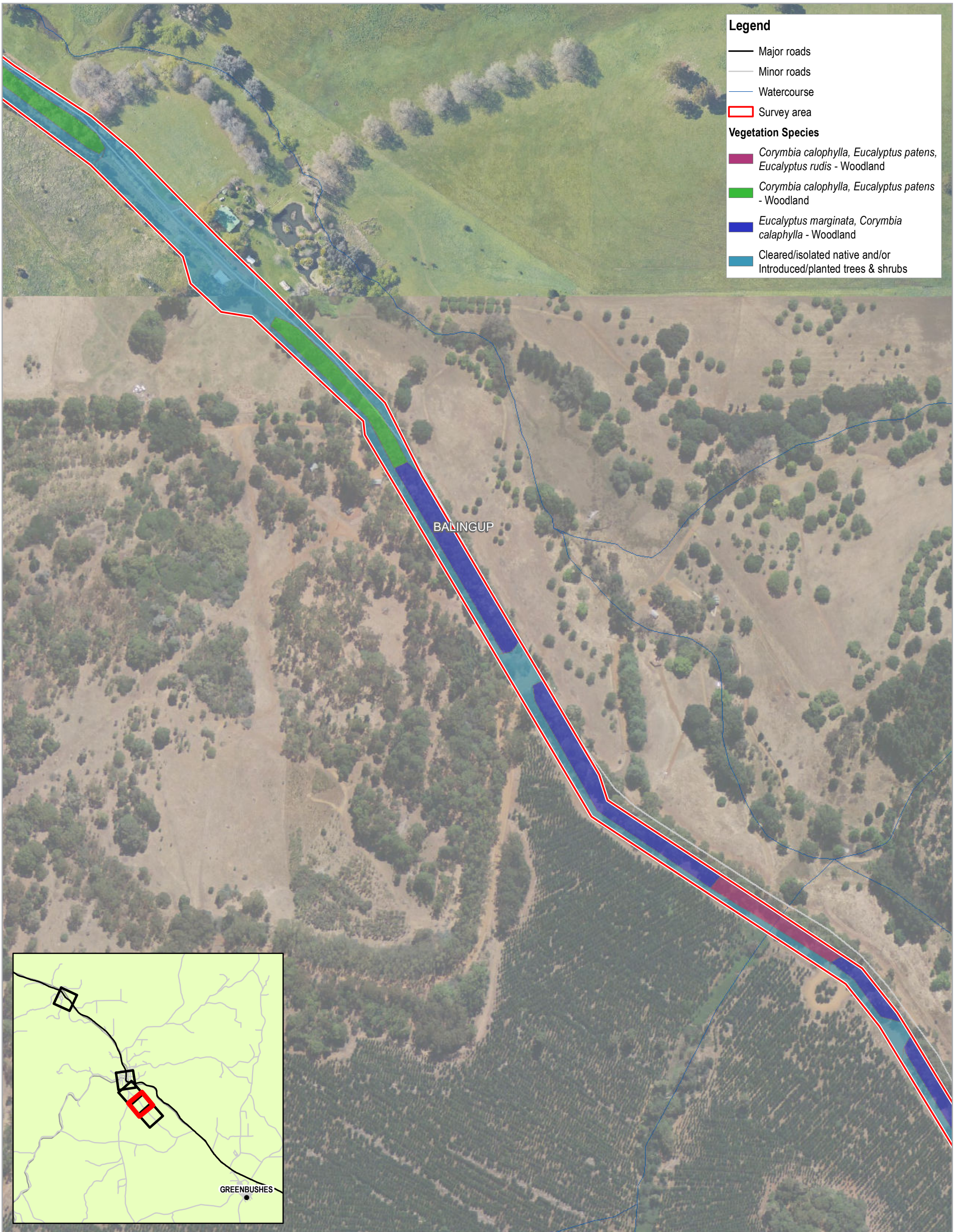


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Vegetation mapping

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FIGURE 2



Legend

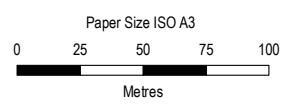
- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation Species

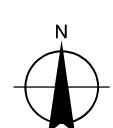
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- ▭ *Corymbia calophylla*, *Eucalyptus patens* - Woodland
- ▭ *Eucalyptus marginata*, *Corymbia calophylla* - Woodland
- ▭ Cleared/isolated native and/or Introduced/planted trees & shrubs

BALINGUP

GREENBUSHES



Map Projection: Transverse Mercator
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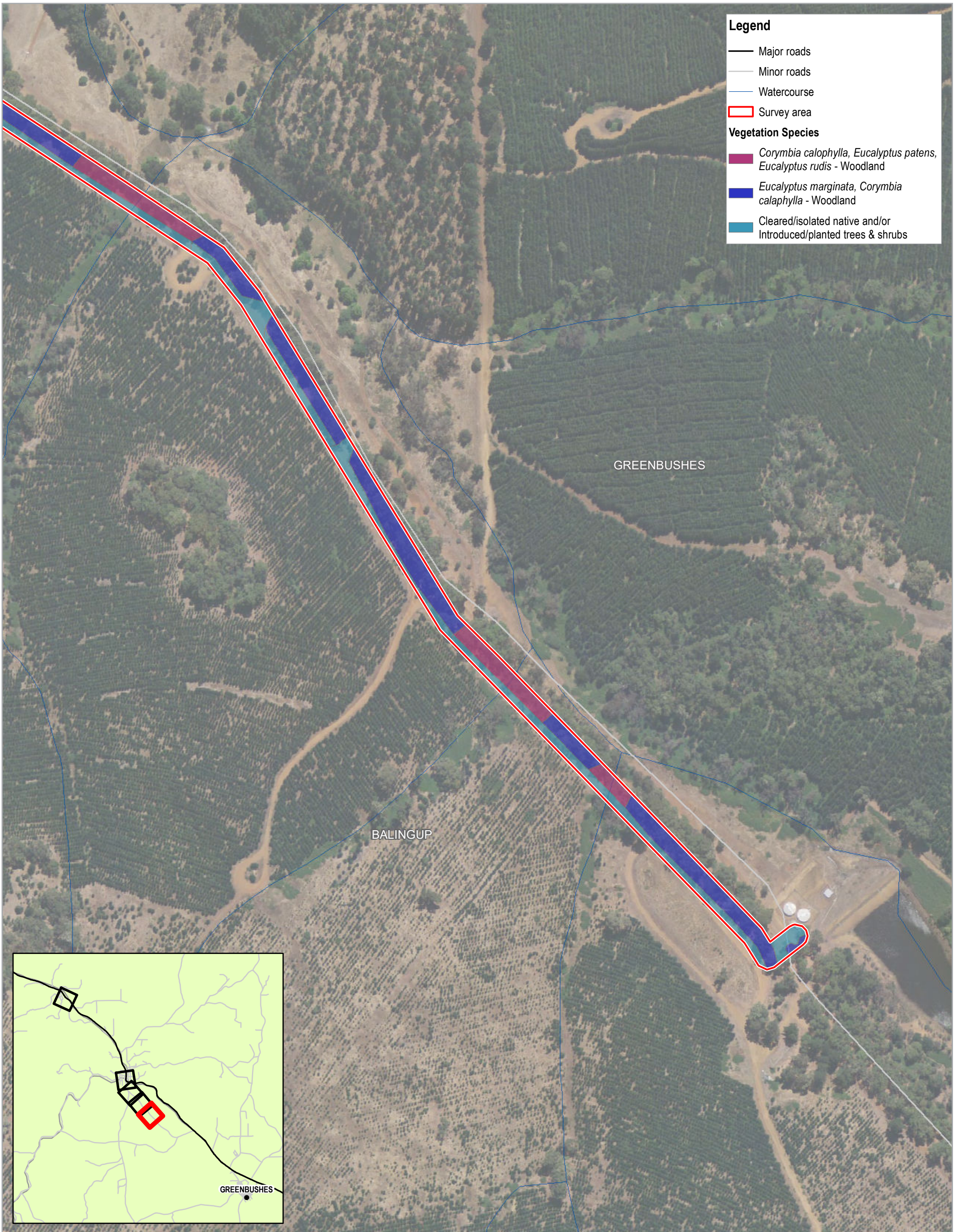


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Legend

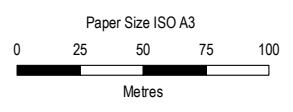
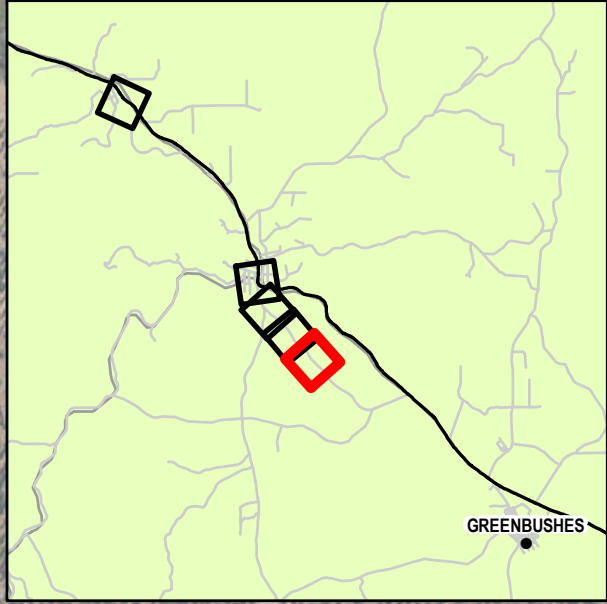
- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation Species

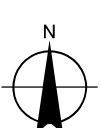
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- ▭ *Eucalyptus marginata*, *Corymbia calophylla* - Woodland
- ▭ Cleared/isolated native and/or Introduced/planted trees & shrubs

GREENBUSHES

BALINGUP



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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FIGURE 2

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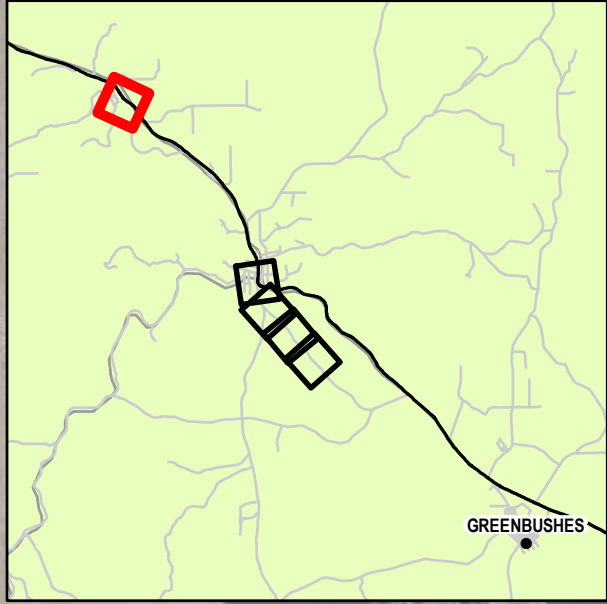


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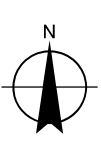
- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation condition

- █ Completely degraded



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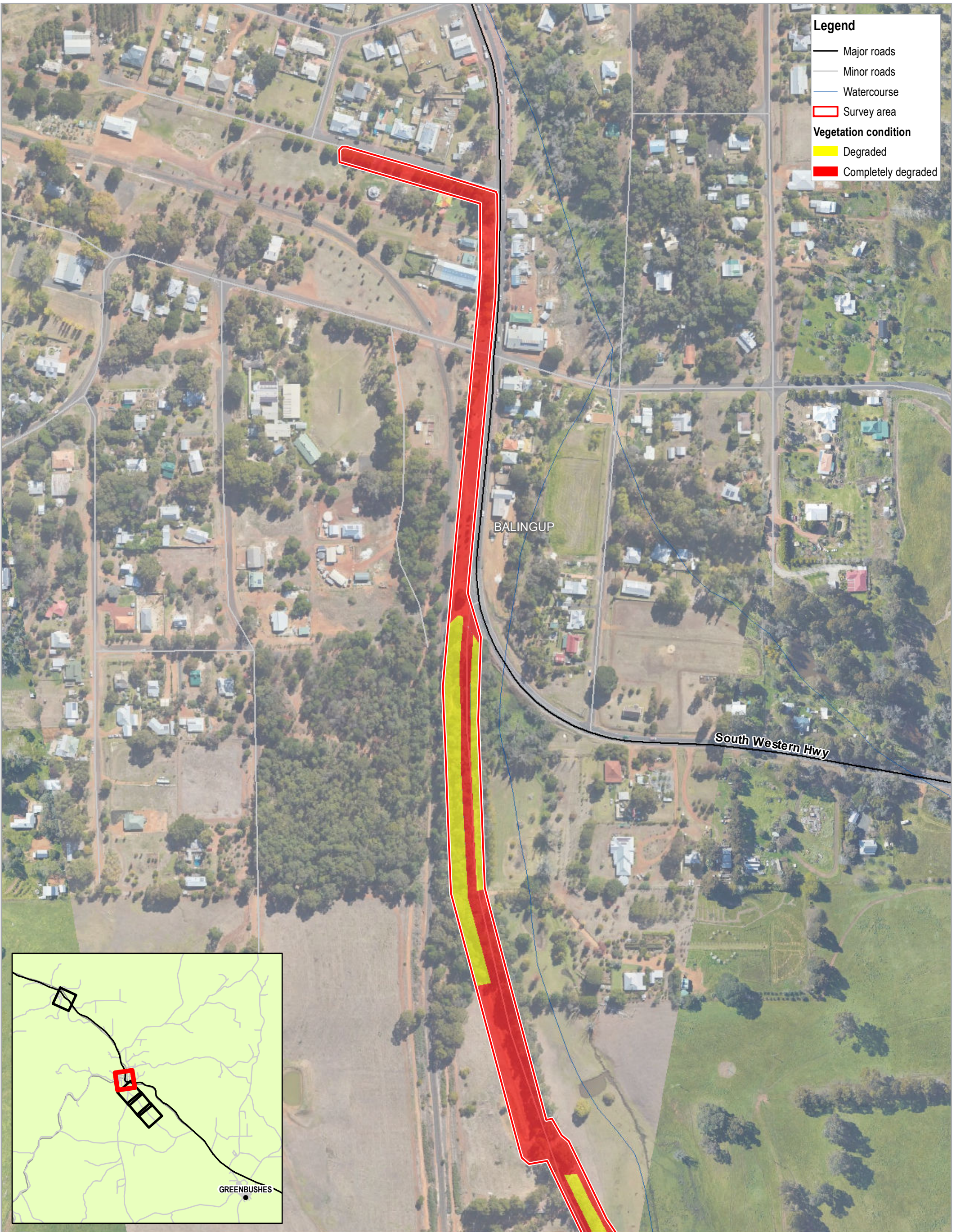


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Vegetation condition

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FIGURE 3

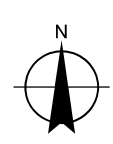
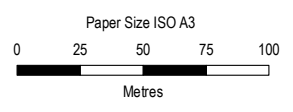


Legend

- Major roads
- Minor roads
- Watercourse
- ▭ Survey area

Vegetation condition

- ▭ Degraded
- ▭ Completely degraded



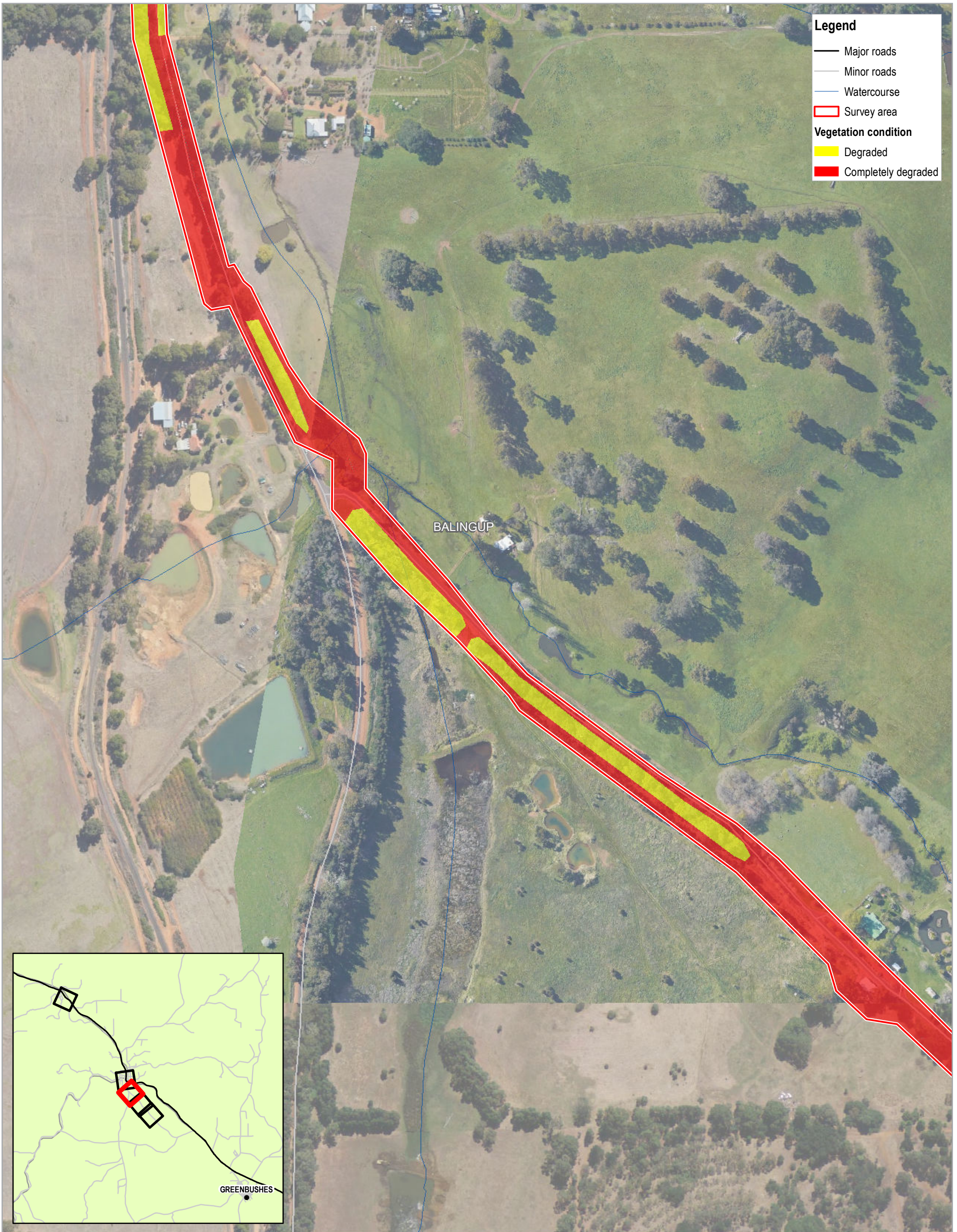
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Vegetation condition

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FIGURE 3



Legend

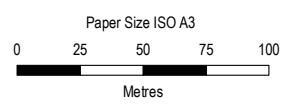
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Vegetation condition

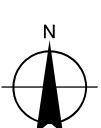
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BALINGUP

GREENBUSHES



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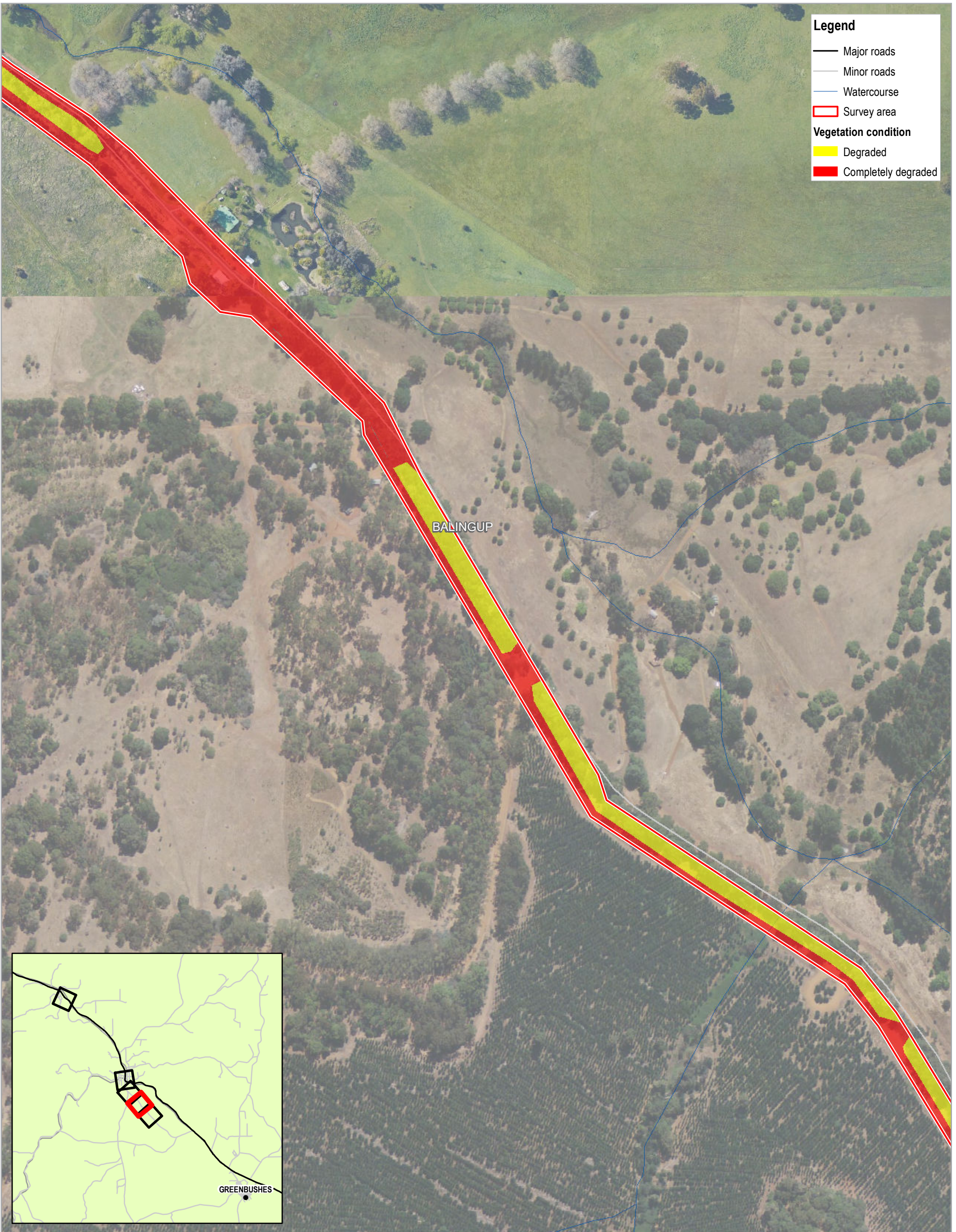


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Vegetation condition

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FIGURE 3



Legend

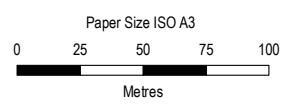
- Major roads
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Vegetation condition

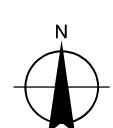
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BALINGUP

GREENBUSHES



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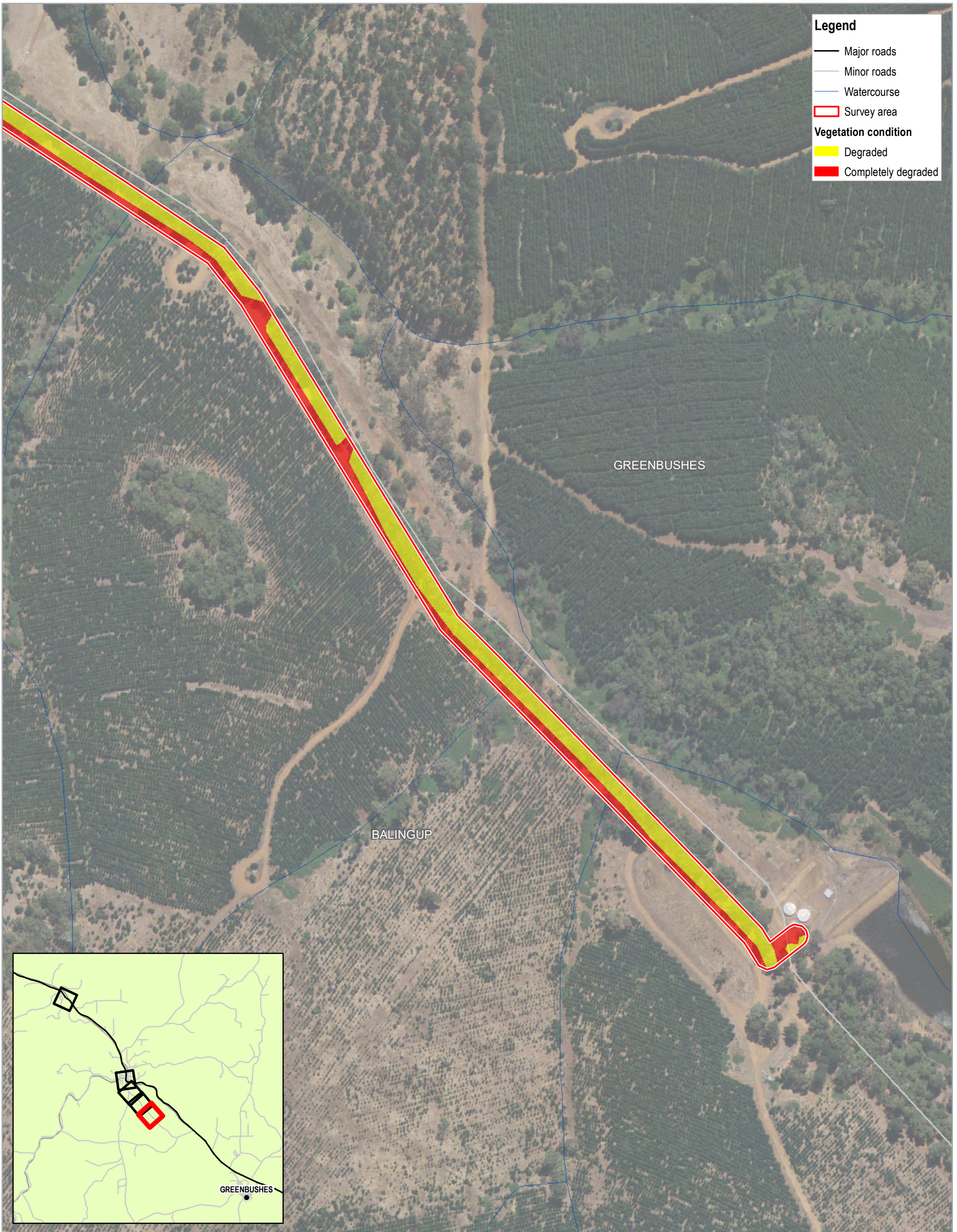


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Vegetation condition

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Legend

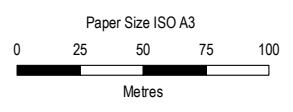
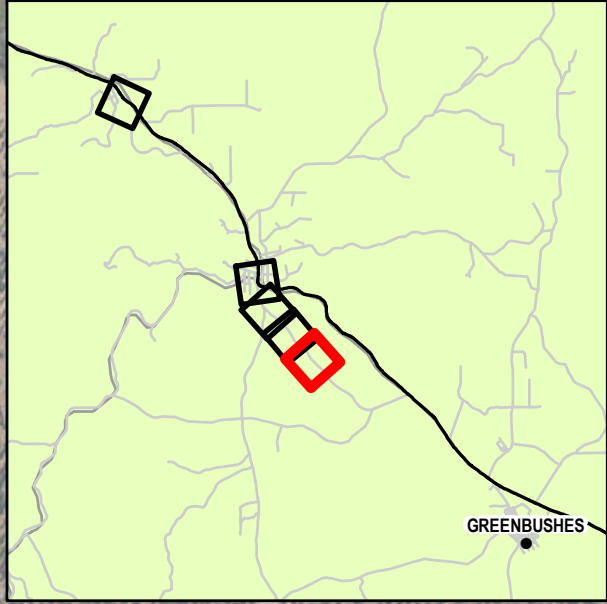
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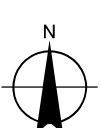
- Degraded
- Completely degraded

GREENBUSHES

BALINGUP



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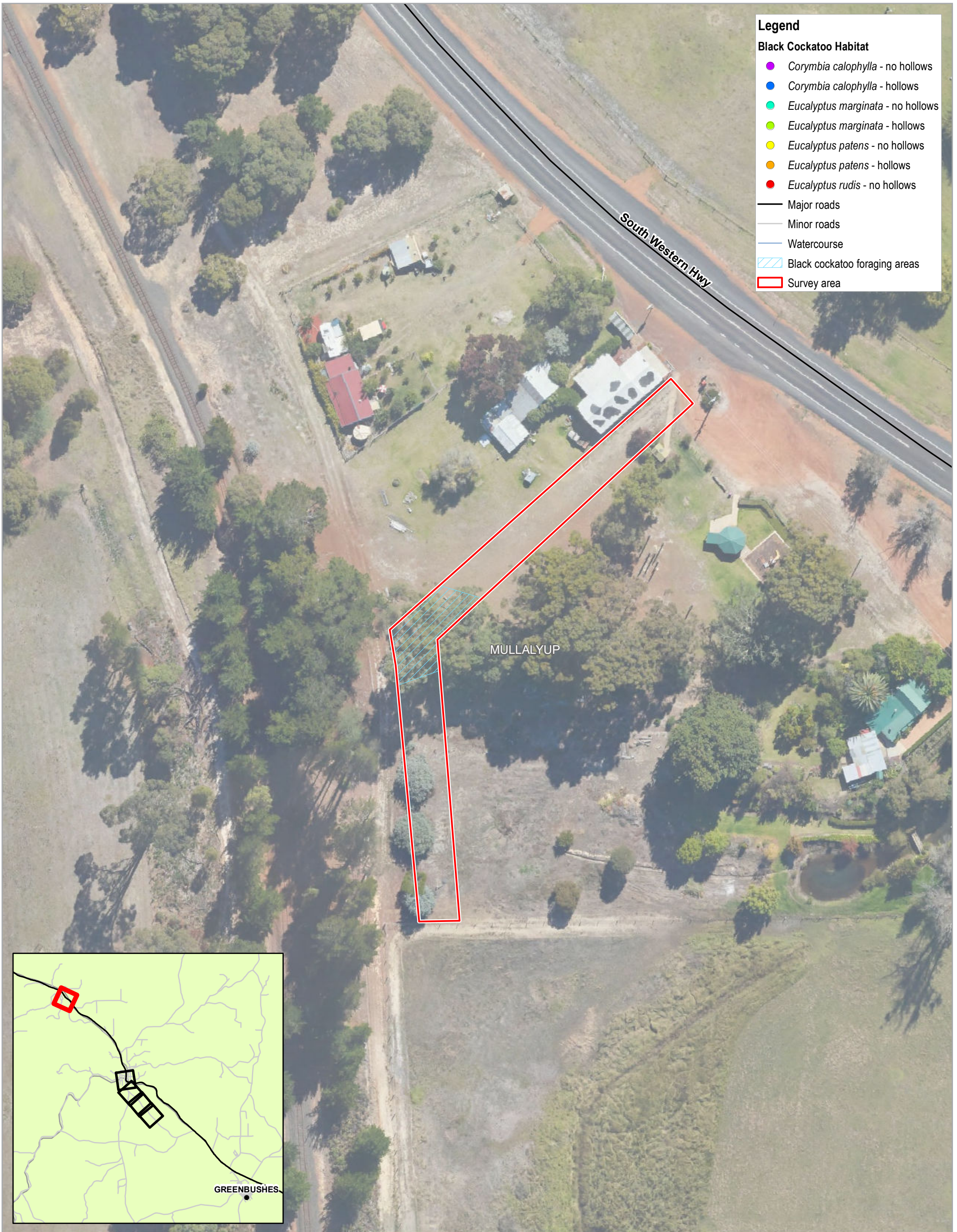


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Vegetation condition

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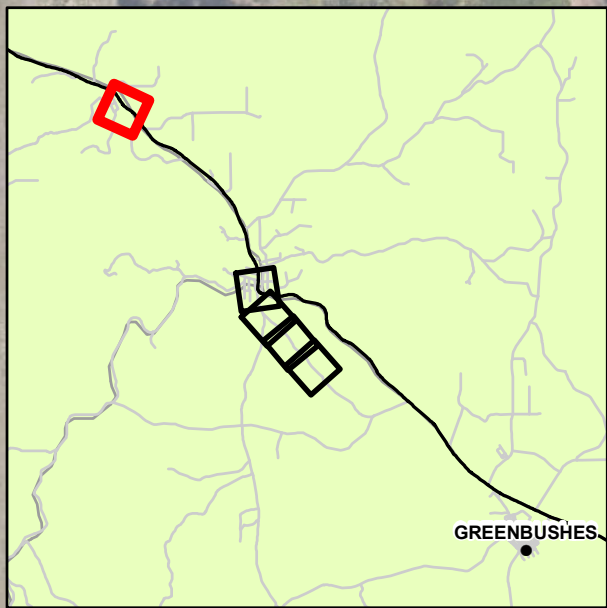


Legend

Black Cockatoo Habitat

- *Corymbia calophylla* - no hollows
- *Corymbia calophylla* - hollows
- *Eucalyptus marginata* - no hollows
- *Eucalyptus marginata* - hollows
- *Eucalyptus patens* - no hollows
- *Eucalyptus patens* - hollows
- *Eucalyptus rudis* - no hollows

- Major roads
- Minor roads
- Watercourse
- Black cockatoo foraging areas
- Survey area

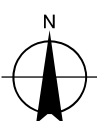


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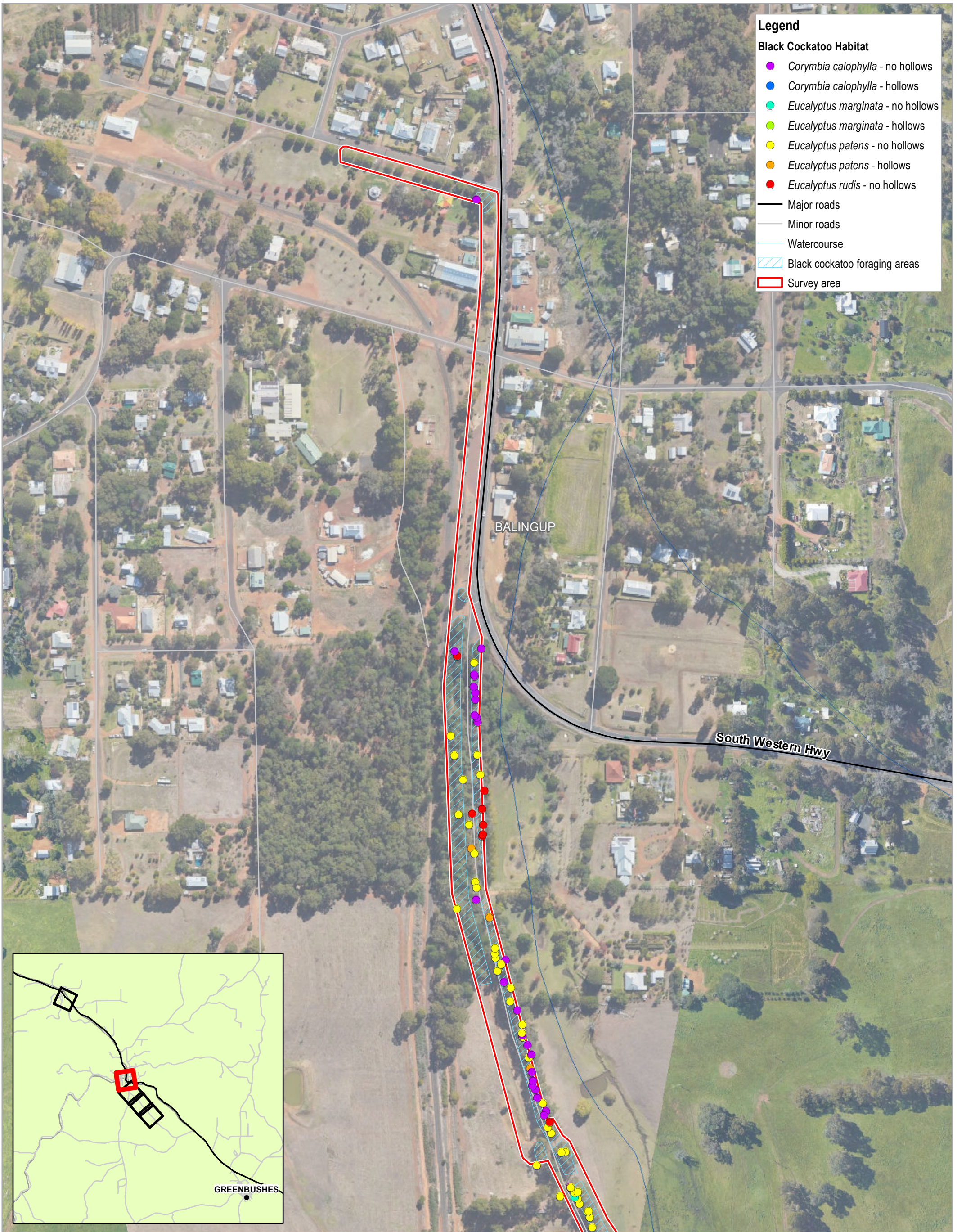


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Black cockatoo habitats

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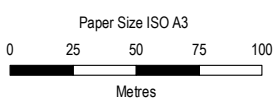


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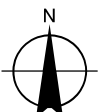
Black Cockatoo Habitat

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- *Eucalyptus marginata* - hollows
- *Eucalyptus patens* - no hollows
- *Eucalyptus patens* - hollows
- *Eucalyptus rudis* - no hollows

- Major roads
- Minor roads
- Watercourse
- ▨ Black cockatoo foraging areas
- ▭ Survey area



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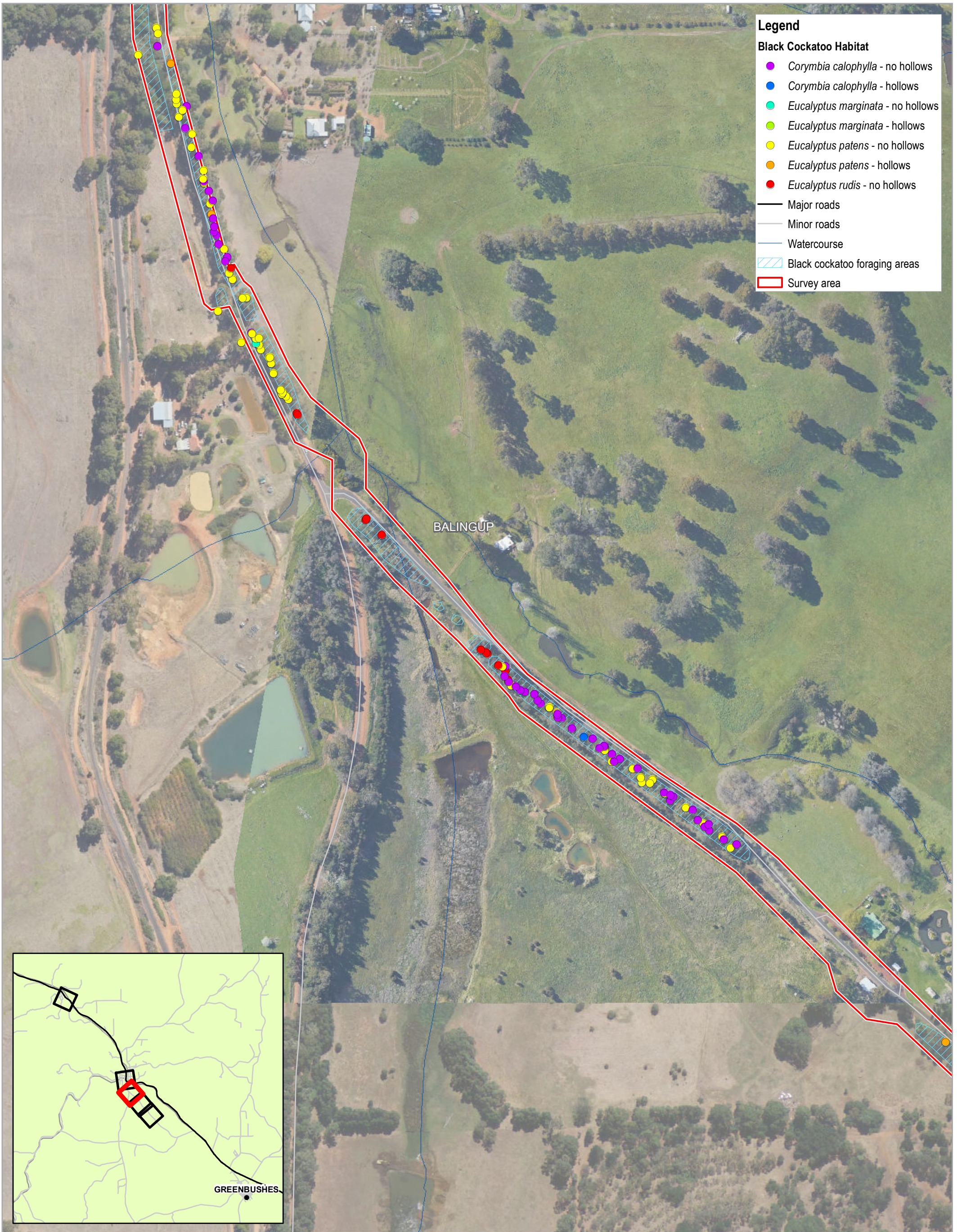


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Black cockatoo habitats

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Legend

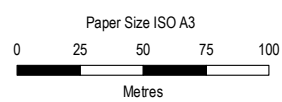
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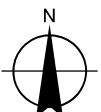
- Major roads
- Minor roads
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- ▨ Black cockatoo foraging areas
- ▭ Survey area

BALINGUP

GREENBUSHES



Map Projection: Transverse Mercator
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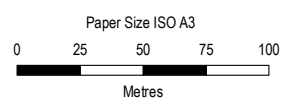
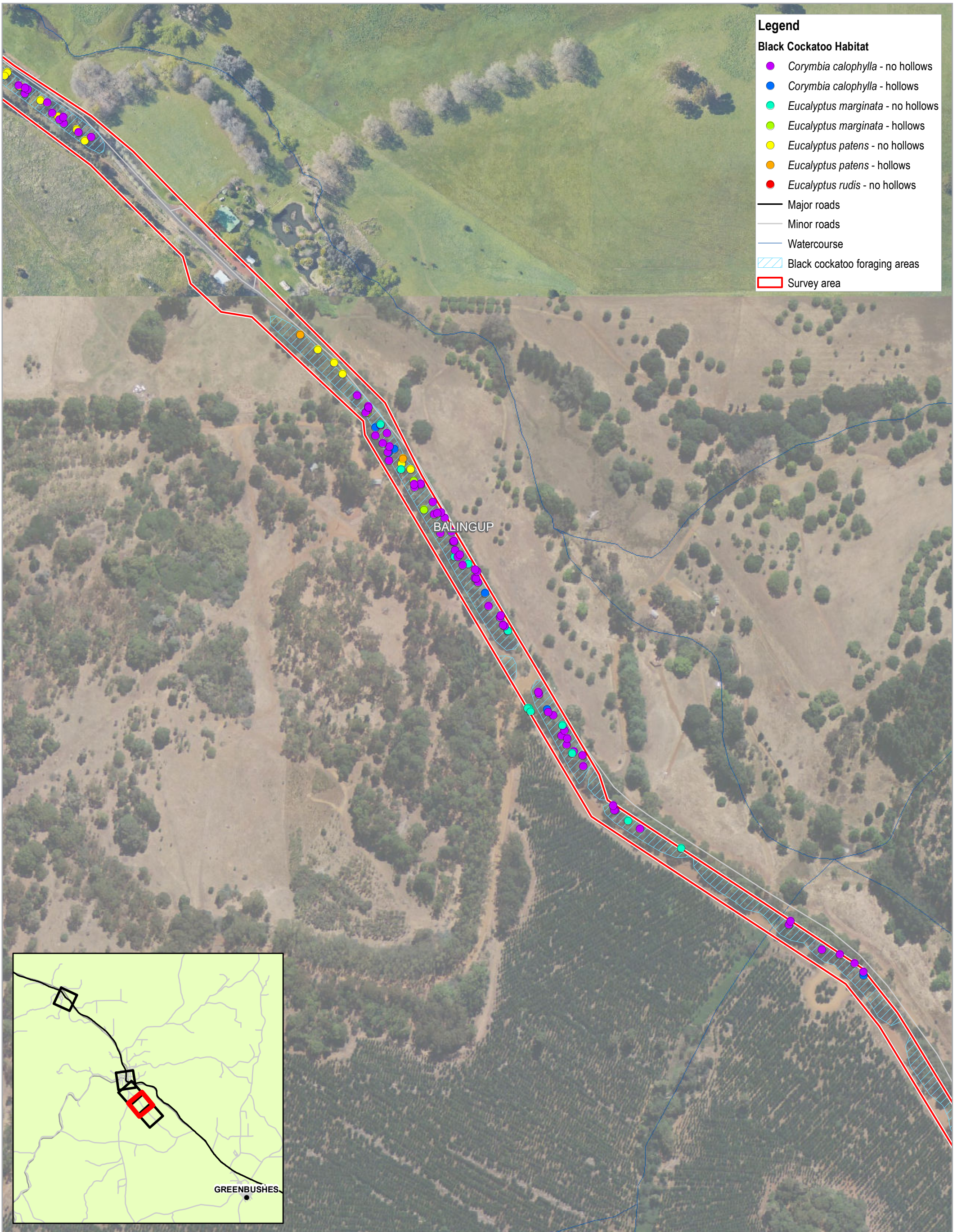


Water Corporation
Greenbushes to Kirup Link EIA & Approvals

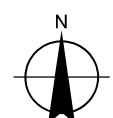
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Black cockatoo habitats

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Map Projection: Transverse Mercator
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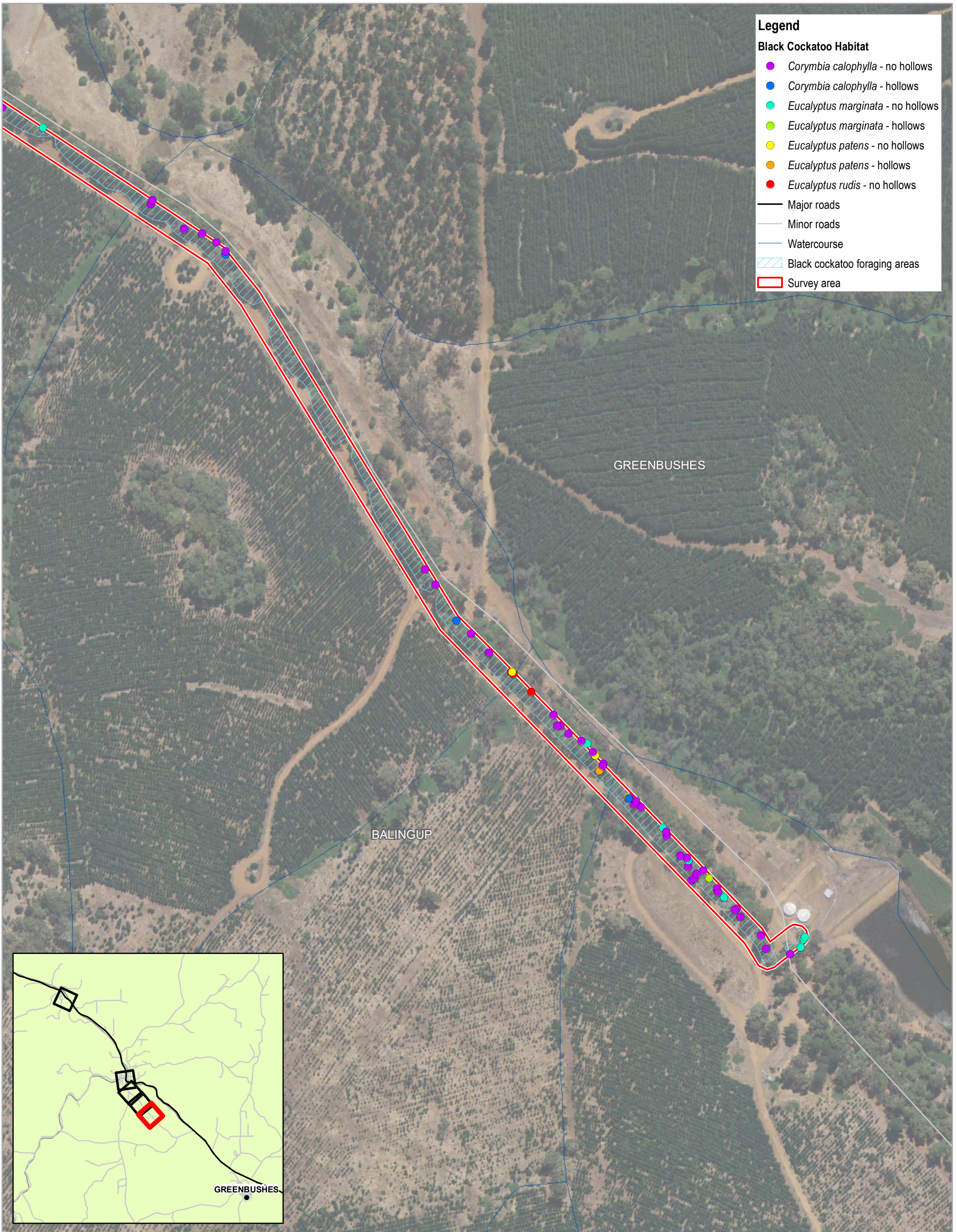


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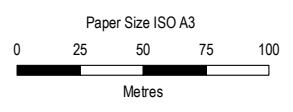
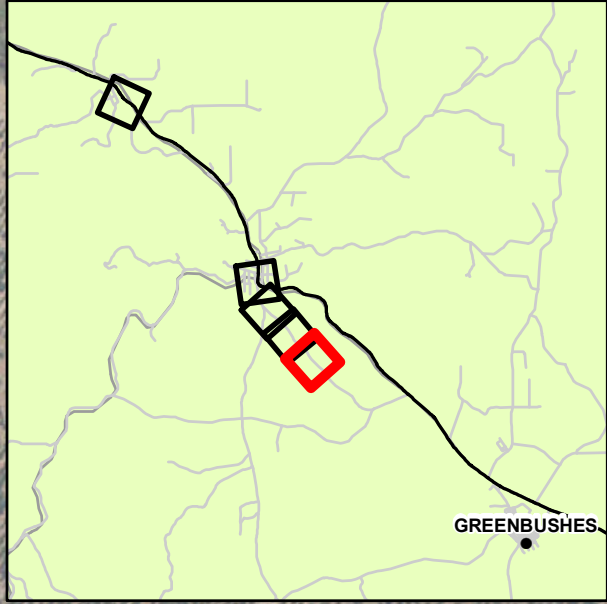
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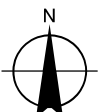
- Major roads
- Minor roads
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GREENBUSHES

BALINGUP



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



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Black cockatoo habitats

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Greenbushes to Kirup Pipeline Route Vegetation, Flora and Fauna Assessment

October 2013

Prepared for
Water Corporation



Astron Environmental Services

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Report Reference: 4175-13-SRV-1Rev0_140129

Greenbushes to Kirup Pipeline Route Vegetation, Flora and Fauna Assessment

Prepared for
Water Corporation




Job Number: 4175-13

Reference: 4175-13-SRV-1Rev0_140129

Revision Status

Rev	Date	Description	Author(s)	Reviewer
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B	20/01/2014	Draft Issued for Client Review	J. Oates V. Clarke	S. Pearse
0	29/01/2014	Final Issued for Information	J. Oates V. Clarke	S. Pearse

Approval

Rev	Date	Issued to	Authorised by	
			Name	Signature
A	19/12/2013	R. Oma	S. Pearse	
B	20/01/2014	R. Oma	S. Pearse	
0	29/01/2014	R. Oma	S. Pearse	



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Abbreviations

Abbreviation	Definition
Astron	Astron Environmental Services
BOM	Bureau of Meteorology
CR	Critically Endangered
cm	Centimetres
DAFWA	Department of Agriculture and Food Western Australia
DBH	Diameter at breast height
DEC	Department of Environment and Conservation (now DPaW or DER)
DER	Department Environmental Regulation
DPaW	Department of Parks and Wildlife
DoE	Department of the Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DoE)
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
m	Metres
mm	Millimetres
MNES	Matters of national environmental significance (under the EPBC Act)
P	Priority
PEC	Priority ecological community
TEC	Threatened ecological community
VU	Vulnerable
WALGA	Western Australian Local Government Association
WC Act	<i>Wildlife Conservation Act 1950</i>

Executive Summary

The Water Corporation is in the process of finalising a planned pipeline route between Greenbushes and Kirup and is seeking the option that will have the least impact upon the ecology of the local area. A flora, vegetation, fauna and fauna habitat assessment was conducted over the proposed alignment in peak spring (14 to 17 October 2013). The results and recommendations arising from the field survey will assist the Water Corporation in selecting an alignment that seeks to minimise impact to the local environment. The alignment follows existing tracks and cleared areas; the impact to flora, vegetation and habitat is likely to be very limited.

Two-hundred-and-six vascular plant taxa representing 128 genera from 48 families were recorded within the survey area with 28 taxa being weeds. The flora and vegetation recorded are typical of the southern jarrah forest and no conservation significant flora or vegetation was recorded. A number of conservation significant flora taxa were listed from the database search results for the survey areas; however suitable habitat for the majority of these taxa was not found. Where potential habitat occurred, the area was intensively searched but none of these taxa were found. Three collections will be lodged with the WA Herbarium due to the atypical characteristics of the collections (*Caladenia ?ferruginea* (atypical colouring); *Synaphea gracillima* (leaf apex atypical) and *Stylidium scandens* (significant range extension)).

Three fauna habitats were recorded in the survey area: high quality jarrah-marri woodland (particularly around Greenbushes and Mullalyup), flooded gum creeklines and cleared areas. Thirty-four fauna species were recorded during the fauna assessment, comprising three amphibian species, 28 bird species and three mammal species. Four species of which, are listed under state and federal legislation and have conservation significance: Baudin's black cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), eastern great egret (*Ardea modesta*) and quenda (*Isoodon obesulus fusciventer*).

Baudin's and the forest red-tailed black cockatoos were both present within the survey area. At the time of survey they were observed overflying, foraging and roosting in small flocks and pairs. Two hundred and nine eucalypt trees (jarrah or marri) with a DBH greater than 50 cm diameter at breast height were recorded with 10 trees containing hollows. Of the 209 total trees recorded, only 185 trees (including seven trees containing potential hollows and 178 trees without hollows) were located within the alignment, with the others located adjacent to the survey area. No breeding black cockatoos were observed during the survey. Breeding habitat is considered limited as most trees did not contain hollows and were relatively young trees of uniform height and width, measuring just over 500 mm DBH.

All jarrah-marri woodland in good condition or better, within the survey area (10.52 ha of a total corridor of 20.3 ha) would be considered medium to high value foraging habitat for the black cockatoo species. Evidence of foraging by black cockatoos was recorded throughout the survey area. Black cockatoo species were regularly observed feeding within the alignment near the golf course and along Cirillo Road.

Astron advises that the project may pose a risk of impact to the black cockatoo species; depending on the number of recorded habitat trees which may require removal for the pipeline. The project may be at variance to Principle B of the 10 Clearing Principles, if clearing of more than one hectare of quality foraging habitat and clearing of breeding habitat (which includes all trees over 500 mm DBH of species known to support breeding) is proposed. Therefore, referral to the Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999* may be required, depending on final alignment selection and tree removal. The tree and habitat loss could be reduced by minimising clearing where possible, in particular habitat trees.

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1 Introduction

1.1 Project Background

The Water Corporation proposes, as part of the Bridgetown Regional Water Supply Scheme, to link and improve the water supply to seven towns: Greenbushes, Balingup, Mullalyup, Kirup, Bridgetown, Hester and Boyup Brook in the south-west of Western Australia (herein referred to as the 'survey area'; Figure 1).

The survey alignment is approximately 20 kilometres (km) long; the corridor was generally 10 metres (m) in width (wider in some areas to accommodate potential variations in alignment) and the total area of survey was 35.66 hectares (ha). The vegetated area is 20 ha and only 10.5 ha remains in good condition or better. The Water Corporation intend to utilise existing tracks and cleared areas (which exist for the entire alignment) for the pipeline; and seek to minimise any clearing which may be required to install the infrastructure.

Astron Environmental Services (Astron) understands the Water Corporation are in the process of finalising a planned alignment and are seeking to utilise the option that will have the least impact upon the ecology of the local area.

The results and recommendations arising from the field survey will assist the Water Corporation in selecting an alignment that seeks to minimise impact to the local environment. Scope and Objectives

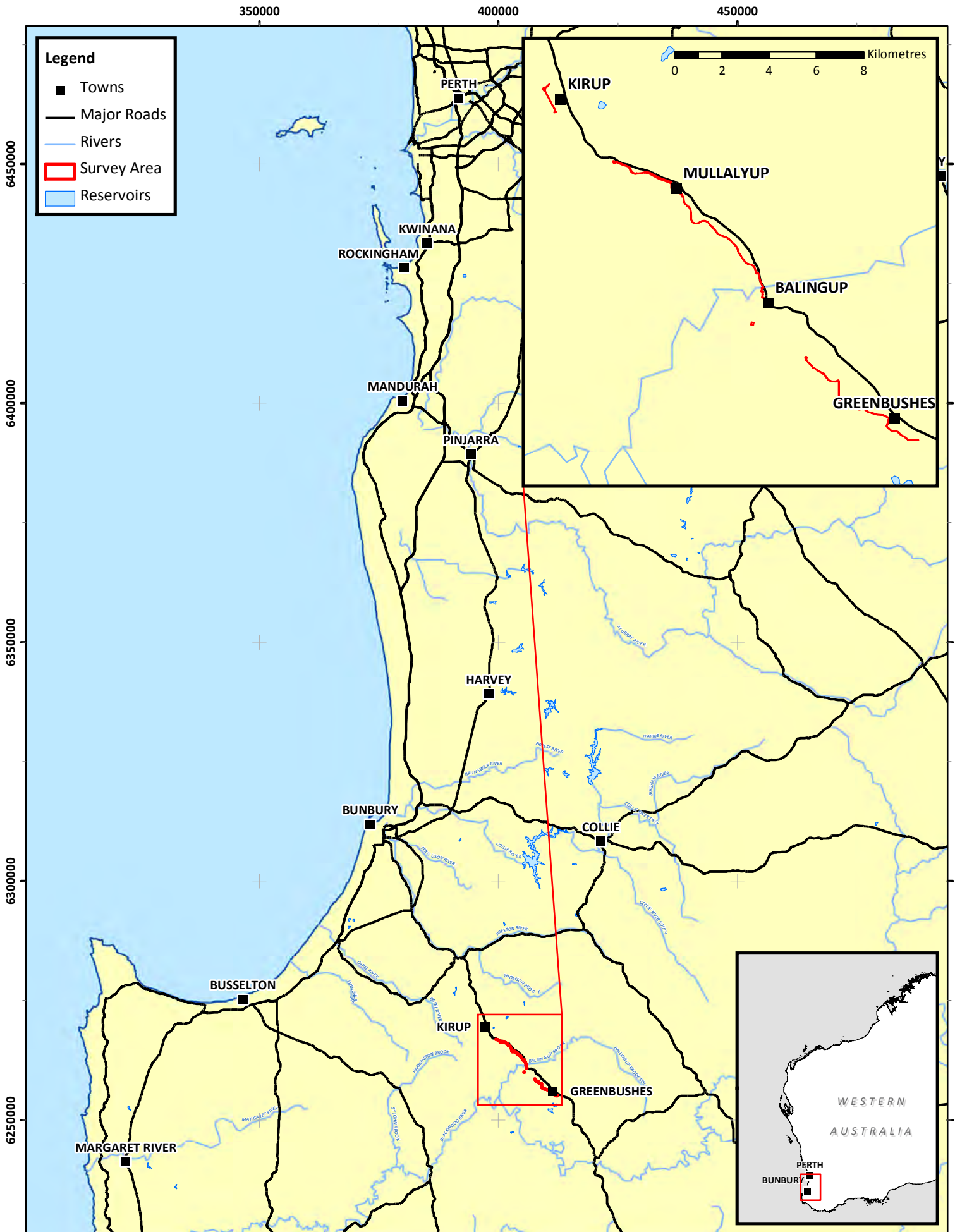
Astron was commissioned by Water Corporation to undertake the following scope of works:

- Level 2 flora and vegetation assessment to be compliant with the Environmental Protection Authority (EPA)'s Position Statement No. 3 (2002) and Guidance Statement 51 (2004).
- Level 1 Fauna assessment to be compliant with the Guidance Statement 56 (EPA 2004b).
- Field survey of trees with hollows suitable for use by black cockatoos and trees with drays likely to be used by ring tailed possums (if any), being Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

More specifically, the requirements of the flora, vegetation and fauna assessment for the route:

- A database and literature search for conservation significant flora, fauna and vegetation (threatened or priority ecological communities (TEC/PECs); locally significant vegetation) that may occur within the survey area.
- A flora and vegetation field survey:
 - identifying and mapping the different vegetation communities on site and their condition
 - recording an inventory of flora species, including weed species
 - recording any threatened or priority flora and ecological communities.
- A fauna field survey:
 - identifying and mapping fauna habitats
 - recording opportunistic fauna sightings

- assessing the potential of available fauna habitats to provide habitat (foraging, roosting, nesting) for fauna of conservation significance, and evidence of recent utilization of such habitat
- mapping of habitat for black cockatoos, including locations of actual roost trees (if any) and trees with suitable hollows.
- Assessment of the proposed clearing of the route against the Department of Environment Regulation's (DER) 10 Clearing Principles.
- For any riparian areas, recommendations on the need for offsets as required by the Statewide Clearing Permit assessment and any minor realignments that minimises or avoids the need for offsets.



Water Corporation
Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure 1: Survey Area Location



Author: V. Clarke	Date: 28-01-2014
Drawn: H.Thornton	4175_13_GDR_1Rev0_140128_Fig1Locn

Datum: GDA 1994
Projection: MGA Zone 50

1.2 Environmental Context

1.2.1 Climate

The survey area is located in the Southwest region of Western Australia. The climate in this region is described as warm Mediterranean, and is characterised by rainfall ranges of between 600 and 1000 millimetres (mm) annually (Mitchell et al. 2002). Weather data from Bridgetown weather station (9510), the nearest long-term weather station located approximately 23 km south of Balingup, indicate the mean annual rainfall from 1901 to 2012 is 821.1 mm (Bureau of Meteorology (BOM) 2013). Maximum daily temperatures range between 27.5°C and 29.8°C in the summer months and between 15.8°C and 16.7°C in the winter months (BOM 2013; Figure 2).

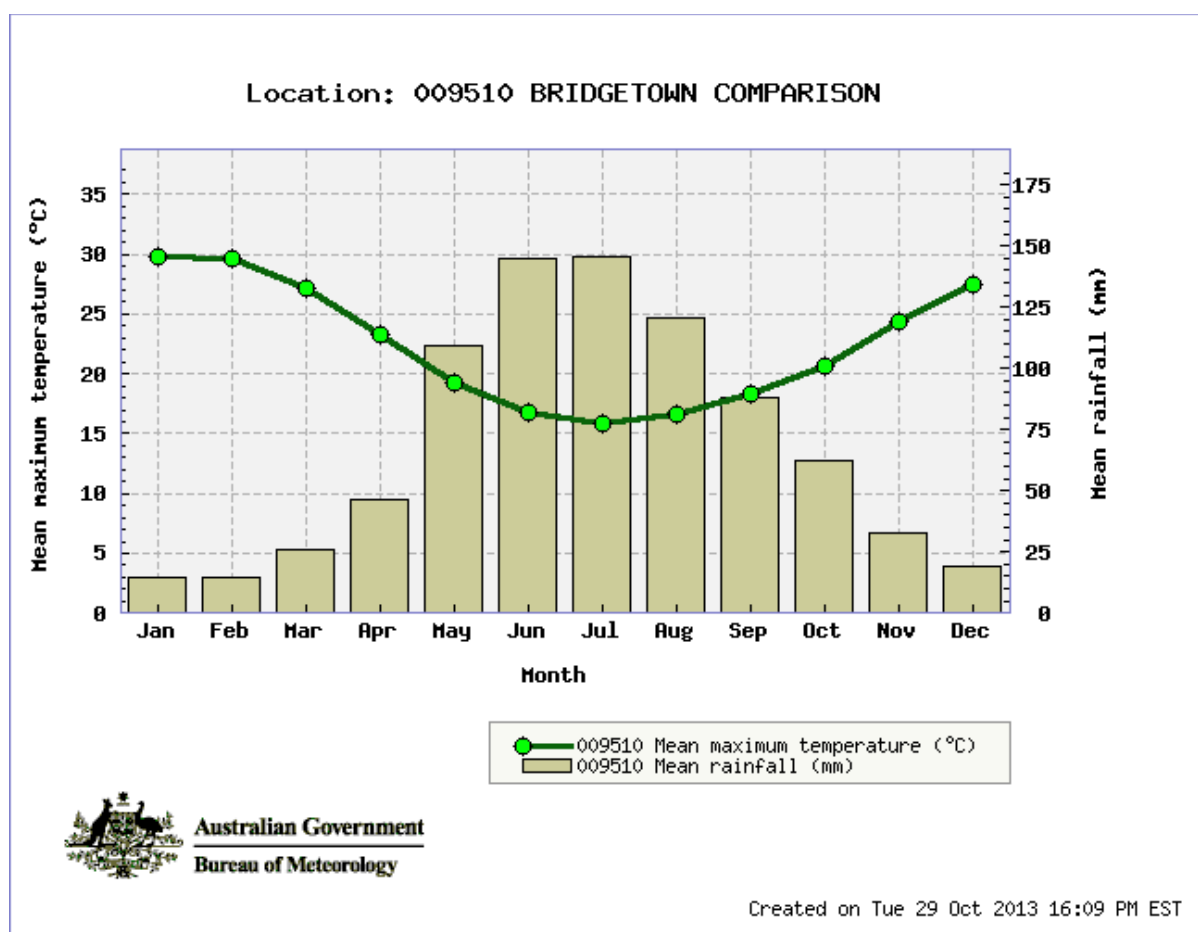


Figure 2: Climate data from Bridgetown weather station (9510) including mean annual rainfall (mm) and mean maximum temperature (°C) (1901-2012) in Western Australia (BOM 2013).

1.2.2 Geology, Landforms and Soils

The survey area is at the border of the southern and northern jarrah forests (Beard 1990), and this subregion occupies the northern portion of the Darling Plateau, east of the Darling Scarp. It overlies Achaean granite and metamorphic rocks and has an average elevation of about 300 m. The plateau is an ancient erosion surface capped by an extensive lateritic duricrust, which has been dissected by later drainage. The plateau is occasionally broken by prominent granite hills of unusual elevation. The dominant soils are lateritic gravels consisting of up to 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon overlying mottled yellow-brown clay subsoil. Some granite boulders may protrude through

the laterite mantle and hard-setting loamy soils to deep loams can be found within valleys (Beard 1990).

1.2.2.1 Land Systems

The project alignment traverses approximately 20 km kilometres from Greenbushes to Kirup and crosses 12 land systems, as mapped by the Western Australian Agriculture Department (DAFWA 2013b). These land systems and their areas of occupancy within the alignment are provided in Table 1.

Table 1: Land systems (DAFWA 2013b) mapped within the project alignment.

Name	Code	Area (ha)	Description
Dwellingup subsystem	DpDW	4.03	Divides, lower to upper slopes and hillcrests. Duplex sandy gravels and loamy gravels with minor areas of shallow gravels, deep sandy gravels, yellow deep sands and yellow and pale deep sands, often gravelly.
Hester subsystem	DpHR	1.20	Ridges and hill crests on laterite and gneiss, relief 5-40 metres (m), slopes 5-15%. Soils are sandy gravels, loamy gravels and loamy earths.
Mornington Hill subsystem	DpMH	0.15	Low hills on laterite overlying granite, relief 40-80 m, slopes 5-20%. Soils are sandy and loamy gravels with some deep sands and loamy earths.
Yarragil Upstream Valleys phase	DpYGu	2.73	Relief 5-20 m, slopes 3-10%. Valley floor is broader than downstream phase. Soil parent material is mainly laterite. Soils are gravels and sands.
Balingup Moderate Slopes phase	LvBL4	2.82	Balingup Subsystem, moderate slope phase, slopes 15-35%, relief 60-120 m.
Balingup Foothslopes phase	LvBLf	3.32	Balingup Subsystem, foothslope phase, slopes 3-10%, relief 5-20 m.
Bridgetown Steep Slopes Phase	LvBT5	0.46	Relief 100-180 m, slopes 15-50%, soils are loamy earths.
Kirup Gentle Slopes Phase	LvKR2	10.55	Foothslopes, relief 20-30 m, slopes 2-10%.
Kirup Low Slopes Phase	LvKR3	6.35	Relief 20-60 m, slopes 5-20%.
Kirup Sandy Slopes Phase	LvKR5	2.22	Relief 20 m, slopes 2-15%. Soils are deep sands and sandy earths.
Mumballup Upstream Flats Phase	LvMLu	1.31	Flats 50-250 m wide, prone to waterlogging and flooding.
Queenwood Low Slopes Phase	LvQW3	0.52	Slopes (5-15%), soils are gravels.

1.2.3 Surface Water and Hydrology

The corridor passes through Capel River Catchment – Busselton Coast Basin, and Hardy Estuary /Blackwood River catchment, Blackwood River.

The alignment is intersected two creeks and a few minor drainage lines. In the vicinity of Greenbushes the alignment intersects Dumpling Gully; in Balingup the Balingup Brook is crossed and in Mullalyup the Mullalyup Brook is crossed; towards Kirup the Capel River is crossed.

1.2.4 Vegetation

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment (DoE) 2013c). IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. Specialist ecological knowledge, combined with appropriate regional and continental scale biophysical datasets were interpreted to define and describe these regions (Thackway and Cresswell 1995). Information about each subregion is used to help determine which ecosystems are adequately protected in the conservation estate. The survey area is located within the IBRA Southern Jarrah Forest Subregion (JF2) of the Jarrah Forest Bioregion.

Pre-European vegetation was mapped at a broad scale across Western Australia (Beard 1990) and the survey area is within the Southwest Botanical Province; the alignment is comprised of one singular unit: 3 medium forest (jarrah-marri) (Government of Western Australia 2013).

The forest areas of southwest Western Australia were mapped at a finer scale within ‘*Vegetation of the Darling System*’ (Hedde et al. 1980) and then further refined as part of the Regional Forest Agreement (Mattiske and Havel 1998). The alignment comprises eight vegetation complexes as defined for the forest region (Table 2).

Table 2: Vegetation complexes traversed for the survey alignment (Mattiske and Havel 1998).

Vegetation complex	Vegetation complex code	Area (ha)
Balingup	BL	7.20
Bridgetown	BT	0.46
Catterick	CC1	2.72
Dwellingup	D1	4.19
Hester	HR	1.19
Kirup	KR	17.69
Mumballup	ML	1.31
Queenwood	QW	0.89
Total		35.66

2 Methodology

2.1 Desktop Assessment

Database searches were conducted to identify listed conservation significant flora, fauna and ecological communities within or in close proximity to the survey area. The search details are summarised in Table 3.

Table 3: Summary of database searches.

Database name	Search focus	Search area
Protected Matters Search Tool (DoE) 2013)	MNES (including flora, fauna, and communities).	20 km radius from a line defined by the coordinates - 33.844436 °S, 116.068749 °E and -33.610867 °S, 115.855889 °E (GDA94).
<i>NatureMap</i> (DPaW 2013a)	Flora and fauna species including those of conservation significance; listed threatened and priority ecological communities (TEC/PECs).	20 km radius from a line defined by the coordinates 33°42' 49" S, 115°53' 43" E and 33°50' 49" S, 116°03' 24" E (GDA94).
Threatened and Priority Flora Database (TPFL) (Department of Parks and Wildlife (DPaW 2013b)	Threatened (also known as declared rare flora) and priority flora species.	20 km radius from a line defined by the coordinates 33°42' 49" S, 115°53' 43" E and 33°50' 49" S, 116°03' 24" E (GDA94).
<i>Birdata</i> (BirdLife Australia 2013)	Bird species.	1 degree from a point defined by the coordinates -33.83508 °S and 116.04195 °E (GDA94).

In addition a literature review was conducted of relevant contextual and Water Corporation supplied reports. The most relevant of these included:

- *Roadside vegetation and conservation values in the Shire of Donnybrook-Balingup*. Roadside Conservation Committee (2008)
- *Native vegetation handbook for the Shire of Bridgetown-Greenbushes*. Shaun B. Grein. (1997)
- *Declared rare and poorly known flora in the central forest region, Western Australian Wildlife Management Program No. 33*. Department of Conservation and Land Management (2001)
- *Dieback interpretation report, Bridgetown pipeline route project Section 1 – Mullalyup to Balingup (Railway line), Southampton Road, Padbury Road, and Bridgetown Loop*. Forest Management Branch, Department of Environment and Conservation (2010)
- *Bridgetown RWSS Pipelines Balingup to Kirup Link, Biological Survey*. AECOM (2010)

2.2 Field Survey

The field survey was conducted by two Astron personnel from the 14 to 17 October 2013. The team consisted of Principal Botanist Vanessa Clarke and Senior Zoologist Dr Jessica Oates.

2.2.1 Level 2 Vegetation and Flora Survey

The vegetation and flora field survey was undertaken in accordance with the requirements for a Level 2 assessment outlined in the EPA's *Position Statement 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (2002) and *Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004).

Information acquired during the desktop study assisted in design of the field survey. Pre-survey planning involved the examination of 1: 10,000 scale aerial photography, nearby survey results and regional vegetation community mapping and descriptions. The number and location of sampling sites were determined based on the following criteria:

- the inclusion of at least one, and where possible, a duplicate sample site in each vegetation association, distinguishable on aerial photographs
- sampling in homogenous vegetation and the avoidance of ecotone areas between associations
- the inclusion of target areas that are prospective for conservation significant flora species identified during the desktop study.

Nine quadrats and six relevés (unmarked and unbounded sample areas), were surveyed in representative vegetation associations within the ~20 km corridor (survey area). The following information was collected at each quadrat and relevé:

- **Location** – coordinates measured using a handheld GPS (MGA50, WGS84). One set of coordinates taken from the corner of a quadrat or a central location of each relevé.
- **Recorder and date** – personnel involved in sampling that location and the survey date.
- **Species** – all vascular plant species present including introduced species. Species that could not be identified in the field were collected for later identification at the Astron herbarium or WA Herbarium.
- **Weeds** – the occurrence of any introduced flora.
- **Percent foliar cover** – The percentage cover was estimated for the dominant species in each layer.
- **Vegetation description** – Vegetation was described according to Aplin's (1979) modification of the vegetation classification system of Specht (1970) (Appendix A). At this level, vegetation is described up to three dominant genera for each of the upper, mid and ground strata are categorised based on dominant growth form, cover and height.
- **Vegetation condition** – assessed according to the *Vegetation Condition Classification* (Appendix C) (Trudgen 1996).
- **Habitat** – a broad description of the surrounding landscape based on landform, topography and soil.
- **Disturbances** – records of any obvious disturbances such as fire, tracks or grazing.
- **Photographs** – a photograph was taken of each quadrat and relevé.

A hard copy of colour aerial photography on 20 A3 colour maps at a scale of 1: 10,000 was used to locate the survey area and to assist in navigation as well as delineating vegetation communities and vegetation condition boundaries. Previous mapping units described by AECOM (2010) were referred to try and align vegetation units encountered.

Targeted searches were undertaken for threatened and priority flora potentially occurring in the survey area as determined by the database searches and literature review. The entire survey area was traversed on foot and all species found within the survey area, including introduced species, were listed opportunistically if they did not occur in a quadrat or relevé. For each introduced species recorded in the survey area, it was also noted whether the species was widespread or dominant.

2.2.2 Level 1 Fauna Survey

The fauna survey was undertaken in conjunction with the vegetation and flora survey. In the context of a Level 1 survey, rather than listing the highly anecdotal sightings of fauna seen during a reconnaissance visit, the guidance statement (EPA 2004b) advises field observers to describe the fauna habitats of the survey area, which give a comprehensive indication of fauna that can reasonably be expected to occur.

The survey area was traversed on foot and by vehicle. Major fauna habitat types were described based on the landform and vegetation type. Habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the descriptors suggested by Thompson and Thompson (2010) (Appendix C). Habitats likely to support fauna species of conservation significance were photographed and a GPS location recorded. All vertebrate fauna species observed opportunistically were recorded, and any locations of conservation significant fauna were recorded using a GPS.

2.2.2.1 Western Ringtail Possum Assessment

A targeted search was conducted for western ringtail possum habitat, concentrating on areas of peppermint (*Agonis flexuosa*). The site was searched for faecal pellets and dreys and if found a photograph and GPS coordinate was taken.

2.2.2.2 Black Cockatoo Assessment

Targeted searches were also undertaken for black cockatoo feeding and breeding habitat. To determine if the site was foraging habitat for black cockatoos, potential foraging plants were identified and recorded, and the ground was searched for any evidence of black cockatoo foraging, for example chewed fruits of the Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*). To determine the breeding habitat classification of the site in accordance with Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) referral guidelines (2011), a habitat assessment was undertaken. Native trees greater than 50 centimetre (cm) diameter at breast height (DBH) are classified as mature trees with potential for breeding hollows to develop (DSEWPaC 2012). The site was searched systematically and trees greater than 50 cm DBH were recorded, including the species, height of tree, GPS coordinate and number of potential hollows. Photographs were taken of a representative sample of trees. To determine if trees had potential breeding hollows, the following criteria were assessed for each mature tree where possible (based on Gibbons and Lindenmayer 2002):

- height of the potential hollow in the tree
- minimum entrance width of a potential hollow

- diameter of the branch on which the potential hollow occurred
- whether the branch was living, part dead or dead
- whether the tree has multiple potential hollows.

2.3 Specimen Identification and Data Entry

Plant specimens that were not identified in the field were collected, pressed and identified in Perth by Astron Principal Botanist, Vanessa Clarke. Some collections that were difficult to determine were provided to consultant botanist Mr Frank Obbens, who assisted with determining their identification with assistance from WA Herbarium staff. Orchids that were collected or photographed were confirmed by DPaW orchid expert Mr Andrew Brown.

2.4 Limitations of the Survey

Excellent seasonal conditions preceded the survey, which was undertaken in peak spring. A good diversity of annual/ephemeral species was able to be censused and survey timing is not considered a limitations.

Day one of the survey had dry weather conditions and the entire alignment was able to be traversed. Day two had light precipitation in the morning and access was restricted to areas that were not on DPaW managed land (i.e. State forest). Day three had also damp conditions from the previous day, so areas that were not DPaW managed were prioritised. On day four, dry conditions were present and the remaining areas were able to be accessed, so that over the course of the survey, all areas were able to be safely traversed without risk of dieback spread.

There are some limitations associated with assessing the suitability of tree hollows for black cockatoos. It is not always possible to determine if a hollow or tree irregularity is suitable for use or in fact possible to enter. The angle of branch and height from ground limit accurate observations as to width, depth and existing occupancy (e.g. bees). Therefore the term “potential hollow” is used. It must be surmised that a significant number of these potential hollows are in fact not currently suitable for various reasons. It is however possible that many have the potential to develop suitable hollow characteristics over time as natural processes occur.

3 Results

3.1 Seasonal Conditions

The field survey was conducted between 14 and 17 October 2013. In the 12 months preceding the survey 969.2 mm of rainfall was received, 148.1 mm above the average annual rainfall since 1901 (821.1 mm) (BOM 2013). Rain associated with low pressure systems during September 2013 (250 mm) resulted in well above average rainfall for that month (Figure 3).

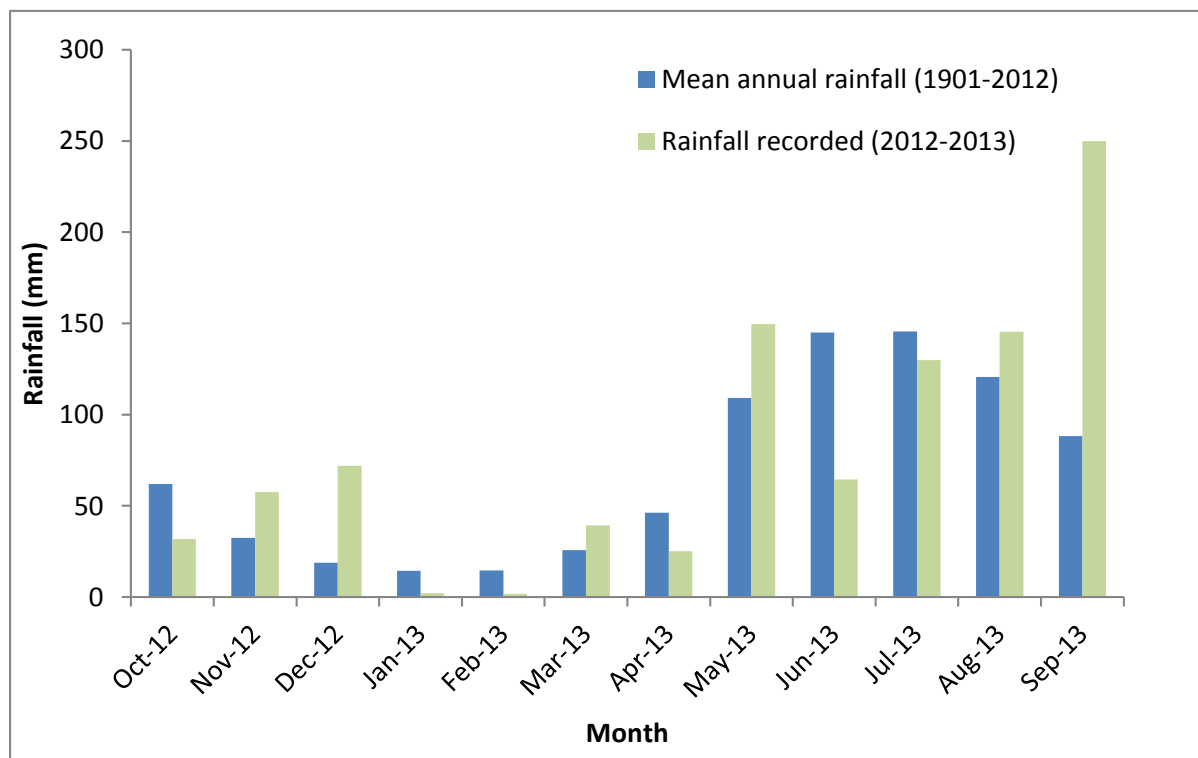


Figure 3: Mean (1901-2012) monthly rainfall (mm) and actual rainfall (mm) preceding the October 2013 survey recorded at Bridgetown (long-term mean) and Bridgetown Comparison (actual) weather station (BOM 2013).

3.2 Desktop Assessment

3.2.1 Vegetation and Flora

No TECs or PECs have previously been recorded within 30 km of the survey area (DPaW 2013b).

The Commonwealth's Protected Matters Search (DoE 2013a) and the State's *NatureMap* (DPaW 2013a) identified 24 threatened flora species within a 20 km radius of the survey area (Table 4). The results of the database searches are provided in full in Appendix B. Conservation categories for flora, fauna and ecological communities are presented in Appendix A.

Table 4: Threatened flora recorded within 20 km of the survey area (DoE 2013; DPaW 2013) listed according to threat.

Taxon	Conservation status	Flowering	Potential to occur in survey area
<i>Brachyscias verecundus</i> *	Critically Endangered (CR)	Oct-Nov	Medium; habitat present.
<i>Darwinia foetida</i> *	CR	Sept-Nov	Low; habitat not present.
<i>Synaphea</i> sp. Fairbridge Farm (D.Papenfus 696)*	CR	Oct	Low; habitat not present.
<i>Andersonia gracilis</i> *	Endangered (EN)		Medium; habitat present.
<i>Banksia nivea</i> subsp. <i>uliginosa</i> *	EN	Aug to Sep	Low; habitat not present.
<i>Caladenia hoffmanii</i> *	EN	Aug to Oct	Low; habitat not present.
<i>Caladenia huegelii</i> *	EN	Sep to Oct	Low-Medium; habitat not ideal.
<i>Caladenia winfieldii</i> *	EN	Oct to Nov	Very Low; habitat not present.
<i>Centrolepis caespitosa</i> *	EN; Priority 4	Oct to Dec	Very Low; habitat not present.
<i>Darwinia whicherensis</i> *	EN	Oct to Dec	Low-Medium; habitat not ideal.
<i>Diuris purdiei</i> *	EN	After fire; Sep to Oct	Low; habitat not present.
<i>Drakaea elastica</i> *	EN	Oct to Nov	Very Low; habitat not present.
<i>Gastrolobium papilio</i> *	EN	Oct	Low-Medium; habitat not ideal.
<i>Lambertia echinata</i> subsp. <i>occidentalis</i> *	EN	Feb or Apr or Dec	Low; habitat not present.
<i>Petrophile latericola</i> *	EN	Nov	Low; habitat not present and no previous collections within alignment vicinity.
<i>Rulingia</i> sp. Trigwell Bridge (R.Smith s.n. 20/6/1989); now <i>Commersonia erythrogyne</i> *	EN	Sept	Medium; only id heavy loam around granite outcrops occurs.
<i>Sphenotoma drummondii</i> *	EN	Sep to Dec	Low to nil; habitat not present in alignment.
<i>Banksia squarrosa</i> subsp. <i>argillacea</i> *	Vulnerable (VU)	Jun to Nov	Low; habitat not present.
<i>Caladenia harringtoniae</i>	VU	Oct to Nov	Medium; creeklines present.
<i>Chamelaucium</i> sp. C Coast Plain (R.D.Royce 4872)*	VU	Oct to Dec	Very Low; habitat not present.
<i>Daviesia elongata</i> subsp. <i>elongata</i> *	VU	Dec or Jan to Feb	Low-Medium; habitat may be present but no collections from alignment vicinity.
<i>Diuris micrantha</i> *	VU	Sep to Oct	Low-Medium; habitat not ideal.
<i>Drakaea micrantha</i> *	VU	Sep to Oct.	Low-Medium; habitat not ideal.
<i>Synaphea stenoloba</i> *	VU	Aug to Oct	Low; heavy soil habitat not present.
<i>Banksia</i> sp. Boyup Brook (L.W. Sage LWS 2366)	Priority (P)1	Oct	Low; unless sandy soils encountered.

Taxon	Conservation status	Flowering	Potential to occur in survey area
<i>Dillwynia</i> sp. Capel (P.A. Jurjevich 1771)	P1	Sept-Oct	Low; habitat not suitable & no collections in alignment vicinity.
<i>Senecio gilbertii</i>	P1	Sep to Nov	Low; habitat not suitable & no collections in alignment vicinity.
<i>Stylidium acuminatum</i> subsp. <i>acuminatum</i>	P1	Oct-Nov	Medium; potential for habitat but no collections in vicinity.
<i>Platytheca anasima</i>	P2	Oct-Dec	Low; unless sandy soils are encountered.
<i>Thysanotus unicus</i>	P2	Oct-Dec	High; suitable habitat.
<i>Corybas abditus</i>	P3	Oct-Nov	Low; no suitable habitat.
<i>Caustis</i> sp. Boyanup (G.S. McCutcheon 1706)	P3		Low; unless sandy soils are encountered.
<i>Synaphea polypodioides</i>	P3	Sep-Oct	Low-Medium; habitat may be present but no collections from alignment vicinity.
<i>Tetraria</i> sp. Blackwood River (A.R. Annel 3043) PN	P3		Low-Medium; habitat may be present but no collections from alignment vicinity.
<i>Tetratheca parvifolia</i>	P3	Oct	Low-Medium; habitat may be present but no collections from alignment vicinity.
<i>Thysanotus gageoides</i>	P3	Oct-Nov	Low; low potential for suitable habitat.
<i>Acacia semitrullata</i>	P4	Jun-Aug	Low; unless sandy soils are encountered.
<i>Grevillea ripicola</i>	P4	Oct-Nov	Medium; potential habitat may be present

*denotes taxa listed as MNES under the Commonwealth EPBC Act with dual listing under the State WC Act except *Centrolepis caespitosa*, which is a priority flora taxon only but was previously thought to be rare. Priority flora are not especially listed under either act.

3.2.2 Vertebrate Fauna

The database searches identified a total of 222 terrestrial vertebrate fauna species recorded within the vicinity of the survey area (Appendix B). This included nine amphibian species, 22 reptile species, 158 bird species (including seven introduced) and 33 mammal species (including nine introduced), of which 28 species are deemed to have conservation significance.

Table 5 lists those species of conservation significance identified by the *NatureMap* (DPaW 2013a) and EPBC Protected Matters (DoE 2013a) database searches. The EPBC Protected Matters Search (DoE 2013a) identified 11 threatened terrestrial fauna species and seven migratory fauna species of national environmental significance within a 20 km radius of the survey area. The *NatureMap* (DPaW 2013a) search identified 10 schedule 1 species, two schedule 3 species, two schedule 4 species, two priority 3 species, five priority 4 species and one priority 5 species. The results of the database searches are in Appendix B.

Marine species have been excluded from the report as they are highly unlikely to occur within the survey area. In addition, a number of records were presented through the results of *NatureMap* that

are clearly not relevant to this assessment and have been deleted accordingly. For example, the greater bilby (*Macrotis lagotis*) and numbat (*Myrmecobius fasciatus*) are locally extinct from the area and have been deleted from the assessment.

Table 5: Conservation significant vertebrate fauna species identified by DPaW NatureMap (2013a), DoE (2013a) and Birdlife Australia (2013) database searches.

Species name	Common name	State conservation status (WC Act)	Federal conservation status (EPBC Act)
Reptiles			
<i>Morelia spilota imbricata</i>	Carpet python	Schedule 4	
<i>Ctenotus delli</i>	Darling Range heath ctenotus	Priority 4	
Birds			
<i>Cacatua pastinator pastinator</i>	Muir's corella (southern)	Schedule 4	Vulnerable
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	Schedule 1	Vulnerable
<i>Calyptorhynchus baudinii</i>	Baudin's black cockatoo	Schedule 1	Vulnerable
<i>Calyptorhynchus latirostris</i>	Carnaby's black cockatoo	Schedule 1	Endangered
<i>Leipoa ocellata</i>	Malleefowl	Schedule 1	Vulnerable
<i>Apus pacificus</i>	Fork-tailed swift	Schedule 3	Migratory
<i>Ardea modesta</i>	Eastern great egret	Schedule 3	Migratory
<i>Ardea ibis</i>	Cattle egret	Schedule 3	Migratory
<i>Botaurus pocioptilus</i>	Australasian Bittern	Schedule 1	Endangered
<i>Ixobrychus flavicollis australis</i>	Australian Black Bittern	Priority 3	
<i>Haliaeetus leucogaster</i>	White-bellied sea eagle	Schedule 3	Migratory
<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 4	
<i>Falcunculus frontatus leucogaster</i>	Western Shrike-tit	Priority 4	
<i>Merops ornatus</i>	Rainbow bee-eater	Schedule 3	Migratory
<i>Atrichornis clamosus</i>	Noisy scrub-bird	Schedule 1	Vulnerable
<i>Tyto novaehollandiae novaehollandiae</i>	Masked owl (southern)	Priority 3	
Mammals			
<i>Bettongia pencillata ogilbyi</i>	Woylie	Schedule 1	Endangered
<i>Dasyurus geoffroii</i>	Chuditch	Schedule 1	Vulnerable
<i>Phascogale calura</i>	Red-tailed phascogale	Schedule 1	Endangered
<i>Phascogale tapoatafa tapoatafa</i>	Southern brush-tailed phascogale	Schedule 1	
<i>Pseudochirus occidentalis</i>	Western ringtail possum	Schedule 1	Vulnerable

Species name	Common name	State conservation status (WC Act)	Federal conservation status (EPBC Act)
<i>Macropus irma</i>	Western brush wallaby	Priority 4	
<i>Setonix brachyurus</i>	Quokka	Schedule 1	Vulnerable
<i>Hydromys chrysogaster</i>	Water rat	Priority 4	
<i>Isoodon obesulus fusciventer</i>	Quenda	Priority 5	
<i>Falsistrellus mackenziei</i>	Western false pipistrelle	Priority 4	

3.3 Field Survey

3.3.1 Vegetation

The vegetation communities of the project area are typical of those found in the jarrah forest region. The scope of works requested that Astron vegetation units be consistent with previous survey work undertaken in the local area by consultants for the Water Corporation (AECOM 2010 summarised in Table 6). However, the Astron-described units were not able to be reconciled with the AECOM (2010) vegetation units due to inconsistencies in definition of the dominant structural layer (i.e. AECOM defined 'Low Woodland to Low Open Forest of *Eucalyptus marginata* and *Corymbia calophylla*' but did not state which published structural definitions were used. Forest is typically only used for trees in excess of 30 m height; or where tree height is 10 – 30 m but the cover is a minimum of 30 – 70 %. Astron found that the areas traversed had trees generally 10 – 30 m with cover also of 10 – 30 % and therefore could only be described as 'Woodland' or infrequently 'Open Woodland'. Seven vegetation units were described and mapped in the survey area. The codes ascribed and vegetation descriptions are grouped in Table 7 and provided in full in Appendix E.

Table 6: Vegetation communities defined for adjacent survey areas (AECOM 2010).

Vegetation code	Vegetation community description (AECOM 2010)
CcLt	Low Open Woodland of <i>Corymbia calophylla</i> over a Closed Herbland dominated by * <i>Lathyrus tingitanus</i> , * <i>Trifolium dubium</i> and * <i>Raphanus raphanistrum</i> on sandy loam.
EmCcLOF	Low Woodland to Low Open Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> with occasional <i>Banksia grandis</i> over a Shrubland to Tall Shrubland dominated by <i>Acacia pulchella</i> , <i>Acacia extensa</i> , <i>Mirbelia dilatata</i> and <i>Xanthorrhoea preissii</i> with occasional <i>Pteridium esculentum</i> and <i>Macrozamia riedlei</i> over a Low Shrubland of <i>Phyllanthus calycinus</i> , <i>Bossiaea ornata</i> and <i>Hibbertia hypericoides</i> with occasional <i>Acacia pulchella</i> and infestations of * <i>Plantago lanceolata</i> on sandy loam.
EmLOW	Low Open Woodland to Open Woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> with occasional * <i>Pinus radiata</i> over a Tall Shrubland dominated by <i>Bossiaea linophylla</i> , <i>Mirbelia dilatata</i> and <i>Taxandria parviceps</i> over a Shrubland of <i>Pteridium esculentum</i> with occasional <i>Xanthorrhoea preissii</i> , <i>Acacia saligna</i> and * <i>Allium triquetrum</i> over an Open Herbland of * <i>Watsonia meriana</i> and * <i>Oxalis hirta</i> over introduced grasses on clayey soils.
ErCcLOW	Low Open Woodland of <i>Eucalyptus rudis</i> with occasional <i>Corymbia calophylla</i> and <i>Acacia saligna</i> over an Open Heath of * <i>Rubus ulmifolius</i> with occasional <i>Pteridium esculentum</i> , * <i>Allium triquetrum</i> and * <i>Oxalis hirta</i> on clayey loam in association with drains and low lying areas adjacent to road reserves.
ErMv	Woodland to Low Closed Forest of <i>Eucalyptus rudis</i> with occasional <i>Melaleuca viminea</i> subsp. <i>viminea</i> , <i>Melaleuca preissiana</i> and * <i>Acacia decurrens</i> over a Shrubland of <i>Pteridium esculentum</i> and <i>Kunzea recurva</i> with scattered <i>Astartea fascicularis</i> and * <i>Watsonia meriana</i> over a Very Open Sedgeland of <i>Meeboldina roycei</i> and <i>Hypolaena exsulca</i> on sandy loam.
CcLOW	Low Open Woodland of <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> and * <i>Pinus radiata</i> over a Shrubland to Tall Shrubland dominated by <i>Pteridium esculentum</i> , <i>Taxandria parviceps</i> , <i>Mirbelia dilatata</i> and <i>Trymalium odoratissimum</i> subsp. <i>trifidum</i> with occasional <i>Bossiaea linophylla</i> and <i>Acacia extensa</i> over a Low Heath of <i>Hypocalymma robustum</i> , <i>Tetraria capillaris</i> and * <i>Oxalis hirta</i> on clayey soils.
P3	Pasture dominated by * <i>Ehrharta longiflora</i> , * <i>Avena fatua</i> and <i>Austrostipa elegantissima</i> with scattered * <i>Acacia decurrens</i> , <i>Pteridium esculentum</i> , <i>Eucalyptus rudis</i> , * <i>Eucalyptus globulus</i> , <i>Eucalyptus accedens</i> , <i>Macrozamia riedlei</i> , <i>Melaleuca preissiana</i> and <i>Xanthorrhoea preissii</i> on sands in association with degraded areas.
Cleared	Cleared areas devoid of any native and non-native species.

Table 7: Astron vegetation units described for the survey area.

Landscape position	Structure	Code	Description
Upper to midslope	Woodland	EmCcW	Jarrah-marri (<i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i>) woodland with a mid-storey that may range in the following dominant taxa in the upper shrub layer: <i>Xanthorrhoea preissii</i> , <i>Macrozamia riedlei</i> , <i>Mirbelia dilatata</i> , <i>Hakea amplexicaulis</i> , <i>Acacia extensa</i> , <i>Leucopogon verticillatus</i> . The following as dominants in the mid-shrub layer: <i>Bossiaea ornata</i> , <i>B. linophylla</i> , <i>Hibbertia hypericoides</i> , <i>Phyllanthus calycinus</i> , <i>Pteridium esculentum</i> over sedges including <i>Tetraria capillaris</i> and <i>Patersonia umbrosa</i> var. <i>xanthina</i> .
	Open Woodland	EmCcOW	Jarrah-marri open woodland with a mid-storey that may range in the following dominant taxa in the upper shrub layer: <i>Pteridium esculentum</i> , <i>Hakea amplexicaulis</i> with <i>Bossiaea ornata</i> , <i>Leucopogon nutans</i> as primary dominants in the lower shrubs; over <i>Tetraria</i> species.
Midslope	Woodland	EmCcBgPIW	Jarrah-marri with bull banksia (<i>Banksia grandis</i>) and snotty gobble (<i>Persoonia longifolia</i>) woodland with a mid-storey that may range in the following dominant taxa in the mid-shrub layer: <i>Bossiaea ornata</i> , <i>Hibbertia amplexicaulis</i> over <i>Tetraria capillaris</i> and <i>Desmocladius fascicularis</i> .
Lower slope	Woodland	CcW	Marri woodland over a mid-shrub layer of <i>Taxandria parviceps</i> and <i>Bossiaea linophylla</i> over lower shrubs including: <i>Pteridium esculentum</i> , <i>Hypocalymma angustifolia</i> , <i>Acacia pulchella</i> , <i>Bossiaea linearifolia</i> over sedges of <i>Tetraria capillaris</i> , <i>Patersonia occidentalis</i> and <i>P. pygmaea</i> .
Creeks and drainage lines	Woodland	CcEmErW	Marri-jarrah-flooded gum (<i>Eucalyptus rudis</i>) woodland over a tall shrubland including <i>Trymalium odoratissimum</i> subsp. <i>trifidum</i> , <i>Agonis linearifolia</i> , <i>Hakea lissocarpha</i> over smaller shrubs such as <i>Phyllanthus calycinus</i> , <i>Acacia pulchella</i> with a dominant sedge layer of <i>Lepidosperma effusum</i> .
Various	Cleared	Cl	Area historically cleared of all native vegetation.
Various	Planted	PI	Area containing planted introduced species that are plantation or orchard.

Vegetation mapping is presented in Figure D.1-19 (Appendix D), and quadrat and relevé data are presented in Appendix E.

No TECs or PECs were recorded within the survey area and none are likely to occur based on the results of database search information (Appendix B) and a comprehensive survey within the survey area.

3.3.2 Vegetation Condition

Vegetation condition in the survey area ranged from ‘completely degraded’ (Plate 1) to ‘excellent’ (Plate 2) (Figure D.1-19 of Appendix D), with the majority of the survey area in ‘very good’ condition, depending on the impact of fire frequency, logging and possibly dieback, which had simplified species diversity at some sites. Areas outside of State Forest had generally been historically cleared and were used for plantations, orchards or other purposes.

Of the four creeklines crossed by the alignment, two remained in very good condition and the other two were completely degraded with little or no remnant vegetation remaining and a high weed occurrence and density:

- Dumping Gully – good to very good condition
- Spring Creek – very good condition
- Balingup Brook – completely degraded
- Mullalyup Brook (two crossings) – both degraded.

The majority of the forested areas had extremely low weed occurrence. Weeds were associated with historically cleared areas and farms or adjacent to tracks and the rail-line.



Plate 1: Vegetation in completely degraded condition. Photograph adjacent to railway line.



Plate 2: Vegetation in excellent condition. Site is also likely to be dieback free; though recovering from fire.

3.3.3 Flora

Two-hundred and six vascular plant taxa representing 128 genera from 48 families were recorded within the survey area, with 28 taxa being non-native (weeds). Three collections will be lodged by the WA Herbarium due to the atypical characteristics of the collections (*Caladenia ?ferruginea*

(atypical colouring); *Synaphea gracillima* (leaf apex atypical) and *Stylidium scandens* (significant range extension)). A complete species list is presented in Appendix F.

The species recorded are typical of the southern jarrah forest and the diversity recorded is representative of total diversity present.

No threatened or priority flora were recorded in the survey area. Thorough searches particularly in areas of suitable habitat, particularly for *Caladenia harringtoniae* did not locate any threatened flora in the vicinity of the survey area.

Of the 28 weeds species encountered, the most serious are the declared pest plant blackberry (**Rubus ulmifolius*) and the weed of national significance, bridal creeper (**Asparagus asparagoides*).

3.3.4 Fauna Habitat

Three broad fauna habitat types were recorded during the survey and relate to the vegetation types mapped in Figures D1-19 (Appendix D):

- Jarrah-marri woodland (Plate 2) – *Eucalyptus marginata* with *Corymbia calophylla* woodlands.
- *Eucalyptus rudis* woodland (Plate 3) – *Eucalyptus rudis* woodland, sometimes with occasional *C. calophylla* and *Melaleuca* species in association with low lying areas and drainage lines.
- Cleared – Cleared areas including roads, parks and previous pine plantations.

Fauna habitat condition was considered to range from ‘highly degraded’ to ‘high quality’ according to the condition rating scale of Thompson and Thompson (2010). Highly degraded habitat was considered to be the cleared habitat. Some areas of woodland were considered to be high quality, as they retained connectivity with other habitats and are likely to support a natural vertebrate fauna assemblage. The foraging and breeding habitat available for black cockatoos is discussed separately in Section 3.3.5.2.



Plate 3: Jarrah-marri woodland.



Plate 4: Flooded gum (*Eucalyptus rudis*) woodland.

3.3.5 Vertebrate Fauna

Thirty-four fauna species were recorded during the survey through direct observation or indirect evidence (Table 8). During the field survey three amphibian species, 28 bird species (including three conservation significant species) and three mammal species (including one conservation significant

and one introduced species) were identified either by sight or indirect evidence, such as calls and dens (Table 8).

Table 8: Vertebrate fauna species recorded opportunistically during the survey.

Common name	Species name	Observation type
Mammals		
Quenda	<i>Isoodon obesulus fusciventer</i>	Diggings
Western grey kangaroo	<i>Macropus fuliginosus</i>	Individuals
Fox	<i>Vulpes vulpes</i>	Dens
Birds		
Emu	<i>Dromaius novaehollandiae</i>	Tracks
Australian shelduck	<i>Tadorna tadornoides</i>	Individuals
Pacific black duck	<i>Anas superciliosa</i>	Individuals
White-faced heron	<i>Ardea novaehollandiae</i>	Individuals
Eastern great egret	<i>Ardea modesta</i>	Individuals
Nankeen night-heron	<i>Nycticorax caledonicus</i>	Individuals
Purple swamphen	<i>Porphyrio porphyrio</i>	Individuals
Common bronzewing	<i>Phaps chalcoptera</i>	Individuals
Forest red-tailed black cockatoo	<i>Calyptorhynchus banksii naso</i>	Individuals
Baudin's black cockatoo	<i>Calyptorhynchus baudinii</i>	Individuals
Galah	<i>Cacatua roseicapilla</i>	Individuals
Australian ringneck	<i>Platycercus zonarius</i>	Individuals
Laughing kookaburra	<i>Dacelo novaeguineae</i>	Individuals
Splendid fairy-wren	<i>Malurus splendens</i>	Individuals
Red-browed pardalote	<i>Pardalotus rubricatus</i>	Individuals
Weebill	<i>Smircronis brevirostris</i>	Individuals
Singing honeyeater	<i>Lichenostomous virescens</i>	Individuals
Western spinebill	<i>Acanthorhynchus superciliosus</i>	Individuals
Red wattlebird	<i>Anthochaera carunculata</i>	Individuals
Golden whistler	<i>Pachycephala pectoralis</i>	Individuals
Rufous whistler	<i>Pachycephala rufiventris</i>	Individuals
Grey fantail	<i>Rhipidura albiscapa</i>	Individuals
Willie wagtail	<i>Rhipidura leucophrys</i>	Individuals
Black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>	Individuals
Magpie-lark	<i>Grallina cyanoleuca</i>	Individuals
Scarlet robin	<i>Petroica boodang</i>	Individuals
Australian magpie	<i>Cracticus tibicen</i>	Individuals
Australian raven	<i>Corvus coronoides</i>	Individuals
Amphibians		
Moaning Frog	<i>Heleioporus eyrei</i>	Calls
Quacking Frog	<i>Crinia georgiana</i>	Calls
Glauert's Froglet	<i>Crinia glauerti</i>	Calls

3.3.5.1 Western Ringtail Possum Assessment

No evidence of western ringtail possums was recorded during the survey.

3.3.5.2 Black Cockatoo Assessment

Baudin's black cockatoo and forest red-tailed black cockatoo were both present within the survey area. Both of the species present at the time of survey were observed overflying, foraging and roosting in small flocks and in some cases in pairs. This pairing of forest red-tailed black cockatoos could be indicative of breeding behaviour. Larger flocks were recorded around the golf course and the section of pipeline that follows Cirillo Road.

A total of 209 eucalypt trees (90 jarrah and 119 marri) with a DBH greater than 50 cm were recorded, including those with and without hollows (Figures H1-19; Appendix H). Of the 209 trees recorded, only 10 trees contained potential hollows that may be suitable for black cockatoos. Definitive evidence of past or current breeding activity by black cockatoos is difficult to ascertain; however, it did not appear that any trees were currently utilised by black cockatoos for breeding.

The high number of healthy marri and jarrah trees present within the survey area would provide considerable foraging opportunity and evidence in the form of chewed fruits was observed on numerous occasions. Chewed marri nuts were observed under many trees, characteristic of forest red-tail black cockatoos. Given the homogenous nature of the survey area most parts of the vegetated alignment would be considered suitable black cockatoo foraging habitat, although there were two areas where feeding evidence suggested that the cockatoos preferred to forage; along the golf course and the section of Cirillo Road. Area of quality foraging habitat within survey area for black cockatoos is 10.52 ha (which is the area of intact vegetation rated in good condition or better).



Plate 5: Chewed marri nuts by forest red-tailed black cockatoos.

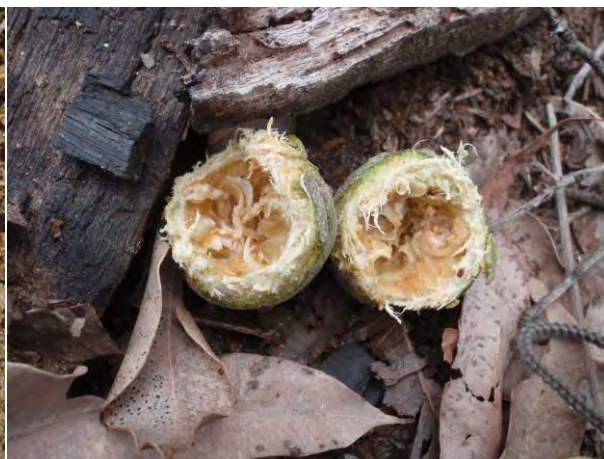


Plate 6: Freshly chewed marri nuts by red-tailed black cockatoos.

3.3.5.3 Other Species of Conservation Significance

In addition to the two species of black cockatoo recorded during the survey, presence of the quenda (priority 5) was recorded within the survey area by their characteristic diggings (Figures H1-19; Appendix H). The eastern great egret (migratory; S3 at state level) was also recorded during the survey around the dams adjacent to the survey area.

In addition to those species recorded during the survey, Carnaby's black cockatoo (*Calyptorhynchus latirostris*), cattle egret (*Ardea ibis*), peregrine falcon (*Falco peregrinus*), carpet python (*Morelia spilota imbricata*), chuditch (*Dasyurus geoffroyi*), southern brush-tailed phascogale (*Phascogale tapaotafa tapaotafa*) and western brush wallaby (*Macropus irma*) have a high likelihood of occurring in the survey area (Table 9).

There is a moderate likelihood of the fork-tailed swift (*Apus pacificus*), western shrike-tit (*Falcunculus frontatus leucogaster*), rainbow bee-eater (*Merops ornatus*), masked owl (*Tyto novaehollandiae novaehollandiae*), woylie (*Bettongia pencillata ogilbyi*), water rat (*Hydromys chrysogaster*) and western false pipistrelle (*Falsistrellus mackenziei*) occurring in the survey area (Table 9).

Darling Range heath ctenotus (*Ctenotus delli*), Muir's corella (*Cacatua pastinator pastinator*), malleefowl (*Leipoa ocellata*), Australasian bittern (*Botaurus pociptillus*), Australian black bittern (*Ixobrychus flavicollis australis*), white-bellied sea eagle (*Haliaeetus leucogaster*), noisy scrub-bird (*Atrichornis clamosus*), red-tailed phascogale (*Phascogale calura*), western ringtail possum (*Pseudocheirus occidentalis*) are considered to have a low likelihood of being present in the survey area (Table 9). These species have been recorded previously within the region but unsuitable habitat occurs within the survey area.

Table 9: Fauna habitat descriptions and likelihood of occurrence in the survey area.

Scientific name	Common name	Conservation codes			Preferred habitat	Extent of habitat in the survey area	Likelihood in survey area
		EPBC	WC	DPaW			
Reptiles							
<i>Morelia spilota imbricata</i>	Carpet python		S4		Recorded in semi-arid coastal and inland habitats consisting of <i>Banksia</i> woodland, eucalypt woodlands and grasslands.	Suitable habitat exists throughout the survey area.	High – but not recorded in current survey
<i>Ctenotus delli</i>	Darling Range heath ctenotus			P4	Occurs in Jarrah and Marri woodland with a shrub-dominated understorey on laterite, sand or clay, and occasionally on granite outcrops.	Survey area is outside of the known distribution.	Low
Birds							
<i>Cacatua pastinator pastinator</i>	Muir's corella (southern)	VU	S4		Eucalypt woodlands dominated by wandoo, marri and jarrah.	Occurs in Lake Muir region and based on known distribution does not occur in the area.	Low
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	S1		Eucalypt forest where it feeds primarily on marri and jarrah fruit.	Suitable foraging habitat exists within the survey area. There are few mature trees able to support potential breeding.	High – individuals sighted within survey area.
<i>Calyptorhynchus baudinii</i>	Baudin's black cockatoo	VU	S1		Eucalypt forest, where it feeds on mainly marri seeds, flowers, nectar and buds. Also feed on seeds of <i>Eucalyptus</i> , <i>Hakea</i> , <i>Banksia</i> and pine species.	Suitable foraging habitat exists within the survey area. There are few mature trees able to support potential breeding.	High – individuals sighted within survey area.
<i>Calyptorhynchus latirostris</i>	Carnaby's black cockatoo	EN	S1		Eucalypt woodland, principally wandoo or salmon gum, and shrubland or kwongan heath dominated by <i>Hakea</i> and <i>Banksia</i> species.	Suitable foraging habitat exists within the survey area. There are few mature trees able to support potential breeding.	High – but not recorded in current survey
<i>Leipoa ocellata</i>	Malleefowl	VU	S1		Largely confined to arid and semi-arid woodland that is dominated by mallee eucalypts on sandy	Suitable habitat does not exist within the survey	Low

Scientific name	Common name	Conservation codes			Preferred habitat	Extent of habitat in the survey area	Likelihood in survey area
		EPBC	WC	DPaW			
					soils with less than 430 mm of rainfall annually.	area.	
<i>Apus pacificus</i>	Fork-tailed Swift	Mi	S3		Summer migrant to Australia and occurs in low to very high airspace over varied habitat from rainforest to semi-desert.	Aerial species	Moderate
<i>Ardea modesta</i>	Eastern great egret	Mi	S3		Wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral).	Suitable habitat exists within the survey area and in immediate vicinity.	High – recorded during the survey
<i>Ardea ibis</i>	Cattle egret	Mi	S3		Largely wetland species however can exploit drier open habitats more than other heron species.	Suitable habitat exists within the survey area and in immediate vicinity.	High - but not recorded in current survey
<i>Botaurus pocioptilus</i>	Australasian bittern	EN	S1		Found in beds of tall rush mixed with or near short fine sedge and open pools. Also occurs around swamps, lakes, pools, rivers and channels fringed with lignum, canegrass or other dense vegetation.	Limited suitable habitat exists within the survey area.	Low
<i>Ixobrychus flavicollis australis</i>	Australian black bittern			P3	Freshwater pools, swamps and lagoons, well screened with trees	Limited suitable habitat exists within the survey area.	Low
<i>Haliaeetus leucogaster</i>	White-bellied sea eagle	Mi	S3		Require presence of large areas of open water and have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarsh and sewage ponds.	Suitable habitat does not exist within the survey area.	Low
<i>Falco peregrinus</i>	Peregrine falcon		S4		Found from woodlands to open grasslands and coastal cliffs. Normally nests on cliff edges.	Suitable habitat exists throughout the survey area and is likely to be an occasional visitor.	High - but not recorded in current survey
<i>Falcunculus frontatus leucogaster</i>	Western shrike-tit			P4	Open eucalypt forest and woodland	Suitable habitat exists within the survey area.	Moderate
<i>Merops ornatus</i>	Rainbow bee-eater	Mi	S3		Lightly wooded, preferably sandy, country near water such as drainage channels and creek lines.	Suitable habitat exists within the survey area.	Moderate
<i>Atrichornis clamosus</i>	Noisy scrub-bird	VU	S1		Wetter areas within the distribution of marri and jarrah, in particular the ecotone between forest and swamp vegetation.	Survey area is outside of the known distribution.	Low

Scientific name	Common name	Conservation codes			Preferred habitat	Extent of habitat in the survey area	Likelihood in survey area
		EPBC	WC	DPaW			
<i>Tyto novaehollandiae novaehollandiae</i>	Masked owl (southern)			P3	Requires large hollows in old growth eucalypts for nesting and often favours areas with dense understorey, particularly along watercourses and gullies.	There are few mature trees able to support potential breeding.	Moderate
Mammals							
<i>Bettongia penicillata ogilbyi</i>	Woylie	EN	S1		Open forest and woodland with a low understorey of tussock grasses or woody scrub.	Suitable habitat exists within the survey area.	Moderate
<i>Dasyurus geoffroii</i>	Chuditch	VU	S1		Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts.	Suitable habitat is found throughout the survey area.	High – but not recorded in current survey
<i>Phascogale calura</i>	Red-tailed Phascogale	EN	S1		Wandoo and Sheoak woodland associations, with populations most dense in the latter vegetation type.	This species is now restricted to the Wheatbelt and South Coast regions and the survey area is outside of this distribution.	Low
<i>Phascogale tapoatafa tapoatafa</i>	Southern brush-tailed phascogale		S1		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees.	Suitable habitat is found throughout the survey area.	High – but not recorded in current survey
<i>Pseudcheirus occidentalis</i>	Western ringtail possum	VU	S1		Inhabit coastal peppermint/tuart associations from Bunbury to Albany. On Swan Coastal Plain the highest densities occur in habitats with dense, lush vegetation.	No suitable habitat exists within the survey area.	Low
<i>Macropus irma</i>	Western brush wallaby			P4	Optimum habitat is open forest or woodland, particularly favouring open, seasonally-wet flats with low grasses and open scrubby thickets.	Suitable habitat is found throughout the survey area.	High – but not recorded in current survey
<i>Setonix brachyurus</i>	Quokka	VU	S1		Densely vegetated swamps and sometimes tea-tree thickets on sandy soils along creek systems and dense heath on slopes.	Limited suitable habitat is found in the survey area.	Low
<i>Hydromys chrysogaster</i>	Water rat			P4	Usually found near permanent bodies of fresh or brackish water along river and lake banks. They prefer areas with riparian vegetation and a degree of habitat complexity.	Suitable habitat is found in the survey area and in immediate vicinity.	Moderate

Scientific name	Common name	Conservation codes			Preferred habitat	Extent of habitat in the survey area	Likelihood in survey area
		EPBC	WC	DPaW			
<i>Isoodon obesulus fusciventer</i>	Quenda			P5	Scrubby, often swampy, vegetation with dense cover up to 1m high, often feeds in adjacent forest and woodland that is burnt regularly and in areas of pasture and cropland lying close to dense cover.	Suitable habitat is found throughout the survey area.	High – evidence of species recorded during the survey
<i>Falsistrellus mackenziei</i>	Western false pipistrelle			P4	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and tuart forests.	Suitable habitat exists within the survey area.	Moderate
HIGH	Species recorded within, or in proximity to, the survey area within 20 km; suitable habitat occurs						
MODERATE	Species recorded outside survey area, but within 20 km; limited suitable habitat occurs						
LOW	Species rarely, or not recorded, within 20 km, and/or suitable habitat does not occur						

4 Discussion and Recommendations

4.1 Vegetation and Flora

The flora and vegetation survey did not record the presence of any conservation significant flora or vegetation, despite good seasonal conditions and intensive searches. The vegetation complex mapping of the area (Mattiske & Havel 1998) and the pre-European extent (Department of Agriculture and Food Western Australia 2013) have been assessed as having sufficient percentage remaining that the proposed clearing would not be a significant issue in terms of local or State vegetation complex representation.

The alignment intersects four creeks and a few minor drainage lines. In the vicinity of Greenbushes the alignment intersected Dumpling Gully; in Balingup the Balingup Brook was crossed and in Mullalyup the Mullalyup Brook was crossed; towards Kirup the Capel River was crossed. Of these water courses only two were still vegetated with remnant vegetation (Dumpling Gully – good to very good condition and Spring Creek – very good condition). There may be a small amount of clearing of riparian vegetation within the two vegetated creeklines; however both creeks already have a vehicle track crossing and it may be possible to reduce clearing to an amount that will not have any significant impact. Based on the potential to utilise existing tracks to cross the creeks, and therefore minimise impact, there is little reason to require an offset.

The required clearing within these two creeks will be minimal (if any) and as such may be considered to 'not likely be at variance' to Principle F of the Department of Environmental Regulation's 10 Clearing Principles (viz '*Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland*').

Very few weed species were present in the majority of the forested survey areas but high weed incidence was observed in degraded areas adjacent to the railway line, farms and some plantations. Weed hygiene measures to prevent the incursion of weeds into areas of good or better condition should be implemented and managed during the project implementation process.

4.2 Vertebrate Fauna

The survey area is a narrow corridor that follows existing tracks and cleared areas. Only a portion of the alignment remains vegetated and an even smaller portion is in good or better condition. The vegetated areas are within relatively extensive and contiguous jarrah-marri forest, particularly around Greenbushes and Mullalyup. Dependant on timber harvesting and fire history of the adjoining forest it may be considered that similar quality and quantity of fauna habitat surrounds, and extends from, the proposed alignment. The survey area does not provide a significant corridor for fauna.

The survey recorded conservation significant species and habitat that is likely to support additional conservation significant species. The characteristic diggings of quenda were observed within the survey area and this species is likely to be present through parts of the survey area. The survey area is likely to provide foraging habitat for the three species of black cockatoo and the jarrah, marri and *Banksia* species recorded in the survey area are target species for feeding by all three conservation significant black-cockatoo species. Baudin's black cockatoo and forest red-tailed black cockatoo were recorded within the survey area and there was evidence of foraging within the survey area. All jarrah-marri woodland within the survey area (10.52 ha) would be considered medium to high value foraging habitat for the black cockatoo species due to the presence of food items such as jarrah, marri, banksia and certain *Hakea* species (Cale 2003). Black cockatoo species were regularly observed feeding within the alignment near the golf course and along Cirillo Road. The flooded gum

(*Eucalyptus rudis*) creek habitat (vegetation unit CcEmErW) and the cleared areas (vegetation unit CI) are considered of low value to black cockatoos for feeding due to the lack of preferred food items.

The survey area provides limited breeding habitat for black cockatoos as there are very few old trees. Of the 209 trees identified, only 10 trees with hollows that would be potentially suitable for cockatoos were identified. Only 185 of these trees including seven trees with hollows (four marri and three jarrah), occur within the proposed alignment. There was no evidence of black cockatoos breeding in these hollows at the time. The hollows were not inspected, however, so the suitability to black cockatoos cannot be assessed. The hollows are also likely to provide habitat for other birds, reptiles and bats. The majority of potential habitat trees were recorded along Cirillo Road near Mullalyup.

The remaining 199 trees were recorded without hollows, of which 178 trees without hollows (110 marri and 68 jarrah) occur within the alignment, are relatively young trees of uniform height and width, measuring just over 50 cm DBH. This is due to the previous logging activities that have removed most of the mature trees. Suitable tree hollows are essential for black cockatoo nesting. A substantial portion of breeding habitat has already been lost through clearing and loss of mature trees by timber harvesting in the jarrah forest. It has been estimated that it takes a minimum of 130 years for jarrah and marri to be of use to hollow dependent fauna (Whitford and Williams 2002). Natural tree recruitment cannot replace large scale loss of mature hollow bearing trees in the short term and significant shortages of hollows have already occurred throughout the forest range of black cockatoos. This is compounded by increased competition for nesting opportunities by other native and introduced species.

As proposed by the Water Corporation, the tree and habitat loss can be reduced by placing the pipeline along already existing tracks and cleared areas and avoiding the trees with hollows where possible. For example, locating the pipeline within the paddock rather than remnant vegetation south of Old Padbury Road and within the blue gum plantation rather than remnant vegetation around the Mullalyup and Cirillo Road sections. In the section along Cirillo Road where the majority of potential habitat trees occur, the alignment is recommended to be located towards the southern edge to avoid clearing trees. In selecting the alignment, the direct (clearing) and indirect (i.e. potential damage to roots) impacts to potential habitat trees needs to be considered. This may mean considering significant trees that are situated just outside the proposed alignment. Recommendations in regards to preferred alignment, to minimise impacts, are illustrated in Appendix H, along with the habitat tree locations.

The proximity of recorded occurrences of the carpet python, peregrine falcon, chuditch, western brush wallaby and southern brush-tailed phascogale, and the suitability of habitat in the survey area suggests they are likely to be present. The western brush wallaby and peregrine falcon are highly mobile species and are therefore considered less likely to be directly affected by clearing vegetation. The carpet python, chuditch and southern brush-tailed phascogale are also likely to occur within the survey area, and these species are more at risk of direct impacts (such as mortality) during vegetation clearing.

Based on the results of the field survey, Astron advises that the project may pose a risk of impact to the black cockatoo species; particularly if clearing of more than one hectare of quality foraging habitat and clearing of breeding habitat (which includes all trees over 50 cm DBH of species known to support breeding) is proposed. Should this be the case, referral to the Minister for the Environment under the EPBC Act is advised. It is likely that the alignment can be managed to avoid and minimise removal of habitat trees and good quality vegetation.

5 The Department of Environment Regulation's 10 Clearing Principles

The proposal to clear vegetation within the Greenbushes to Kirup pipeline route is considered below in terms of the DER's 10 Clearing Principles under Schedule 5 of the *Environmental Protection Act 1986*, which stipulate that native vegetation should not be cleared if:

a) It comprises a high level of biological diversity

The application area covers 35.66 ha (although only half of this area contains remnant vegetation) of which only 10.5 ha remains in good condition or better. The alignment is approximately 20 km in length between Greenbushes and Kirup, Western Australia. It lies within the Southern Jarrah Forest subregion of the Jarrah Forest IBRA region.

A Level 2 flora and vegetation survey of the application area was conducted by Astron in October 2013. Two hundred and six vascular plant taxa representing 128 genera from 48 families were recorded within the survey area, with 28 taxa being non-native (weeds). This level of diversity is representative of a comprehensive survey undertaken during peak spring conditions with a good suite of orchids and other ephemeral taxa recorded.

The vegetation associations within the survey area are typical jarrah forest on laterite soils; no sandy soils or granitic habitats were encountered along the alignment. None of the vegetation associations are considered to be rare or restricted and previous surveys indicate that these communities are present outside of the application area (AECOM 2010).

There are no known TECs or PECs within the application area (DPaW 2013a). The closest known PEC, is more than 70 km to the west of the survey area (DPaW 2013a).

No priority flora was recorded within the application area during the field survey (Astron 2013), despite intensive searches.

Twenty-eight introduced flora species were recorded within the survey area, of particular note is **Rubus ulmifolius* (blackberry), which was noted in some low-lying areas adjacent to the alignment. This species is listed as a declared pest under the *Biosecurity and Agriculture Management Act 2007* by the Department of Agriculture and Food (2013). Some serious environmental weeds were also noted within the alignment including arum lily, bridal creeper, watsonia, woody acacias and freesia.

Three fauna habitat types were recorded in the survey area: jarrah/marri woodland, *E. rudis* woodland and cleared habitat. Highly degraded habitat was considered to be the cleared habitat. Some areas of woodland were considered to be high quality, as they retained connectivity with other habitats and are likely to support a native vertebrate fauna assemblage. The other habitats extend beyond the survey area and are adjacent to the area surveyed. In addition they are considered to be common throughout the bioregion and therefore unlikely to support a greater level of faunal diversity than the surrounding areas.

Based on the information presented above, the survey area does not contain a level of biodiversity that is higher, or restricted to the survey area. In a regional context, the survey area is small and the flora, vegetation and habitats found extend over a significant area regionally.

Therefore, the proposed clearing is not likely to be at variance to this Principle.

b) It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia

The survey area includes three broad fauna habitat types: jarrah-marri woodland, creeklines with flooded gum (*E. rudis*) woodland and cleared areas. The cleared areas are considered to be in a highly disturbed (Thompson and Thompson 2010) condition and of little value to fauna. The remaining two habitats are considered to be well represented outside of the survey area and are contiguous to adjacent to the survey area.

Four conservation significant fauna species were recorded during the current survey and an additional seven species have been assessed as having high potential of occurring within the survey area:

Recorded

- *Calyptorhynchus banksia naso* Forest red-tailed black cockatoo (VU, S1)
- *Calyptorhynchus baudinii* Baudin's black cockatoo (VU, S1)
- *Ardea modesta* Eastern reef egret (Mi, S3)
- *Isoodon obesulus fusciventer* Quenda (P5)

Likely to Occur

- *Morelia spilota imbricata* Carpet python (S4)
- *Ardea ibis* Cattle egret (Mi, S3)
- *Falco peregrinus* Peregrine falcon (S4)
- *Calyptorhynchus latirostris* Carnaby's black cockatoo (EN, S1)
- *Dasyurus geoffroii* Chuditch (EN, S1)
- *Phascogale tapaotafa tapaotafa* Southern brush-tailed phascogale (S1)
- *Macropus irma* Western brush wallaby (P4)

While the habitats within the survey area may be utilised by the conservation significant fauna species listed above, mainly as a part of a larger foraging area, the proposed area for clearing is small, linear in nature and is considered unlikely to significantly impact on these species. The majority of the species listed are mobile and are likely to temporarily move away from the area being disturbed.

The survey area provides suitable feeding and breeding habitat for Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tailed black cockatoo. Baudin's Black-cockatoo and forest red-tailed black cockatoos were recorded within the survey area and there was evidence of foraging within the survey area. All jarrah-marri woodland within the survey area of good condition or better (10.52 ha) would be considered medium to high value foraging habitat for the black cockatoo species. Black cockatoo species were regularly observed feeding within the alignment near the golf course and along Cirillo Road.

One hundred and eighty-five trees were recorded within the proposed alignment as potential breeding habitat for black cockatoos; however very few mature trees (seven trees) old enough to have potentially suitable hollows were observed. The majority of potential habitat trees were recorded along Cirillo Road near Mullalyup. It is difficult to assess the suitability of these hollows for breeding black cockatoos without inspecting the hollows; however, there was no evidence at the time of the survey that they were being used by black cockatoos.

Based on the above information, the proposed clearing of the potential feeding and breeding habitat trees within the survey area is at variance to this Principle.

c) It includes, or is necessary for the continued existence of, rare flora

Twenty-four threatened flora species, were listed as occurring within the vicinity of the survey area (DoE & DPaW 2013a); however only two of these were rated as having high potential to occur within the survey area based on habitat (*Brachyscias verecundus* and *Caladenia harringtoniae*). The survey corridor was traversed on foot, targeting potential habitat for both taxa, but neither were located despite intensive searches in areas of potential habitat (creeklines, moss swords). Seasonal conditions and the timing of the survey were optimal for potentially recording these two taxa, however neither was encountered.

Based on a comprehensive survey of the proposed clearing area, the proposed clearing is not likely to be variance to this Principle.

d) It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community

No TECs listed under the EPBC Act have been located within or adjacent (<20 km away) to the survey area (DoE 2013; DPaW 2013b).

Given that no TECs occur within a minimum distance of at least 20 km from the proposed alignment; the proposed clearing is not likely to impact on any TEC/PECs and is therefore not at variance to this Principle.

e) It is significant as a remnant of native vegetation in an area that has been extensively cleared

The survey alignment is approximately 20 km long; the corridor was generally 10 m in width (wider in some areas to accommodate potential variations in alignment) and the total area of survey was 35.66 ha. The vegetated area is ~20 ha of which only 10.5 ha remains in good condition or better. The Water Corporation intends to utilise existing tracks and cleared areas (which exist for the entire alignment) for the pipeline; and seeks to minimise any clearing which may be required to install the infrastructure.

The application area occurs within the Southern Jarrah Forest Subregion (JF2) of the Jarrah Forest IBRA bioregion; the Shire of Bridgetown-Greenbushes and the Shire of Donnybrook-Balingup; the alignment is comprised of one singular pre-European vegetation unit: 3 medium forest (jarrah-marri) (DPaW 2013a). Table 10 shows the pre-European vegetation extents remaining within the bioregions and local government areas. The mapped vegetation has not been cleared to below a critical threshold level and therefore the proposal does not represent a significant amount of clearing at a local and regional scale.

Table 11 has the current extent of forest region vegetation complexes (Mattiske and Havel 1998). Three vegetation complexes (Balingup, Bridgetown and Mumballup) have less than 30% extent remaining. However, the mapped areas of these three complexes do not contain any remnant vegetation within the proposed alignment. Therefore no impact to these complexes is proposed and therefore no offset is required.

Table 10: Extent of region and pre-European vegetation remaining (DEC 2013a).

	Pre-European (ha)	Current extent (ha)	% Remaining	% Remaining in DPaW reserves
IBRA Bioregion				
Jarrah Forest	4,506,660	2,459,298	54.57	39.34
IBRA Subregion				
Southern Jarrah Forest	2,607,879	1,335,801	51.22	37.01
Shire				
Shire of Donnybrook-Balingup	156,003	88,337	56.63	55.72
Shire of Bridgetown-Greenbushes	133,759	72,590	54.27	48.66
Pre-European Vegetation Association Jarrah Forest IBRA bioregion				
3	2,661,405	1,631,110	68.23	57.65
3 within Shire of Donnybrook-Balingup	93,346	61,452	65.83	71.66
3 within Shire of Bridgetown-Greenbushes	121,152	69,307	57.21	52.37

Table 11: Vegetation complexes mapped within the survey alignment (Mattiske and Havel 1998).

Vegetation complex	Vegetation code	Area in survey area(ha)	Extent remaining; area in reservation
Balingup	BL	7.2076	24%; 5.4%*
Bridgetown	BT	0.4558	12%; 1.7%*
Catterick	CC1	2.7210	62%; 6.9%**
Dwellingup	D1	4.1906	88%; 14.7%*
Hester	HR	1.1945	74.3%; 13.7%**
Kirup	KR	17.6884	60.2%; 3.9%**
Mumballup	ML	1.3137	4%; 0.9%*
Queenwood	QW	0.8888	38.9%; 0%**
Total area		35.66	

*Havel (2002).

**WALGA (2014).

The vegetation described and mapped within the application area by Astron (2013) is considered to be widespread throughout the Southern Jarrah Forest bioregion and all vegetation is contiguous with surrounding forested areas adjacent to the survey area (Astron 2013). Clearing of the relatively small area of native vegetation within the application area will not significantly reduce the known pre-European extents or vegetation complex extents.

The survey area is not within a highly-cleared landscape and is not a critical corridor for fauna dispersal.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

f) It is growing in, or in association with, an environment associated with a watercourse or wetland

There are no regionally significant wetlands or watercourses with permanent water within the application area.

The alignment intersects four creeks and a few minor drainage lines. In the vicinity of Greenbushes the alignment intersected Dumpling Gully; in Balingup the Balingup Brook was crossed and in Mullalyup the Mullalyup Brook was crossed; towards Kirup the Capel River was crossed.

Of these water courses only two were still vegetated with native vegetation (Dumpling Gully – good to very good condition and Spring Creek – very good condition). There may be a small amount of clearing of riparian vegetation within the two vegetated creeklines; however both creeks already have a vehicle track crossing and it may be possible to reduce clearing to an amount that will not have any significant impact. Based on the potential to utilise existing tracks to cross the creek and therefore minimise impact, there is little reason to require an offset.

The proposed clearing may be at variance to this Principle.

g) The clearing of the vegetation is likely to cause appreciable land degradation

The application area has been mapped as intersecting 12 land systems (see Section 1.3.2). The survey alignment is approximately 20 km in length and follows existing tracks, roads and cleared areas. The clearing requirement for low gauge water pipe is minimal and the topography of the alignment is generally low relief with minimal slopes.

The minor clearing associated with this project is not likely to cause appreciable land degradation either from wind erosion, changes to soil properties or chemistry; nor likely to impact on adjacent vegetation.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

h) The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area

The application area is not located within or adjacent to any conservation reserves. However, some of the alignment is within Greenbushes State Forest 20 and 21 (DPaW 2013b). State Forest is managed for timber extraction but also has important ecological values. The clearing associated with this project is minor and will occur adjacent to or within previously cleared tracks/areas. Therefore no significant impacts to environmental values are expected.

The proposed clearing is therefore not likely to be at variance to this Principle.

i) The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water

The corridor passes through Capel River Catchment – Busselton Coast Basin, and Hardy Estuary /Blackwood River catchment, Blackwood River. The alignment is intersected by two creeks and a few minor drainage lines. In the vicinity of Greenbushes the alignment is intersected Dumpling Gully; in Balingup the Balingup Brook is crossed and in Mullalyup the Mullalyup Brook is crossed; towards Kirup the Capel River is crossed.

The alignment passes through the Greenbushes Catchment Area and Padbury Reservoir Catchment Area, which are both Public Drinking Water Supply Areas but neither are assigned a priority level. It also passes close to the Kirup Dam Catchment Area (P1 and P2 Areas) and Mullalyup Water Reserve (no assigned priority level). However, due to the limited amount of clearing (along pre-existing cleared areas or tracks and roads) it is considered unlikely that the proposed clearing will impact the quality of either water source.

The limited clearing is unlikely to have a significant impact on the quality of surface or underground water. The proposed clearing is not likely to be at variance to this Principle.

j) The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding

The proposed clearing follows pre-existing tracks, roads and previously cleared land. Along the alignment some low-lying areas are present but the minimal amount of clearing for the project would have no significant impact on the natural surface and groundwater processes. The proposal is not likely to cause, or exacerbate, the incidence or intensity of flooding.

Therefore, the proposed clearing is not at variance to this Principle.

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Appendix A: Definitions, Categories and Criteria for Conservation Significant Vegetation, Flora and Fauna

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Table A.1: Categories of threatened ecological communities (DEC 2010).

<p>PD: Presumed Destroyed</p>
<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
<p>CR : Critically Endangered</p>
<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

- A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):
- i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
 - ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
- B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):
- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
 - ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
 - iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
- C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

- A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
- B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
- C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Table A.2: Definitions and criteria for priority ecological communities (DEC 2010).

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists 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. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

P1: Priority One – Poorly-known ecological communities
Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-Known ecological communities
Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-Known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
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. These communities require regular monitoring. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table A.3: Definitions and Criteria for Threatened Ecological communities (DoE 2013b).

Three categories exist for listing threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised:

Categories of ecological communities	
Critically endangered	A native species is eligible to be included in the critically endangered category 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.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.

Table A.4: Conservation codes for Western Australian flora and fauna (DPaW 15 May 2013).

Code	Conservation category	Definition
X	Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the <i>Wildlife Conservation Act 1950</i> . <ul style="list-style-type: none"> • Presumed Extinct Fauna • Presumed Extinct Flora (Declared Rare Flora – Extinct) 	Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
T	Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the <i>Wildlife Conservation Act 1950</i> . <ul style="list-style-type: none"> • Threatened Fauna (Fauna that is rare or is likely to become extinct) • Threatened Flora (Declared Rare Flora - Extant) 	Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
IA	Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice under the <i>Wildlife Conservation Act 1950</i> . <ul style="list-style-type: none"> • Birds protected under an international agreement 	Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S	Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice under the <i>Wildlife Conservation Act 1950</i> . <ul style="list-style-type: none"> • Other specially protected fauna 	Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
<p>Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:</p> <ul style="list-style-type: none"> • CR: Critically Endangered - considered to be facing an extremely high risk of extinction in the wild. • EN: Endangered - considered to be facing a very high risk of extinction in the wild. • VU: Vulnerable - considered to be facing a high risk of extinction in the wild. 		

Table A.5: Priority species under Western Australian Wildlife Conservation Act 1950.

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.

<p>P1: Priority One – Poorly known taxa</p> <p>Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
<p>P2: Priority Two – Poorly known taxa</p> <p>Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>
<p>P3: Priority Three – Poorly known taxa</p> <p>Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.</p>
<p>P4: Priority Four: Rare, near threatened and other taxa in need of monitoring</p> <p>(a) Rare. Taxa 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 taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>P5: Priority Five: Conservation dependent taxa</p> <p>Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.</p>

Table A.6: Categories and definitions for EPBC Act listed flora and fauna species (DEWSPaC 2013).

Conservation category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the wild	Taxa known to survive only in captivity.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium term.
Near threatened (NT)	Taxa that risk becoming Vulnerable in the wild.
Conservation dependant (CD)	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data deficient (insufficiently known) (DD)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least concern (LC)	Taxa that are not considered threatened.

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Appendix B: Database Search Results

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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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 23/09/13 16:37:44

[Summary](#)

[Details](#)

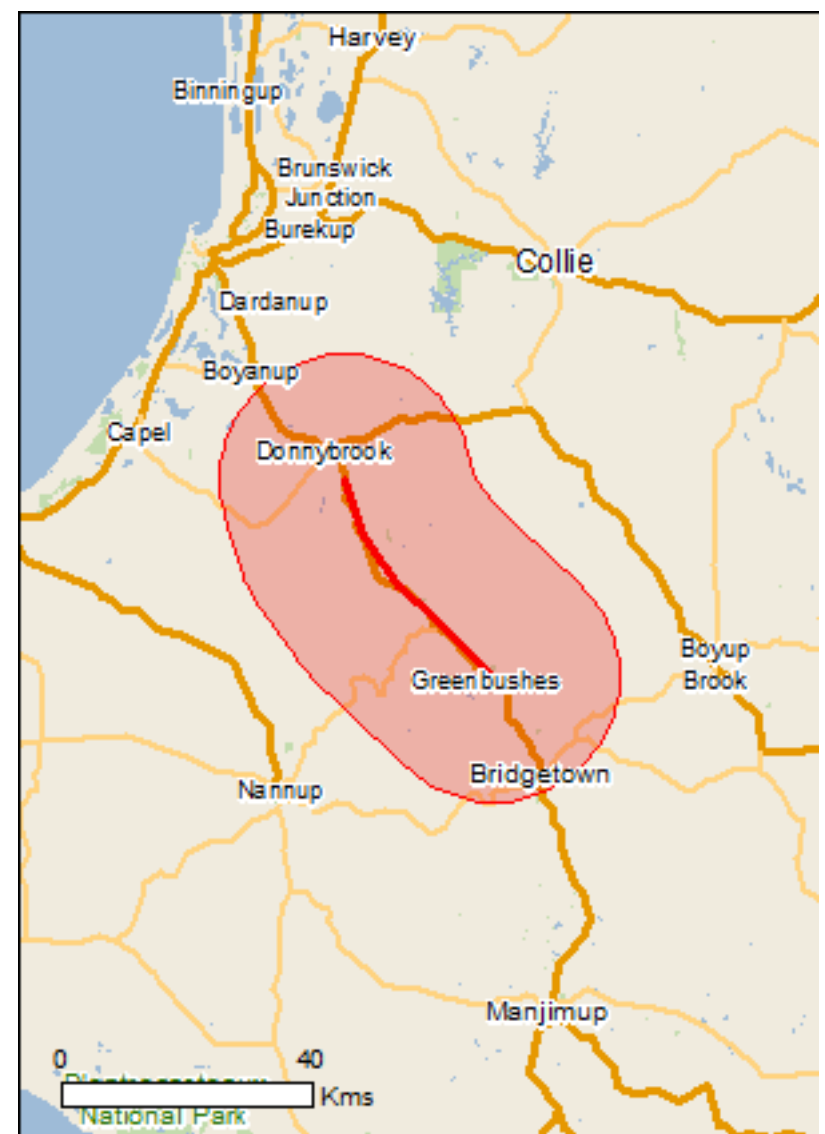
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

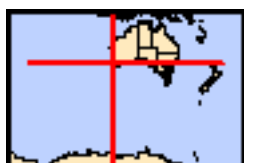
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 20.0Km



Summary

Matters of National Environmental 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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	33
Listed Migratory Species:	7

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 and the heritage values of a place on the Register of the National Estate.

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.

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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	6
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	28
State and Territory Reserves:	13
Regional Forest Agreements:	1
Invasive Species:	29
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR)	[Resource Information]
Name	Proximity
Vasse-wonnerup system	Upstream from Ramsar

Listed Threatened Species

Name	Status	Type of Presence
Birds		
Cacatua pastinator pastinator		
Muir's Corella (southern), Western Long-billed Corella (southern) [25981]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum [25911]	Vulnerable	Species or species habitat known to occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat known to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat known to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Caladenia winfieldii Majestic Spider-orchid [64504]	Endangered	Species or species habitat likely to occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. C Coast Plain (R.D.Royce 4872) Royce's Waxflower [82023]	Vulnerable	Species or species habitat may occur within area
Darwinia foetida Muceha Bell [83190]	Critically Endangered	Species or species habitat may occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leaved Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Rulingia sp. Trigwell Bridge (R.Smith s.n. 20/6/1989) Trigwell's Rulingia [64541]	Endangered	Species or species habitat may occur within area
Sphenotoma drummondii [21160]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cacatua pastinator pastinator Muir's Corella (southern), Western Long-billed Corella (southern) [25981]	Vulnerable	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Migratory Wetlands Species

Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

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.

Name

Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Dalgarup Management Priority Area	WA	Indicative Place
Dardanup Management Priority Area	WA	Indicative Place
Greenbushes Management Priority Area	WA	Indicative Place
Mullalyup Management Priority Area	WA	Indicative Place
Preston - Noggerup Management Priority Area	WA	Indicative Place
Powlalup Nature Reserve (1977 boundary)	WA	Registered
Historic		
Blue Atlas Cedar	WA	Indicative Place
Bridgedale	WA	Indicative Place
Brookview Farm Homestead	WA	Indicative Place
Careydale Farm Homestead	WA	Indicative Place
Hawterville Farmhouse and Garden	WA	Indicative Place
Marri	WA	Indicative Place
Old Brookhampton Farm Group	WA	Indicative Place
Old Brookhampton Hall	WA	Indicative Place

Name	State	Status
St Peters Anglican Church	WA	Indicative Place
St Thomas Anglican Church	WA	Indicative Place
Torridon Farm Homestead	WA	Indicative Place
Trotts Cottage	WA	Indicative Place
Yabberup Hall	WA	Indicative Place
All Saints Anglican Church	WA	Registered
Anchor and Hope Inn (former)	WA	Registered
Blackwood Inn and former Barns	WA	Registered
Brooklands Farm Homestead (former)	WA	Registered
Crendon Farm Homestead	WA	Registered
Golden Valley Farm Homestead, Outbuildings and Garden	WA	Registered
Paynedale Farm Homestead	WA	Registered
Soldiers Memorial Hall	WA	Registered
Southampton Farm Homestead	WA	Registered

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Dalgarup	WA
Dardanup	WA
Greater Preston	WA
Greenbushes	WA
Hester	WA
Kerr	WA
Powlalup	WA
Unnamed WA20751	WA
Unnamed WA26238	WA
Unnamed WA3412	WA
Unnamed WA43031	WA
Wellington	WA
Wellington Discovery Forest	WA

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within

Name	Status	Type of Presence area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Coordinates

-33.844436 116.068749,-33.77369 115.980172,-33.737153 115.932107,-33.678319
115.881982,-33.622304 115.860009,-33.610867 115.855889

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

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:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA 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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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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NatureMap Species Report

Created By Guest user on 29/10/2013

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Group By Family

Family	Species	Records
Alliaceae	1	4
Amaranthaceae	3	11
Amaryllidaceae	3	3
Anarthriaceae	4	6
Apiaceae	14	44
Apocynaceae	1	1
Apodanthaceae	1	2
Araceae	1	1
Araliaceae	2	2
Asparagaceae	23	64
Asteraceae	39	103
Boraginaceae	2	2
Boryaceae	2	2
Brassicaceae	9	14
Bryaceae	5	9
Campanulaceae	4	9
Caprifoliaceae	3	4
Caryophyllaceae	2	2
Casuarinaceae	2	4
Celastraceae	2	6
Centrolepidaceae	2	6
Chenopodiaceae	4	5
Colchicaceae	5	11
Commelinaceae	1	1
Convolvulaceae	2	2
Cucurbitaceae	1	1
Cupressaceae	1	1
Cyperaceae	37	68
Dasygongonaceae	2	7
Dennstaedtiaceae	1	3
Dicranaceae	3	25
Dilleniaceae	14	53
Ditrichaceae	2	5
Droseraceae	11	21
Elaeocarpaceae	8	38
Ericaceae	25	86
Euphorbiaceae	3	7
Fabaceae	105	292
Fissidentaceae	1	1
Gentianaceae	2	5
Geraniaceae	2	4
Goodeniaceae	13	60
Haemodoraceae	13	34
Haloragaceae	4	6
Hemerocallidaceae	8	15
Hydrocharitaceae	1	1
Hypericaceae	2	5
Hypoxidaceae	3	6
Iridaceae	25	72
Juncaceae	10	23
Juncaginaceae	3	4
Lamiaceae	9	17
Lauraceae	2	3
Lentibulariaceae	2	2
Linaceae	2	3
Lindsaeaceae	1	5
Loganiaceae	3	10
Loranthaceae	2	4
Lythraceae	1	2
Malvaceae	7	16
Menyanthaceae	1	1
Moraceae	1	1
Myrtaceae	39	98
Olaceae	1	2
Oleaceae	1	1
Onagraceae	5	5
Orchidaceae	46	94
Orobanchaceae	3	5
Orthodontiaceae	1	1
Oxalidaceae	4	9
Papaveraceae	4	4
Passifloraceae	1	1
Phyllanthaceae	3	9
Pinaceae	1	1
Pittosporaceae	6	18
Plantaginaceae	6	12
Poaceae	42	86
Podocarpaceae	1	15
Polygalaceae	3	3

Polygonaceae	6	16
Potamogetonaceae	3	4
Pottiaceae	2	10
Primulaceae	2	5
Proteaceae	49	108
Pteridaceae	1	4
Racopilaceae	1	3
Ranunculaceae	4	11
Restionaceae	19	48
Rhamnaceae	1	2
Rosaceae	10	22
Rubiaceae	6	13
Rutaceae	7	14
Salviniaceae	1	1
Santalaceae	4	13
Sapindaceae	2	5
Scrophulariaceae	1	1
Selaginellaceae	1	1
Sematoophyllaceae	1	8
Solanaceae	2	2
Stylidiaceae	18	35
Thymelaeaceae	9	12
Tropaeolaceae	1	1
Urticaceae	1	1
Verbenaceae	1	1
Violaceae	3	5
Xanthorrhoeaceae	2	8
Xyridaceae	3	3
Zamiaceae	1	9
Zygophyllaceae	1	1
TOTAL	798	1956

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Alliaceae				
1.	1378 <i>Allium triquetrum</i> (Three-cornered Garlic)	Y		
Amaranthaceae				
2.	2656 <i>Amaranthus caudatus</i> (Love Lies Bleeding)	Y		
3.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
4.	2742 <i>Ptilotus manglesii</i> (Pom Poms, Mulamula)			
Amaryllidaceae				
5.	1489 <i>Amaryllis belladonna</i> (Belladonna Lily)	Y		
6.	1493 <i>Leucojum aestivum</i> (Snowflake)	Y		
7.	1494 <i>Narcissus pseudonarcissus</i>	Y		
Anarthriaceae				
8.	1062 <i>Anarthria prolifera</i>			
9.	1063 <i>Anarthria scabra</i>			
10.	1097 <i>Lyginia barbata</i>			
11.	18049 <i>Lyginia imberbis</i>			
Apiaceae				
12.	6203 <i>Actinotus glomeratus</i>			
13.	8595 <i>Apium graveolens</i> (Wild Celery)	Y		
14.	12040 <i>Apium prostratum</i> var. <i>prostratum</i> (Sea Celery)			
15.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
16.	6219 <i>Eryngium pinnatifidum</i> (Blue Devils)			
17.	6222 <i>Homalosciadium homalocarpum</i>			
18.	6245 <i>Pentapeltis peltigera</i>			
19.	6246 <i>Pentapeltis silvatica</i> (Southern Pentapeltis)			
20.	6253 <i>Platysace filiformis</i>			
21.	6259 <i>Platysace tenuissima</i>			
22.	6283 <i>Xanthosia atkinsoniana</i>			
23.	6284 <i>Xanthosia candida</i>			
24.	6285 <i>Xanthosia ciliata</i>			
25.	6289 <i>Xanthosia huegelii</i>			
Apocynaceae				
26.	6575 <i>Vinca major</i> (Blue Periwinkle)	Y		
Apodanthaceae				
27.	2408 <i>Pilostyles hamiltonii</i>			
Araceae				
28.	1049 <i>Zantedeschia aethiopica</i> (Arum Lily)	Y		
Araliaceae				
29.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
30.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
Asparagaceae				
31.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
32.	1201 <i>Asparagus officinalis</i> (Asparagus)	Y		
33.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
34.	11299 <i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>			
35.	1308 <i>Laxmannia sessiliflora</i> (Nodding Lily)			
36.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
37.	1309 <i>Laxmannia squarrosa</i>			
38.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
39.	1225 <i>Lomandra drummondii</i>			
40.	1228 <i>Lomandra hermaphrodita</i>			
41.	1229 <i>Lomandra integra</i>			
42.	1234 <i>Lomandra nigricans</i>			
43.	1236 <i>Lomandra odora</i> (Tiered Matrush)			
44.	1238 <i>Lomandra pauciflora</i>			
45.	1239 <i>Lomandra preissii</i>			
46.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
47.	1244 <i>Lomandra sonderi</i>			
48.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
49.	1330 <i>Thysanotus fastigiatus</i>			
50.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
51.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
52.	1351 <i>Thysanotus sparteus</i>			
53.	35519 <i>Thysanotus unicipensis</i>			

P2

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Asteraceae				
54.	7838 <i>Arctotheca calendula</i> (Cape Weed)	Y		
55.	7851 <i>Asteridea pulverulenta</i> (Common Bristle Daisy)			
56.	7909 <i>Carduus pycnocephalus</i> (Slender Thistle)	Y		
57.	7910 <i>Carduus tenuiflorus</i> (Sheep Thistle)	Y		
58.	7911 <i>Carthamus lanatus</i> (Saffron Thistle)	Y		
59.	7935 <i>Cichorium intybus</i> (Chicory)	Y		
60.	7937 <i>Cirsium vulgare</i> (Spear Thistle)	Y		
61.	7941 <i>Conyza parva</i>	Y		
62.	20074 <i>Conyza sumatrensis</i>	Y		
63.	13354 <i>Craspedia variabilis</i>			
64.	29054 <i>Crepis foetida</i> subsp. <i>foetida</i>	Y		
65.	19893 <i>Cynara cardunculus</i> subsp. <i>flavescens</i>	Y		
66.	7968 <i>Erigeron karvinskianus</i>	Y		
67.	19088 <i>Euchiton collinus</i>			
68.	12741 <i>Hyalosperma cotula</i>			
69.	8086 <i>Hypochoeris glabra</i> (Smooth Catsear)	Y		
70.	8096 <i>Lactuca serriola</i> (Prickly Lettuce)	Y		
71.	18585 <i>Lagenophora huegelii</i>			
72.	8106 <i>Millotia tenuifolia</i> (Soft Millotia)			
73.	8143 <i>Olearia paucidentata</i> (Autumn Scrub Daisy)			
74.	18352 <i>Pithocarpa pulchella</i> var. <i>melanostigma</i>			
75.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
76.	8177 <i>Podolepis lessonii</i>			
77.	8195 <i>Quinetia urvillei</i>			
78.	8203 <i>Senecio diaschides</i>	Y		
79.	20719 <i>Senecio glomeratus</i> subsp. <i>glomeratus</i>			
80.	8208 <i>Senecio hispidulus</i> (Hispid Fireweed)			
81.	8215 <i>Senecio minimus</i> (Toothed Fireweed)			
82.	20663 <i>Senecio multicaulis</i> subsp. <i>multicaulis</i>			
83.	8223 <i>Sigesbeckia orientalis</i> (Indian Weed)	Y		
84.	14583 <i>Siloxerus multiflorus</i>			
85.	8227 <i>Silybum marianum</i> (Variegated Thistle)	Y		
86.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
87.	25902 <i>Symphotrichum squamatum</i> (Bushy Starwort)	Y		
88.	8248 <i>Tolpis barbata</i> (Yellow Hawkweed)	Y		
89.	29048 <i>Tolpis virgata</i>	Y		
90.	8250 <i>Tragopogon porrifolius</i> (Salsify)	Y		
91.	8251 <i>Trichocline spathulata</i> (Native Gerbera)			
92.	8257 <i>Vellereophyton dealbatum</i> (White Cudweed)	Y		
Boraginaceae				
93.	6674 <i>Borago officinalis</i> (Borage)	Y		
94.	6722 <i>Myosotis australis</i> (Southern Forget-me-not)			
Boryaceae				
95.	1272 <i>Borya scirpoidea</i>			
96.	1273 <i>Borya sphaerocephala</i> (Pincushions)			
Brassicaceae				
97.	2995 <i>Brassica napus</i>	Y		
98.	3000 <i>Brassica tournefortii</i> (Mediterranean Turnip)	Y		
99.	3018 <i>Lepidium africanum</i> (Rubble Pepperpress)	Y		
100.	19989 <i>Lepidium didymum</i>	Y		
101.	3061 <i>Raphanus raphanistrum</i> (Wild Radish)	Y		
102.	3063 <i>Rapistrum rugosum</i> (Turnip Weed)	Y		
103.	3066 <i>Rorippa nasturtium-aquaticum</i> (Watercress)	Y		
104.	3071 <i>Sisymbrium officinale</i> (Hedge Mustard)	Y		
105.	3072 <i>Sisymbrium orientale</i> (Indian Hedge Mustard)	Y		
Bryaceae				
106.	32417 <i>Ptychostomum angustifolium</i>			
107.	32424 <i>Rosulabryum albolimbatum</i>			
108.	32426 <i>Rosulabryum campylothecium</i>			
109.	32427 <i>Rosulabryum capillare</i>			
110.	32429 <i>Rosulabryum torquescens</i>			
Campanulaceae				
111.	9289 <i>Lobelia anceps</i> (Angled Lobelia)			
112.	7385 <i>Wahlenbergia communis</i> (Native Bluebell)			
113.	7388 <i>Wahlenbergia multicaulis</i>			
114.	7392 <i>Wahlenbergia stricta</i> (Austral Bluebell)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Caprifoliaceae				
115.	35322 <i>Centranthus ruber</i> subsp. <i>ruber</i>	Y		
116.	7365 <i>Lonicera japonica</i> (Japanese Honeysuckle)	Y		
117.	7368 <i>Scabiosa atropurpurea</i> (Purple Pincushion)	Y		
Caryophyllaceae				
118.	2891 <i>Corrigiola litoralis</i> (Strapwort)	Y		
119.	11803 <i>Silene gallica</i> var. <i>quinquevulnera</i>	Y		
Casuarinaceae				
120.	1728 <i>Allocasuarina fraseriana</i> (Sheoak, Kondil)			
121.	1732 <i>Allocasuarina humilis</i> (Dwarf Sheoak)			
Celastraceae				
122.	4733 <i>Stackhousia monogyna</i>			
123.	4737 <i>Tripterococcus brunonis</i> (Winged Stackhousia)			
Centrolepidaceae				
124.	1117 <i>Aphelia cyperoides</i>			
125.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
Chenopodiaceae				
126.	2490 <i>Chenopodium glaucum</i> (Glaucous Goosefoot)	Y		
127.	11368 <i>Dysphania glomulifera</i> subsp. <i>glomulifera</i>			
128.	33480 <i>Dysphania pumilio</i> (Clammy Goosefoot)			
129.	30434 <i>Salsola australis</i>			
Colchicaceae				
130.	1382 <i>Baeometra uniflora</i>	Y		
131.	12770 <i>Burchardia congesta</i>			
132.	1385 <i>Burchardia multiflora</i> (Dwarf Burchardia)			
133.	1394 <i>Wurmbea dioica</i> (Early Nancy)			
134.	1402 <i>Wurmbea sinora</i>			
Commelinaceae				
135.	1162 <i>Cartonema philydroides</i>			
Convolvulaceae				
136.	41761 <i>Calystegia silvatica</i>	Y		Y
137.	6663 <i>Cuscuta epithymum</i> (Lesser Dodder, Greater Dodder)	Y		
Cucurbitaceae				
138.	7372 <i>Cucumis myriocarpus</i> (Prickly Paddy Melon)	Y		
Cupressaceae				
139.	93 <i>Callitris drummondii</i> (Drummond's Cypress Pine)			
Cyperaceae				
140.	743 <i>Baumea juncea</i> (Bare Twigrush)			
141.	747 <i>Baumea rubiginosa</i>			
142.	749 <i>Bolboschoenus caldwellii</i> (Marsh Club-rush)			
143.	754 <i>Carex divisa</i> (Divided Sedge)	Y		
144.	756 <i>Carex inversa</i> (Knob Sedge)			
145.	759 <i>Carex tereticaulis</i>		P1	
146.	13766 <i>Caustis</i> sp. <i>Boyanup</i> (G.S. McCutcheon 1706)		P3	
147.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
148.	768 <i>Cyathochaeta avenacea</i>			
149.	17618 <i>Cyathochaeta equitans</i>			
150.	20216 <i>Ficinia nodosa</i> (Knotted Club Rush)			
151.	900 <i>Gahnia aristata</i>			
152.	902 <i>Gahnia decomposita</i>			
153.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
154.	20198 <i>Isolepis fluitans</i> var. <i>fluitans</i>			
155.	914 <i>Isolepis hookeriana</i> (Bristle Club Rush)			
156.	42741 <i>Lepidosperma apricola</i>			
157.	930 <i>Lepidosperma costale</i>			
158.	932 <i>Lepidosperma effusum</i> (Spreading Sword-sedge)			
159.	933 <i>Lepidosperma gladiatum</i> (Coast Sword-sedge, Kerbin)			
160.	936 <i>Lepidosperma leptostachyum</i>			
161.	937 <i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
162.	944 <i>Lepidosperma scabrum</i>			
163.	29150 <i>Lepidosperma</i> sp. <i>Margaret River</i> (B.J. Lepschi 1841)			
164.	945 <i>Lepidosperma squamatum</i>			
165.	948 <i>Lepidosperma tetraquetrum</i>			
166.	953 <i>Mesomelaena graciliceps</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
167.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
168.	969 <i>Schoenoplectus validus</i> (Lake Club-rush)			
169.	976 <i>Schoenus breviculmis</i>			
170.	984 <i>Schoenus curvifolius</i>			
171.	985 <i>Schoenus discifer</i>			
172.	999 <i>Schoenus loliaceus</i>		P2	
173.	1002 <i>Schoenus nanus</i> (Tiny Bog Rush)			
174.	1036 <i>Tetraria octandra</i>			
175.	35578 <i>Tetraria</i> sp. Blackwood River (A.R. Annels 3043)		P3	
176.	35579 <i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391)			

Dasyopogonaceae

177.	1218 <i>Dasyopogon bromeliifolius</i> (Pineapple Bush)			
178.	1219 <i>Dasyopogon hookeri</i> (Pineapple Bush)			

Dennstaedtiaceae

179.	41651 <i>Pteridium esculentum</i> subsp. <i>esculentum</i>			
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Dicranaceae

180.	32334 <i>Campylopus australis</i>			
181.	32338 <i>Campylopus introflexus</i>	Y		
182.	32344 <i>Dicranoloma diaphanoneuron</i>			

Dilleniaceae

183.	5109 <i>Hibbertia amplexicaulis</i>			
184.	5114 <i>Hibbertia commutata</i>			
185.	5117 <i>Hibbertia cuneiformis</i> (Cutleaf Hibbertia)			
186.	20051 <i>Hibbertia diamesogenos</i>			
187.	5125 <i>Hibbertia ferruginea</i>			
188.	19778 <i>Hibbertia glomerata</i> subsp. <i>darlingensis</i>			
189.	20059 <i>Hibbertia hemignosta</i>			
190.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
191.	5137 <i>Hibbertia inconspicua</i>			
192.	5157 <i>Hibbertia polystachya</i>			
193.	5159 <i>Hibbertia pulchra</i>			
194.	20032 <i>Hibbertia pulchra</i> var. <i>pulchra</i>			
195.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
196.	5176 <i>Hibbertia vaginata</i>			

Ditrichaceae

197.	32462 <i>Ceratodon purpureus</i> subsp. <i>convolutus</i>			
198.	32351 <i>Eccremidium pulchellum</i>			

Droseraceae

199.	3092 <i>Drosera bulbosa</i> (Red-leaved Sundew)			
200.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			
201.	13217 <i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>			
202.	15453 <i>Drosera gigantea</i> subsp. <i>gigantea</i>			
203.	3098 <i>Drosera glanduligera</i> (Pimpernel Sundew)			
204.	3108 <i>Drosera marchantii</i>			
205.	13209 <i>Drosera marchantii</i> subsp. <i>marchantii</i>			
206.	3109 <i>Drosera menziesii</i> (Pink Rainbow)			
207.	3118 <i>Drosera pallida</i> (Pale Rainbow)			
208.	3131 <i>Drosera stolonifera</i> (Leafy Sundew)			
209.	13205 <i>Drosera tubaestylis</i>			

Elaeocarpaceae

210.	4524 <i>Platytheca galioides</i>			
211.	4526 <i>Tetratheca affinis</i>			
212.	4535 <i>Tetratheca hirsuta</i> (Black Eyed Susan)			
213.	4538 <i>Tetratheca parvifolia</i>		P3	
214.	4544 <i>Tetratheca setigera</i>			
215.	4546 <i>Tetratheca virgata</i>			
216.	4547 <i>Tremandra diffusa</i>			
217.	4548 <i>Tremandra stelligera</i>			

Ericaceae

218.	6306 <i>Andersonia caerulea</i> (Foxtails)			
219.	6312 <i>Andersonia involucrata</i>			
220.	6314 <i>Andersonia lehmanniana</i>			
221.	6323 <i>Astroloma ciliatum</i> (Candle Cranberry)			
222.	6325 <i>Astroloma drummondii</i>			
223.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
224.	14504 <i>Astroloma</i> sp. Nannup (R.D. Royce 3978)		P4	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
225.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
226.	6360 <i>Leucopogon australis</i> (Spiked Beard-heath)			
227.	6367 <i>Leucopogon capitellatus</i>			
228.	6374 <i>Leucopogon conostephioides</i>			
229.	6396 <i>Leucopogon glabellus</i>			
230.	41260 <i>Leucopogon microcarpus</i>			
231.	40941 <i>Leucopogon obovatus</i> subsp. <i>revolutus</i>			
232.	6425 <i>Leucopogon oxycedrus</i>			
233.	6428 <i>Leucopogon pendulus</i>			
234.	6436 <i>Leucopogon propinquus</i>			
235.	6441 <i>Leucopogon reflexus</i> (Heart-leaf Beard-heath)			
236.	18098 <i>Leucopogon</i> sp. <i>Darradup</i> (R.D. Royce 2998)			
237.	19662 <i>Leucopogon</i> sp. <i>Margaret River</i> (J. Scott 207)			
238.	6454 <i>Leucopogon verticillatus</i> (Tassel Flower)			
239.	34736 <i>Lysinema pentapetalum</i>			
240.	31931 <i>Sphenotoma capitata</i>			
241.	31952 <i>Sphenotoma gracilis</i> (Swamp Paper-heath)			
242.	6476 <i>Styphelia tenuiflora</i> (Common Pinheath)			

Euphorbiaceae

243.	13101 <i>Amperea simulans</i>			
244.	34160 <i>Euphorbia lathyris</i> (Caper Spurge)	Y		
245.	4666 <i>Monotaxis occidentalis</i>			

Fabaceae

246.	15429 <i>Acacia alata</i> var. <i>alata</i>			
247.	15466 <i>Acacia applanata</i>			
248.	18285 <i>Acacia baileyana</i>	Y		
249.	11731 <i>Acacia browniana</i> var. <i>browniana</i>			
250.	11377 <i>Acacia browniana</i> var. <i>obscura</i>			
251.	17858 <i>Acacia dealbata</i>	Y		
252.	19920 <i>Acacia dealbata</i> subsp. <i>dealbata</i>	Y		
253.	3294 <i>Acacia dentifera</i>			
254.	3307 <i>Acacia divergens</i>			
255.	18287 <i>Acacia elata</i>	Y		
256.	3331 <i>Acacia extensa</i> (Wiry Wattle)			
257.	3339 <i>Acacia flagelliformis</i>		P4	
258.	18286 <i>Acacia floribunda</i>	Y		
259.	3374 <i>Acacia huegelii</i>			
260.	16165 <i>Acacia insolita</i> subsp. <i>insolita</i>			
261.	18217 <i>Acacia iteaphylla</i>	Y		
262.	3410 <i>Acacia lateriticola</i>			
263.	17464 <i>Acacia longifolia</i> subsp. <i>longifolia</i>	Y		
264.	17958 <i>Acacia mearnsii</i>	Y		
265.	10955 <i>Acacia melanoxylon</i>	Y		
266.	3448 <i>Acacia mooreana</i>			
267.	3453 <i>Acacia myrtifolia</i>			
268.	3454 <i>Acacia nervosa</i> (Rib Wattle)			
269.	3464 <i>Acacia obovata</i>			
270.	3496 <i>Acacia preissiana</i>			
271.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
272.	15481 <i>Acacia pulchella</i> var. <i>glaberrima</i>			
273.	15483 <i>Acacia pulchella</i> var. <i>pulchella</i>			
274.	3504 <i>Acacia pycnantha</i> (Golden Wattle)	Y		
275.	30034 <i>Acacia saligna</i> subsp. <i>pruinescens</i>			
276.	30032 <i>Acacia saligna</i> subsp. <i>saligna</i>			
277.	30036 <i>Acacia saligna</i> subsp. <i>stolonifera</i>			
278.	3537 <i>Acacia semitrullata</i>		P4	
279.	3591 <i>Acacia urophylla</i>			
280.	15487 <i>Acacia varia</i> var. <i>varia</i>			
281.	3686 <i>Aotus cordifolia</i>			
282.	14396 <i>Bossiaea aquifolium</i> subsp. <i>aquifolium</i>			
283.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
284.	3713 <i>Bossiaea linophylla</i>			
285.	3714 <i>Bossiaea ornata</i> (Broad Leaved Brown Pea)			
286.	18497 <i>Bossiaea</i> sp. <i>Waroona</i> (B.J. Keighery & N. Gibson 229)			
287.	10861 <i>Callistachys lanceolata</i> (Wonnich)			
288.	18156 <i>Chamaecytisus palmensis</i> (Tagasaste)	Y		
289.	8971 <i>Chorizema cordatum</i>			
290.	3757 <i>Chorizema glycinifolium</i>			
291.	13107 <i>Chorizema retrorsum</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
292.	3761 <i>Chorizema rhombeum</i>			
293.	3799 <i>Daviesia cordata</i> (Bookleaf)			
294.	3800 <i>Daviesia costata</i>			
295.	3807 <i>Daviesia divaricata</i> (Marmo)			
296.	3808 <i>Daviesia elongata</i>			
297.	14529 <i>Daviesia elongata</i> subsp. <i>elongata</i>		T	
298.	15505 <i>Daviesia incrassata</i> subsp. <i>incrassata</i>			
299.	3817 <i>Daviesia inflata</i>			
300.	3832 <i>Daviesia physodes</i>			
301.	3835 <i>Daviesia preissii</i>			
302.	3866 <i>Dillwynia uncinata</i> (Silky Parrot Pea)			
303.	3867 <i>Dipogon lignosus</i> (Dolichos Pea)	Y		
304.	3891 <i>Gastrolobium bilobum</i> (Heart Leaf Poison)			
305.	14202 <i>Gastrolobium glabratum</i>			
306.	19733 <i>Gastrolobium retusum</i>			
307.	3924 <i>Gastrolobium spinosum</i> (Prickly Poison)			
308.	20474 <i>Gastrolobium whicherense</i>		P2	
309.	3936 <i>Genista linifolia</i> (Flaxleaf Broom)	Y		
310.	18143 <i>Genista monspessulana</i>	Y		
311.	3948 <i>Gompholobium capitatum</i>			
312.	10909 <i>Gompholobium confertum</i>			
313.	3950 <i>Gompholobium knightianum</i>			
314.	3951 <i>Gompholobium marginatum</i>			
315.	3953 <i>Gompholobium ovatum</i>			
316.	3954 <i>Gompholobium polymorphum</i>			
317.	3955 <i>Gompholobium preissii</i>			
318.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
319.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
320.	3964 <i>Hovea chorizemifolia</i> (Holly-leaved Hovea)			
321.	3965 <i>Hovea elliptica</i> (Tree Hovea)			
322.	3968 <i>Hovea trisperma</i> (Common Hovea)			
323.	3992 <i>Isotropis cuneifolia</i> (Granny Bonnets)			
324.	4012 <i>Jacksonia furcellata</i> (Grey Stinkwood)			
325.	4017 <i>Jacksonia horrida</i>			
326.	4036 <i>Kennedia carinata</i>			
327.	4037 <i>Kennedia coccinea</i> (Coral Vine)			
328.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
329.	4045 <i>Kennedia stirlingii</i> (Bushy Kennedia)			
330.	3669 <i>Labichea punctata</i> (Lance-leaved Cassia)			
331.	4047 <i>Lathyrus tingitanus</i> (Tangier Pea)	Y		
332.	8564 <i>Lotus subbiflorus</i>	Y		
333.	4063 <i>Lotus uliginosus</i> (Greater Lotus)	Y		
334.	4065 <i>Lupinus angustifolius</i> (Narrowleaf Lupin)	Y		
335.	4067 <i>Lupinus luteus</i> (Yellow Lupin)	Y		
336.	4090 <i>Mirbelia dilatata</i> (Holly-leaved Mirbelia)			
337.	3618 <i>Paraserianthes lophantha</i> (Albizia)			
338.	17114 <i>Paraserianthes lophantha</i> subsp. <i>lophantha</i>			
339.	17016 <i>Podalyria sericea</i>	Y		
340.	4177 <i>Pultenaea ochreatea</i>			
341.	4181 <i>Pultenaea reticulata</i>			
342.	4187 <i>Pultenaea verruculosa</i>			
343.	17020 <i>Robinia pseudoacacia</i>	Y		
344.	17551 <i>Sphaerolobium drummondii</i>			
345.	4207 <i>Sphaerolobium medium</i>			
346.	4208 <i>Sphaerolobium nudiflorum</i>			
347.	4313 <i>Trifolium subterraneum</i> (Subterranean Clover)	Y		
348.	4317 <i>Ulex europaeus</i> (Gorse)	Y		
349.	4320 <i>Vicia hirsuta</i> (Hairy Vetch)	Y		
350.	12070 <i>Vicia sativa</i> subsp. <i>sativa</i>	Y		

Fissidentaceae

351. 32369 *Fissidens tenellus*

Gentianaceae

352. 6539 *Centaurium erythraea* (Common Centaury)

353. 6543 *Cicendia filiformis* (Slender Cicendia)

Geraniaceae

354. 4340 *Geranium retrorsum*

355. 4341 *Geranium solanderi* (Native Geranium)

Goodeniaceae

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
356.	7420 <i>Dampiera alata</i> (Winged-stem Dampiera)			
357.	7444 <i>Dampiera hederacea</i> (Karri Dampiera)			
358.	7446 <i>Dampiera heteroptera</i>		P3	
359.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
360.	29362 <i>Goodenia coerulea</i>			
361.	7505 <i>Goodenia eatoniana</i>			
362.	19285 <i>Goodenia pulchella</i> subsp. <i>Wheatbelt</i> (L.W. Sage & F. Hort 795)			
363.	13165 <i>Goodenia pusilla</i>			
364.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
365.	7575 <i>Lechenaultia formosa</i> (Red Leschenaultia)			
366.	7602 <i>Scaevola calliptera</i>			
367.	7613 <i>Scaevola glandulifera</i> (Viscid Hand-flower)			
368.	7665 <i>Velleia trinervis</i>			
Haemodoraceae				
369.	1406 <i>Anigozanthos bicolor</i> (Little Kangaroo Paw)			
370.	11931 <i>Anigozanthos bicolor</i> subsp. <i>decrescens</i>			
371.	1407 <i>Anigozanthos flavidus</i> (Tall Kangaroo Paw)			
372.	11261 <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>			
373.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
374.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
375.	1447 <i>Conostylis pusilla</i>			
376.	1453 <i>Conostylis serrulata</i>			
377.	1454 <i>Conostylis setigera</i> (Bristly Cottonhead)			
378.	11597 <i>Conostylis setigera</i> subsp. <i>setigera</i>			
379.	1465 <i>Haemodorum discolor</i>			
380.	1468 <i>Haemodorum laxum</i>			
381.	1478 <i>Phlebocarya ciliata</i>			
Haloragaceae				
382.	6143 <i>Glischrocaryon aureum</i> (Common Popflower)			
383.	6144 <i>Glischrocaryon flavescens</i>			
384.	6146 <i>Gonocarpus benthamii</i>			
385.	6189 <i>Myriophyllum crispatum</i>			
Hemerocallidaceae				
386.	23474 <i>Agrostocrinum hirsutum</i>			
387.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
388.	1259 <i>Dianella revoluta</i> (Blueberry Lily)			
389.	1295 <i>Johnsonia acaulis</i>			
390.	1296 <i>Johnsonia inconspicua</i>		P3	
391.	1297 <i>Johnsonia lupulina</i> (Hooded Lily)			
392.	1260 <i>Styandra glauca</i> (Blind Grass)			
393.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
Hydrocharitaceae				
394.	168 <i>Ottelia ovalifolia</i> (Swamp Lily)			
Hypericaceae				
395.	20043 <i>Hypericum canariense</i>	Y		
396.	5182 <i>Hypericum perforatum</i> (St John's Wort)	Y		
Hypoxidaceae				
397.	1500 <i>Hypoxis glabella</i> (Tiny Star)			
398.	1503 <i>Hypoxis occidentalis</i>			
399.	11845 <i>Hypoxis occidentalis</i> var. <i>quadriloba</i>			
Iridaceae				
400.	18279 <i>Babiana angustifolia</i>	Y		
401.	18392 <i>Freesia alba</i> x <i>leichtlinii</i>	Y		
402.	1519 <i>Gladiolus cardinalis</i>	Y		
403.	1523 <i>Gladiolus tristis</i> (Largeflower Gladiolus)	Y		
404.	1524 <i>Gladiolus undulatus</i> (Wild Gladiolus)	Y		
405.	1532 <i>Ixia maculata</i> (Yellow Ixia)	Y		
406.	1533 <i>Ixia paniculata</i>	Y		
407.	1534 <i>Ixia polystachya</i> (Variable Ixia)	Y		
408.	19179 <i>Moraea flaccida</i> (One-leaf Cape Tulip)	Y		
409.	11749 <i>Orthrosanthus laxus</i> var. <i>laxus</i> (Morning Iris)			
410.	1542 <i>Patersonia babianoides</i>			
411.	1546 <i>Patersonia juncea</i> (Rush Leaved Patersonia)			
412.	30472 <i>Patersonia occidentalis</i> var. <i>occidentalis</i>			
413.	1551 <i>Patersonia pygmaea</i> (Pygmy Patersonia)			
414.	1553 <i>Patersonia umbrosa</i> (Yellow Flags)			
415.	11550 <i>Patersonia umbrosa</i> var. <i>xanthina</i> (Yellow Flags)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
416.	11544 <i>Romulea rosea</i> var. <i>australis</i> (Guildford Grass)	Y		
417.	1558 <i>Sparaxis bulbifera</i>	Y		
418.	1560 <i>Sparaxis pillansii</i> (Harlequin Flower)	Y		
419.	1561 <i>Tritonia crocata</i>	Y		
420.	38401 <i>Tritonia gladiolaris</i> (Lined Tritonia)	Y		
421.	13103 <i>Watsonia borbonica</i>	Y		
422.	1566 <i>Watsonia marginata</i>	Y		
423.	18108 <i>Watsonia meriana</i> var. <i>bulbillifera</i>	Y		
424.	18118 <i>Watsonia meriana</i> var. <i>meriana</i>	Y		
Juncaceae				
425.	20454 <i>Juncus acutus</i> subsp. <i>acutus</i>	Y		
426.	8328 <i>Juncus amabilis</i>			
427.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
428.	1179 <i>Juncus caespiticius</i> (Grassy Rush)			
429.	1180 <i>Juncus capitatus</i> (Capitate Rush)	Y		
430.	1184 <i>Juncus holoschoenus</i> (Jointleaf Rush)			
431.	11922 <i>Juncus kraussii</i> subsp. <i>australiensis</i>			
432.	1188 <i>Juncus pallidus</i> (Pale Rush)			
433.	1195 <i>Juncus subsecundus</i> (Finger Rush)			
434.	1198 <i>Luzula meridionalis</i> (Field Woodrush)			
Juncaginaceae				
435.	40660 <i>Cycnogeton huegelii</i>			
436.	40661 <i>Cycnogeton lineare</i>			
437.	151 <i>Triglochin striata</i>			
Lamiaceae				
438.	6839 <i>Hemiantra pungens</i> (Snakebush)			
439.	6855 <i>Hemigenia humilis</i>			
440.	6856 <i>Hemigenia incana</i> (Silky Hemigenia)			
441.	6866 <i>Hemigenia pritzelii</i>			
442.	38323 <i>Lavandula stoechas</i> subsp. <i>stoechas</i>	Y		
443.	6881 <i>Marrubium vulgare</i> (Horehound)	Y		
444.	15994 <i>Mentha x piperita</i> var. <i>citrata</i>	Y		
445.	6906 <i>Moluccella laevis</i> (Molucca Balm)	Y		
446.	6930 <i>Stachys arvensis</i> (Staggerweed)	Y		
Lauraceae				
447.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
448.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
Lentibulariaceae				
449.	7126 <i>Utricularia benthamii</i>			
450.	7157 <i>Utricularia violacea</i> (Violet Bladderwort)			
Linaceae				
451.	4362 <i>Linum marginale</i> (Wild Flax)			
452.	4363 <i>Linum trigynum</i> (French Flax)	Y		
Lindsaeaceae				
453.	59 <i>Lindsaea linearis</i> (Screw Fern)			
Loganiaceae				
454.	6506 <i>Logania campanulata</i> (Bell-flowered Logania)			
455.	13128 <i>Logania serpyllifolia</i> subsp. <i>angustifolia</i>			
456.	14551 <i>Logania serpyllifolia</i> subsp. <i>serpyllifolia</i>			
Loranthaceae				
457.	2380 <i>Amyema miquelii</i> (Stalked Mistletoe)			
458.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
Lythraceae				
459.	5281 <i>Lythrum hyssopifolia</i> (Lesser Loosestrife)	Y		
Malvaceae				
460.	4903 <i>Abutilon theophrasti</i>	Y		Y
461.	5033 <i>Lasiopetalum floribundum</i> (Free Flowering Lasiopetalum)			
462.	5083 <i>Thomasia glutinosa</i> (Sticky Thomasia)			
463.	5084 <i>Thomasia grandiflora</i> (Large Flowered Thomasia)			
464.	5086 <i>Thomasia macrocalyx</i>			
465.	5092 <i>Thomasia pauciflora</i> (Few Flowered Thomasia)			
466.	5094 <i>Thomasia purpurea</i>			
Menyanthaceae				
467.	36181 <i>Ornduffia parnassifolia</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Moraceae				
468.	1747 <i>Ficus carica</i> (Common Fig)	Y		
Myrtaceae				
469.	20249 <i>Astartea leptophylla</i>			
470.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
471.	5429 <i>Calothamnus sanguineus</i> (Silky-leaved Blood flower, Pindak)			
472.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
473.	5465 <i>Calytrix leschenaultii</i>			
474.	5485 <i>Calytrix variabilis</i>			
475.	17104 <i>Corymbia calophylla</i> (Marri)			
476.	5508 <i>Darwinia citriodora</i> (Lemon-scented Darwinia)			
477.	13534 <i>Eucalyptus aspersa</i>			
478.	5615 <i>Eucalyptus decipiens</i> (Limestone Marlock, Moit)			
479.	13538 <i>Eucalyptus decipiens</i> subsp. <i>chalara</i>			
480.	13536 <i>Eucalyptus decipiens</i> subsp. <i>decipiens</i>			
481.	5628 <i>Eucalyptus drummondii</i> (Drummond's Gum)			
482.	12697 <i>Eucalyptus latens</i> (Narrow-leaved Red Mallee)			
483.	5708 <i>Eucalyptus marginata</i> (Jarrah, Djara)			
484.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
485.	5739 <i>Eucalyptus patens</i> (Swan River Blackbutt, Dwuda)			
486.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
487.	18085 <i>Eucalyptus utilis</i>			
488.	36445 <i>Harmogia parviflora</i>			
489.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
490.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
491.	5841 <i>Kunzea recurva</i>			
492.	14775 <i>Kunzea spathulata</i>			
493.	5847 <i>Leptospermum erubescens</i> (Roadside Teatree)			
494.	5850 <i>Leptospermum laevigatum</i> (Coast Teatree)	Y		
495.	13273 <i>Melaleuca incana</i> subsp. <i>incana</i>			
496.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
497.	5952 <i>Melaleuca preissiana</i> (Moonah)			
498.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
499.	5980 <i>Melaleuca thymoides</i>			
500.	5987 <i>Melaleuca viminea</i> (Mohan)			
501.	13280 <i>Melaleuca viminea</i> subsp. <i>viminea</i>			
502.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
503.	15501 <i>Pericalymma spongiocaula</i>			
504.	20135 <i>Taxandria linearifolia</i>			
505.	20133 <i>Taxandria parviceps</i>			
506.	6065 <i>Thryptomene saxicola</i> (Rock Thryptomene)			
507.	15618 <i>Verticordia plumosa</i> var. <i>plumosa</i>			
Olacaceae				
508.	2365 <i>Olax benthamiana</i>			
Oleaceae				
509.	40242 <i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Y		Y
Onagraceae				
510.	11570 <i>Epilobium billardioreanum</i> subsp. <i>billardioreanum</i> (Smooth Willow Herb)			
511.	11756 <i>Epilobium billardioreanum</i> subsp. <i>cinereum</i> (Variable Willow Herb)			
512.	6132 <i>Epilobium ciliatum</i>	Y		
513.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
514.	6139 <i>Oenothera glazioviana</i> (Evening Primrose)	Y		
Orchidaceae				
515.	13853 <i>Caladenia arrecta</i>			
516.	15332 <i>Caladenia attingens</i> subsp. <i>atingens</i>			
517.	15335 <i>Caladenia brownii</i>			
518.	1580 <i>Caladenia cairnsiana</i> (Zebra Orchid)			
519.	1590 <i>Caladenia ferruginea</i> (Rusty Spider Orchid)			
520.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
521.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
522.	13621 <i>Caladenia harringtoniae</i>		T	
523.	1597 <i>Caladenia infundibularis</i>			
524.	1603 <i>Caladenia longiclavata</i> (Clubbed Spider Orchid)			
525.	1604 <i>Caladenia macrostylis</i> (Leaping Spider Orchid)			
526.	15371 <i>Caladenia nana</i> subsp. <i>nana</i>			
527.	15372 <i>Caladenia nana</i> subsp. <i>unita</i>			
528.	15377 <i>Caladenia reptans</i> subsp. <i>reptans</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
529.	15380 <i>Caladenia splendens</i>			
530.	15382 <i>Caladenia uliginosa</i> subsp. <i>candicans</i>			
531.	15383 <i>Caladenia uliginosa</i> subsp. <i>uliginosa</i>			
532.	18019 <i>Caladenia vulgata</i>			
533.	12935 <i>Corybas abditus</i>		P3	
534.	12945 <i>Corybas recurvus</i>			
535.	1627 <i>Cryptostylis ovata</i> (Slipper Orchid)			
536.	15404 <i>Cyanicula sericea</i>			
537.	10916 <i>Cyrtostylis huegelii</i>			
538.	10964 <i>Cyrtostylis robusta</i>			
539.	10942 <i>Cyrtostylis tenuissima</i>			
540.	19649 <i>Disa bracteata</i>	Y		
541.	11049 <i>Diuris corymbosa</i>			
542.	1632 <i>Diuris emarginata</i> (Tall Donkey Orchid)			
543.	11156 <i>Drakaea livida</i>			
544.	1643 <i>Elythranthera brunonis</i> (Purple Enamel Orchid)			
545.	1644 <i>Elythranthera emarginata</i> (Pink Enamel Orchid)			
546.	15411 <i>Eriochilus dilatatus</i> subsp. <i>magnus</i>			
547.	15412 <i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>			
548.	12932 <i>Gastrodia lacista</i>			
549.	1653 <i>Leporella fimbriata</i> (Hare Orchid)			
550.	15418 <i>Leptoceras menziesii</i>			
551.	1656 <i>Lyperanthus serratus</i> (Rattle Beak Orchid)			
552.	15424 <i>Praecoxanthus aphyllus</i>			
553.	1686 <i>Pterostylis barbata</i> (Bird Orchid)			
554.	11118 <i>Pterostylis pyramidalis</i> (Snail Orchid)			
555.	1693 <i>Pterostylis recurva</i> (Jug Orchid)			
556.	18655 <i>Pterostylis</i> sp. <i>crinkled leaf</i> (G.J. Keighery 13426)			
557.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
558.	16367 <i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
559.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
560.	11053 <i>Thelymitra macrophylla</i>			
Orobanchaceae				
561.	7122 <i>Orobanche minor</i> (Lesser Broomrape)	Y		
562.	7089 <i>Parentucellia latifolia</i> (Common Bartsia)	Y		
563.	7090 <i>Parentucellia viscosa</i> (Sticky Bartsia)	Y		
Orthodontiaceae				
564.	32406 <i>Orthodontium lineare</i>			
Oxalidaceae				
565.	30375 <i>Oxalis exilis</i>			
566.	4351 <i>Oxalis flava</i> (Pinkbulb Soursob)	Y		
567.	4354 <i>Oxalis incarnata</i>	Y		
568.	4356 <i>Oxalis pes-caprae</i> (Soursob)	Y		
Papaveraceae				
569.	8365 <i>Fumaria bastardii</i>	Y		
570.	2969 <i>Fumaria capreolata</i> (Whiteflower Fumitory)	Y		
571.	31532 <i>Fumaria muralis</i> subsp. <i>muralis</i>	Y		
572.	2968 <i>Romneya trichocalyx</i>	Y		Y
Passifloraceae				
573.	5225 <i>Passiflora filamentosa</i>	Y		
Phyllanthaceae				
574.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
575.	4690 <i>Poranthera huegelii</i>			
576.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
Pinaceae				
577.	88 <i>Pinus radiata</i> (Radiata Pine)	Y		
Pittosporaceae				
578.	3157 <i>Billardiera floribunda</i> (White-flowered Billardiera)			
579.	25788 <i>Billardiera fraseri</i> (Elegant Pronaya)			
580.	25798 <i>Billardiera fusiformis</i> (Australian Bluebell)			
581.	3165 <i>Billardiera variifolia</i>			
582.	28290 <i>Cheiranthra parviflora</i>			
583.	17630 <i>Marianthus tenuis</i>			
Plantaginaceae				
584.	12008 <i>Kickxia elatine</i> subsp. <i>crinita</i>	Y		
585.	7068 <i>Kickxia spuria</i> (Roundleaf Toadflax)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
		Y		
586.	11785 <i>Plantago coronopus</i> subsp. <i>commutata</i>	Y		
587.	7301 <i>Plantago exilis</i>			
588.	7108 <i>Veronica arvensis</i> (Wall Speedwell)	Y		
589.	7109 <i>Veronica calycina</i> (Cup Speedwell)			
Poaceae				
590.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
591.	13380 <i>Amphibromus nervosus</i>			
592.	194 <i>Amphipogon amphipogonoides</i>			
593.	197 <i>Amphipogon debilis</i>			
594.	200 <i>Amphipogon turbinatus</i>			
595.	17233 <i>Austrostipa campylachne</i>			
596.	17240 <i>Austrostipa flavescens</i>			
597.	17253 <i>Austrostipa semibarbata</i>			
598.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
599.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
600.	245 <i>Briza minor</i> (Shivery Grass)	Y		
601.	249 <i>Bromus diandrus</i> (Great Brome)	Y		
602.	250 <i>Bromus hordeaceus</i> (Soft Brome)	Y		
603.	252 <i>Bromus madritensis</i> (Madrid Brome)	Y		
604.	41566 <i>Cenchrus longisetus</i> (Feathertop)	Y		
605.	277 <i>Cortaderia selloana</i> (Pampas Grass)	Y		
606.	283 <i>Cynodon dactylon</i> (Couch)	Y		
607.	299 <i>Deyeuxia quadriseta</i> (Reed Bentgrass)			
608.	306 <i>Dichelachne crinita</i> (Longhair Plumegrass)			
609.	340 <i>Echinopogon ovatus</i> (Hedgehog Grass)			
610.	348 <i>Ehrharta erecta</i> (Panic Veldt Grass)	Y		
611.	373 <i>Eragrostis brownii</i> (Brown's Lovegrass)			
612.	379 <i>Eragrostis elongata</i> (Clustered Lovegrass)			
613.	437 <i>Glyceria maxima</i> (Water Meadowgrass)	Y		
614.	439 <i>Hemarthria uncinata</i> (Matgrass)			
615.	11451 <i>Hemarthria uncinata</i> var. <i>uncinata</i>			
616.	444 <i>Holcus lanatus</i> (Yorkshire Fog)	Y		
617.	10957 <i>Lolium perenne</i> x <i>rigidum</i>	Y		
618.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
619.	492 <i>Neurachne alopecuroidea</i> (Foxtail Mulga Grass)			
620.	528 <i>Paspalum distichum</i> (Water Couch)	Y		
621.	533 <i>Paspalum vaginatum</i> (Salt Water Couch)	Y		
622.	548 <i>Phalaris aquatica</i> (Phalaris)	Y		
623.	557 <i>Piptatherum miliaceum</i> (Rice Millet)	Y		
624.	578 <i>Poa porphyroclados</i>			
625.	40431 <i>Rytidosperma acerosum</i>			
626.	40430 <i>Rytidosperma pilosum</i>			
627.	40427 <i>Rytidosperma setaceum</i>			
628.	617 <i>Sorghum halepense</i> (Johnson Grass)	Y		
629.	635 <i>Sporobolus virginicus</i> (Marine Couch)			
630.	667 <i>Tetrarrhena laevis</i> (Forrest Ricegrass)			
631.	673 <i>Themeda triandra</i>			
Podocarpaceae				
632.	86 <i>Podocarpus drouynianus</i> (Wild Plum, Kula)			
Polygalaceae				
633.	4551 <i>Comesperma ciliatum</i>			
634.	4553 <i>Comesperma drummondii</i> (Drummond's Milkwort)			
635.	4564 <i>Comesperma virgatum</i> (Milkwort)			
Polygonaceae				
636.	17774 <i>Acetosella vulgaris</i>	Y		
637.	13911 <i>Persicaria decipiens</i>			
638.	16983 <i>Persicaria maculosa</i>	Y		
639.	11052 <i>Persicaria prostrata</i>			
640.	2432 <i>Rumex conglomeratus</i> (Clustered Dock)	Y		
641.	2433 <i>Rumex crispus</i> (Curled Dock)	Y		
Potamogetonaceae				
642.	110 <i>Potamogeton drummondii</i>			
643.	111 <i>Potamogeton ochreatus</i> (Blunt Pondweed)			
644.	112 <i>Potamogeton pectinatus</i> (Fennel Pondweed)			
Pottiaceae				
645.	32315 <i>Barbula calycina</i>			

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646.	32445 <i>Tortula muralis</i>			
Primulaceae				
647.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
648.	6483 <i>Samolus junceus</i>			
Proteaceae				
649.	1790 <i>Adenanthos meisneri</i>			
650.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
651.	28281 <i>Adenanthos</i> sp. <i>Whicher Range</i> (G.J. Keighery 9736)			
652.	32576 <i>Banksia dallanneyi</i> (Couch Honeypot)			
653.	32616 <i>Banksia dallanneyi</i> subsp. <i>sylvestris</i>			
654.	32580 <i>Banksia dallanneyi</i> var. <i>dallanneyi</i>			
655.	32577 <i>Banksia dallanneyi</i> var. <i>melicula</i>			
656.	1819 <i>Banksia grandis</i> (Bull Banksia, Pulgarla)			
657.	1848 <i>Banksia seminuda</i> (River Banksia)			
658.	32080 <i>Banksia sessilis</i> var. <i>sessilis</i>			
659.	1851 <i>Banksia sphaerocarpa</i> (Round-fruit Banksia)			
660.	12111 <i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i> (Fox Banksia)			
661.	32046 <i>Banksia squarrosa</i> subsp. <i>argillacea</i>		T	
662.	1863 <i>Conospermum capitatum</i>			
663.	16853 <i>Conospermum capitatum</i> subsp. <i>glabratum</i>			
664.	16850 <i>Conospermum flexuosum</i> subsp. <i>laevigatum</i>			
665.	1945 <i>Franklandia triaristata</i> (Lanoline Bush)		P4	
666.	13085 <i>Grevillea centrastigma</i>			
667.	2066 <i>Grevillea pilulifera</i> (Woolly-flowered Grevillea)			
668.	2080 <i>Grevillea quercifolia</i> (Oak-leaf Grevillea)			
669.	2082 <i>Grevillea ripicola</i> (Collie Grevillea)		P4	
670.	2112 <i>Grevillea trifida</i>			
671.	2128 <i>Hakea amplexicaulis</i> (Prickly Hakea)			
672.	2137 <i>Hakea ceratophylla</i> (Horned Leaf Hakea)			
673.	2174 <i>Hakea linearis</i>			
674.	2175 <i>Hakea lissocarpha</i> (Honey Bush)			
675.	2191 <i>Hakea oleifolia</i> (Dungyn)			
676.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
677.	2203 <i>Hakea ruscifolia</i> (Candle Hakea)			
678.	2206 <i>Hakea stenocarpa</i> (Narrow-fruited Hakea)			
679.	2215 <i>Hakea undulata</i> (Wavy-leaved Hakea)			
680.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
681.	2225 <i>Isopogon buxifolius</i>			
682.	2237 <i>Isopogon sphaerocephalus</i> (Drumstick Isopogon)			
683.	2264 <i>Persoonia graminea</i>			
684.	2267 <i>Persoonia longifolia</i> (Snottygobble)			
685.	2273 <i>Persoonia saccata</i> (Snottygobble)			
686.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
687.	16874 <i>Petrophile recurva</i>			
688.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
689.	2317 <i>Stirlingia simplex</i>			
690.	2323 <i>Synaphea gracillima</i>			
691.	16769 <i>Synaphea hians</i>		P3	
692.	2324 <i>Synaphea petiolaris</i> (Synaphea)			
693.	16863 <i>Synaphea petiolaris</i> subsp. <i>triloba</i>			
694.	31767 <i>Synaphea polypodioides</i>		P3	
695.	19055 <i>Synaphea</i> sp. <i>Pinjarra</i> (R. Davis 6578)		T	
696.	16749 <i>Synaphea stenoloba</i>		T	
697.	2331 <i>Xylomelum occidentale</i> (Woody Pear, Djandin)			
Pteridaceae				
698.	25 <i>Adiantum aethiopicum</i> (Common Maidenhair)			
Racopilaceae				
699.	32480 <i>Racopilum cuspidigerum</i> var. <i>convolutaceum</i>			
Ranunculaceae				
700.	2929 <i>Clematis pubescens</i> (Common Clematis)			
701.	10911 <i>Ranunculus amphitrichus</i>			
702.	2932 <i>Ranunculus colonorum</i> (Common Buttercup)			
703.	2933 <i>Ranunculus muricatus</i> (Sharp Buttercup)	Y		
Restionaceae				
704.	17689 <i>Chordifex laxus</i>			
705.	17692 <i>Cytogonidium leptocarpoides</i>			
706.	17663 <i>Desmocladus asper</i>			

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707.	17691 <i>Desmocladius fasciculatus</i>			
708.	16595 <i>Desmocladius flexuosus</i>			
709.	1070 <i>Hypolaena exsulca</i>			
710.	1071 <i>Hypolaena fastigiata</i>			
711.	15556 <i>Leptocarpus elegans</i>			
712.	1082 <i>Leptocarpus tenax</i> (Slender Twine Rush)			
713.	1085 <i>Lepyrodia glauca</i>			
714.	1090 <i>Lepyrodia muirii</i>			
715.	1092 <i>Loxocarya cinerea</i>			
716.	13779 <i>Loxocarya magna</i>		P3	
717.	17679 <i>Meeboldina coangustata</i>			
718.	17976 <i>Meeboldina decipiens</i> subsp. <i>decipiens</i>		P3	
719.	17678 <i>Meeboldina kraussii</i>			
720.	17677 <i>Meeboldina roycei</i>			
721.	17694 <i>Meeboldina scariosa</i>			
722.	17681 <i>Platychora applanata</i>			
Rhamnaceae				
723.	33438 <i>Trymalium odoratissimum</i> subsp. <i>trifidum</i>			
Rosaceae				
724.	3184 <i>Acaena echinata</i> (Sheep's Burr)			
725.	3185 <i>Acaena novae-zelandiae</i>	Y		
726.	18320 <i>Cotoneaster pannosus</i>	Y		
727.	17211 <i>Prunus cerasifera</i>	Y		
728.	10764 <i>Rosa chinensis</i> x <i>multiflora</i>	Y		
729.	3187 <i>Rosa rubiginosa</i> (Sweet Briar)	Y		
730.	20506 <i>Rubus anglocandicans</i>	Y		
731.	20496 <i>Rubus laudatus</i>	Y		
732.	23990 <i>Rubus ulmifolius</i> var. <i>ulmifolius</i>	Y		
733.	3192 <i>Sanguisorba minor</i> (Sheep's Burnet)	Y		
Rubiaceae				
734.	7321 <i>Galium divaricatum</i>	Y		
735.	18254 <i>Opercularia apiciflora</i>			
736.	7348 <i>Opercularia hispidula</i> (Hispid Stinkweed)			
737.	7350 <i>Opercularia rubioides</i>		P3	
738.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
739.	17273 <i>Richardia brasiliensis</i>	Y		
Rutaceae				
740.	17653 <i>Boronia crenulata</i> subsp. <i>pubescens</i>			
741.	4417 <i>Boronia dichotoma</i>			
742.	4420 <i>Boronia fastigiata</i> (Bushy Boronia)			
743.	16618 <i>Boronia humifusa</i>		P1	
744.	4428 <i>Boronia megastigma</i> (Scented Boronia)			
745.	11381 <i>Boronia ramosa</i> subsp. <i>anethifolia</i>			
746.	18529 <i>Philothea spicata</i> (Pepper and Salt)			
Salviniaceae				
747.	17737 <i>Azolla pinnata</i>			
Santalaceae				
748.	2335 <i>Choretrum lateriflorum</i> (Dwarf Sour Bush)			
749.	2342 <i>Leptomeria cunninghamii</i>			
750.	17703 <i>Leptomeria ellytes</i>			
751.	2355 <i>Leptomeria squarrolosa</i>			
Sapindaceae				
752.	4757 <i>Dodonaea ceratocarpa</i>			
753.	11247 <i>Dodonaea viscosa</i> subsp. <i>angustissima</i>			
Scrophulariaceae				
754.	7107 <i>Verbascum virgatum</i> (Twiggy Mullein)	Y		
Selaginellaceae				
755.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
Sematophyllaceae				
756.	32433 <i>Sematophyllum homomallum</i>			
Solanaceae				
757.	6964 <i>Datura stramonium</i> (Common Thornapple)	Y		
758.	7022 <i>Solanum nigrum</i> (Black Berry Nightshade)	Y		
Stylidiaceae				

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759.	7674 <i>Levenhookia preissii</i> (Preiss's Stylewort)			
760.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
761.	7677 <i>Levenhookia stipitata</i> (Common Stylewort)			
762.	7678 <i>Stylidium adnatum</i> (Common Beaked Triggerplant)			
763.	7681 <i>Stylidium affine</i> (Queen Triggerplant)			
764.	7684 <i>Stylidium amoenum</i> (Lovely Triggerplant)			
765.	30278 <i>Stylidium androsaceum</i>			
766.	7688 <i>Stylidium barleei</i> (Tooth-leaved Triggerplant)			
767.	7702 <i>Stylidium ciliatum</i> (Golden Triggerplant)			
768.	7708 <i>Stylidium crassifolium</i> (Thick-leaved Triggerplant)			
769.	7718 <i>Stylidium diversifolium</i> (Touch-me-not)			
770.	7734 <i>Stylidium guttatum</i> (Dotted Triggerplant)			
771.	7745 <i>Stylidium junceum</i> (Reed Triggerplant)			
772.	7773 <i>Stylidium petiolare</i> (Horn Triggerplant)			
773.	7796 <i>Stylidium scandens</i> (Climbing Triggerplant)			
774.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
775.	7799 <i>Stylidium spathulatum</i> (Creamy Triggerplant)			
776.	25845 <i>Stylidium tenue</i>			
Thymelaeaceae				
777.	5231 <i>Pimelea angustifolia</i> (Narrow-leaved Pimelea)			
778.	5232 <i>Pimelea argentea</i> (Silvery Leaved Pimelea)			
779.	11928 <i>Pimelea ciliata</i> subsp. <i>ciliata</i>			
780.	11533 <i>Pimelea imbricata</i> var. <i>imbricata</i>			
781.	11402 <i>Pimelea imbricata</i> var. <i>piligera</i>			
782.	11182 <i>Pimelea lehmanniana</i> subsp. <i>nervosa</i>			
783.	5259 <i>Pimelea preissii</i>			
784.	5264 <i>Pimelea spectabilis</i> (Bunjong)			
785.	5269 <i>Pimelea sylvestris</i>			
Tropaeolaceae				
786.	4360 <i>Tropaeolum majus</i> (Garden Nasturtium)	Y		
Urticaceae				
787.	1767 <i>Urtica urens</i> (Small Nettle)	Y		
Verbenaceae				
788.	36096 <i>Verbena incompta</i> (Purple-top Verbena)	Y		
Violaceae				
789.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
790.	5218 <i>Hybanthus debilissimus</i>			
791.	12007 <i>Hybanthus floribundus</i> subsp. <i>floribundus</i>			
Xanthorrhoeaceae				
792.	1253 <i>Xanthorrhoea gracilis</i> (Graceful Grass Tree, Mimidi)			
793.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
Xyridaceae				
794.	1149 <i>Xyris lacera</i>			
795.	1150 <i>Xyris lanata</i>			
796.	1151 <i>Xyris laxiflora</i>			
Zamiaceae				
797.	85 <i>Macrozamia riedlei</i> (<i>Zamia</i> , Djiridji)			
Zygophyllaceae				
798.	4383 <i>Tribulus terrestris</i> (Caltrop)	Y		

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Taxon	Status	Rank	IUCN	Criteria	EPBC	DEC	Region	DEC	District	Distribution	Flowering	Period	Recovery	Plan
Acacia flacelliformis		4				SWST		BLACKWOOD	WELLINGTON	Harvey, Eaton, Bunbury, Capel, Busseton, Donnybrook	Jul-Sep			
Acacia semitrullata		4				SWST		BLACKWOOD	WELLINGTON	Yallingup, Donnybrook, Harvey, Yarloop, Collie	Jun-Aug			
Banksia sp. Boyup Brook (L.W. Sage LWS 2366)		1				SWST		BLACKWOOD		Wilga S.F.				
Calothamnus rupestris		4				SWAN,SWST,WHTB		PERTH HILLS,BLACKWOOD,WELLINGTON,GREAT SOUTHERN		Red Hill, Gosnells, St Ronans N.R., Boyagin Rock, Collie, Wilga	Aug-Oct			
Causis sp. Boyanup (G.S. McCutcheon 1706)		3				SCST,SWST,WARR,WHTB		BLACKWOOD,WELLINGTON,DONNELLY,ALBANY,GREAT SOUTHERN		Boyanup State Forest, Bescabel, Kojonup, Whicher NR, Vasse, S of Stirling Ranges, Donnybrook, tutanning NR, Blackwood River NP, Shannon NP				
Corybas abditus		3				SCST,SWST,WARR		BLACKWOOD,FRANKLAND,ALBANY		Donnybrook, Walpole, Manypeaks	Oct-Nov			
Dillwynia sp. Capel (P.A. Jurjevich 1771)		1				SWST,WARR		BLACKWOOD,DONNELLY		Whicher Range, Nannup, Donnybrook, Pemberton	Sept-Oct			
Grevillea ripicola		4				SWST		BLACKWOOD,WELLINGTON		Collie, Kirup	Oct-Dec			
Platytheca anasima		2				SWST		BLACKWOOD		Capel, Donnybrook	Oct-Nov			
Senecio gilbertii		1				SWAN,SWST		PERTH HILLS,BLACKWOOD		Birdoon, York, Wooroloo, Wilga, Gooseberry Hill	Sep-Nov			
Stylidium acuminatum subsp. acuminatum		1				SWST		BLACKWOOD,WELLINGTON		Collie, Donnybrook	Oct-Nov			
Synsphaea polypodoides		3				SWST		BLACKWOOD,WELLINGTON		Dardanup, Boyanup, Donnybrook	Sep-Oct			
Tetralia sp. Blackwood River (A.R. Annels 3043) PN		3				SCST,SWST,WARR		BLACKWOOD,DONNELLY,FRANKLAND,ALBANY		Denmark, Witchescliffe, Green Range,Manjimup, Mullalyup				
Tetralia parvifolia		3				SWST		BLACKWOOD		Capel, East of Donnybrook, Collie	Oct			
Thysanotus gageoides		3				SCST,SWST,WHTB		BLACKWOOD,ALBANY,GREAT SOUTHERN		Cranbrook, Cape Riche, Stirling Range, Borden, Ongerup, Mullalyup, Corackerup, Boxwood Hill	Oct-Nov			
Thysanotus unicus		2				SWST,WARR		BLACKWOOD,WELLINGTON,DONNELLY		Boyup Brook, Collie, Unicap, Kingston, Mullalyup	Oct-Dec			

NatureMap Species Report

Created By Guest user on 29/10/2013

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Group By Family

Family	Species	Records
Acanthizidae	6	443
Accipitridae	9	86
Actinopodidae	3	4
Aegothelidae	2	6
Agamidae	1	1
Anatidae	11	380
Araneidae	8	9
Ardeidae	5	15
Artamidae	2	35
Boidae	1	1
Bothriuridae	1	1
Bovidae	1	1
Burhinidae	1	3
Burramyidae	1	4
Callionymidae	1	2
Campephagidae	3	70
Canidae	1	1
Casuariidae	2	32
Cervidae	1	1
Cheluidae	1	1
Climacteridae	1	24
Columbidae	3	76
Corvidae	2	177
Cracticidae	4	198
Cuculidae	5	33
Dasyuridae	6	102
Dicaeidae	1	3
Dicruridae	5	164
Elapidae	3	22
Estrilidae	1	44
Falconidae	7	39
Felidae	1	1
Galaxiidae	2	10
Garypidae	1	1
Gekkonidae	1	3
Geotriidae	1	1
Halcyonidae	4	131
Hirundinidae	2	65
Hylidae	2	6
Idiopidae	2	2
Lamponidae	2	2
Laridae	1	1
Lepidogalaxiidae	1	2
Leporidae	1	8
Limnodynastidae	2	6
Lycosidae	2	3
Macropodidae	3	32
Maluridae	3	201
Megapodiidae	1	1
Meliphagidae	8	476
Meropidae	1	30
Molossidae	2	2
Motacillidae	1	2
Muridae	4	31
Myobatrachidae	5	62
Myrmecobiidae	1	4
Nannoperidae	1	9
Nemesiidae	1	2
Neosittidae	2	36
Otididae	1	1
Pachycephalidae	7	258
Pardalotidae	4	120
Pelecanidae	1	2
Peramelidae	1	21
Percichthyidae	1	5
Percidae	1	4
Petroicidae	6	103
Phalacrocoracidae	5	32
Phalangeridae	1	15
Podargidae	2	18
Podicipedidae	4	76
Potoridae	1	3
Procellariidae	1	1
Pseudocheiridae	1	8
Psittacidae	14	474
Pygopodidae	1	2
Rallidae	7	93
Salticidae	1	1
Scincidae	13	92

Strigidae	1	18
Sturnidae	1	2
Suidae	1	1
Sylviidae	2	5
Tachyglossidae	1	3
Tetragnathidae	2	2
Tettigoniidae	1	1
Threskiornithidae	3	71
Thylacomyidae	1	2
Turnicidae	2	2
Typhlopidae	1	6
Tytonidae	3	30
Urodacidae	1	6
Varanidae	1	4
Vespertilionidae	5	12
Zosteropidae	2	192
paradoxosomatidae	1	4
TOTAL	259	4798

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Acanthizidae				
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
5.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
6.	30948 <i>Smicronis brevirostris</i> (Weebill)			
Accipitridae				
7.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
8.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
9.	24282 <i>Accipiter fasciatus</i> subsp. <i>fasciatus</i> (Brown Goshawk)			
10.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
11.	24288 <i>Circus approximans</i> (Swamp Harrier)			
12.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
13.	24290 <i>Elanus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)			
14.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)		IA	
15.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
Actinopodidae				
16.	-13329 <i>Missulena granulosa</i> subsp. <i>granulosa</i>			
17.	-12846 <i>Missulena granulosa</i> subsp. <i>hoggi</i>			
18.	-12829 <i>Missulena occatoria</i>			
Aegothelidae				
19.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
20.	24301 <i>Aegotheles cristatus</i> subsp. <i>cristatus</i> (Australian Owlet-nightjar)			
Agamidae				
21.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
Anatidae				
22.	24312 <i>Anas gracilis</i> (Grey Teal)			
23.	24313 <i>Anas platyrhynchos</i> (Mallard)			
24.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
25.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
26.	24318 <i>Aythya australis</i> (Hardhead)			
27.	24319 <i>Biziura lobata</i> (Musk Duck)			
28.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
29.	24322 <i>Cygnus atratus</i> (Black Swan)			
30.	24328 <i>Oxyura australis</i> (Blue-billed Duck)			
31.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
32.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
Araneidae				
33.	-13382 <i>Araneus cyphoxis</i>			
34.	-12899 <i>Araneus senicaudatus</i>			
35.	-1751 <i>Argiope protensa</i>			
36.	-13324 <i>Argiope trifasciata</i>			
37.	-11836 <i>Austracantha minax</i>			
38.	-11681 <i>Celaenia excavata</i>			
39.	-13332 <i>Cyclosa trilobata</i>			
40.	-12692 <i>Heurodes turritus</i>			
Ardeidae				
41.	41324 <i>Ardea modesta</i> (Eastern Great Egret)		IA	
42.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
43.	24347 <i>Ixobrychus flavicollis</i> subsp. <i>australis</i> (Australian Black Bittern)		P3	
44.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
45.	24350 <i>Nycticorax caledonicus</i> subsp. <i>hilli</i> (Rufous Night Heron)			
Artamidae				
46.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
47.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
Boidae				
48.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)		S	
Bothriuridae				
49.	-12810 <i>Cercophonius sulcatus</i>			
Bovidae				
50.	24251 <i>Bos taurus</i> (European Cattle)	Y		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Burhinidae				
51.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)		P4	
Burramyidae				
52.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
Callionymidae				
53.	-13853 ? ?			
Campephagidae				
54.	24361 <i>Coracina maxima</i> (Ground Cuckoo-shrike)			
55.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
56.	24362 <i>Coracina novaehollandiae</i> subsp. <i>novaehollandiae</i> (Black-faced Cuckoo-shrike)			
Canidae				
57.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
Casuariidae				
58.	-13506 <i>Dromaius ater</i>			Y
59.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
Cervidae				
60.	24256 <i>Dama dama</i> (Fallow Deer)	Y		
Cheluidae				
61.	25337 <i>Chelodina oblonga</i> (Oblong Turtle)			
Climacteridae				
62.	24396 <i>Climacteris rufa</i> (Rufous Treecreeper)			
Columbidae				
63.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
64.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
65.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
Corvidae				
66.	25592 <i>Corvus coronoides</i> (Australian Raven)			
67.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
Cracticidae				
68.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
69.	24422 <i>Cracticus tibicen</i> subsp. <i>dorsalis</i> (White-backed Magpie)			
70.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
71.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
Cuculidae				
72.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
73.	24427 <i>Cacomantis flabelliformis</i> subsp. <i>flabelliformis</i> (Fan-tailed Cuckoo)			
74.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
75.	25601 <i>Chrysococcyx lucidus</i> (Shining Bronze Cuckoo)			
76.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
Dasyuridae				
77.	25449 <i>Antechinus flavipes</i> (Yellow-footed Antechinus)			
78.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
79.	24098 <i>Phascogale calura</i> (Red-tailed Phascogale, Kenngoor)		T	
80.	24099 <i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i> (Southern Brush-tailed Phascogale, Wambenger)		T	
81.	24111 <i>Sminthopsis gilberti</i> (Gilbert's Dunnart)			
82.	-17953 <i>Sminthopsis murina</i>			
Dicaeidae				
83.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
Dicruridae				
84.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
85.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
86.	25613 <i>Rhipidura fuliginosa</i> (Grey Fantail)			
87.	24452 <i>Rhipidura fuliginosa</i> subsp. <i>preissi</i> (Grey Fantail)			
88.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
Elapidae				
89.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
90.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
91.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
Estrilidae				
92.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Falconidae				
93.	25621 <i>Falco berigora</i> (Brown Falcon)			
94.	24471 <i>Falco berigora</i> subsp. <i>berigora</i> (Brown Falcon)			
95.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
96.	24472 <i>Falco cenchroides</i> subsp. <i>cenchroides</i> (Australian Kestrel)			
97.	25623 <i>Falco longipennis</i> (Australian Hobby)			
98.	24474 <i>Falco longipennis</i> subsp. <i>longipennis</i> (Australian Hobby)			
99.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
Felidae				
100.	24041 <i>Felis catus</i> (Cat)	Y		
Galaxiidae				
101.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
102.	34027 <i>Galaxiella nigrostriata</i> (Black-stripe Minnow)		P3	
Garypidae				
103.	-12635 <i>Synsphyronus magnus</i>			
Gekkonidae				
104.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
Geotriidae				
105.	34030 <i>Geotria australis</i> (Pouched Lamprey)		P1	
Halcyonidae				
106.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
107.	30902 <i>Dacelo novaeguineae</i> subsp. <i>novaeguineae</i> (Laughing Kookaburra)	Y		
108.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
109.	24309 <i>Todiramphus sanctus</i> subsp. <i>sanctus</i> (Sacred Kingfisher)			
Hirundinidae				
110.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
111.	25629 <i>Hirundo nigricans</i> (Tree Martin)			
Hylidae				
112.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
113.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
Idiopidae				
114.	-13271 <i>Euoplos festivus</i>			Y
115.	-12117 <i>Idiosoma sigillatum</i>			
Lamponidae				
116.	-11816 <i>Lampona brevipes</i>			
117.	-1712 <i>Lampona cylindrata</i>			
Laridae				
118.	24529 <i>Sterna leucoptera</i> (White-winged Black Tern)		IA	
Lepidogalaxiidae				
119.	-16271 <i>Lepidogalaxias salamandroides</i>			
Leporidae				
120.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
Limnodynastidae				
121.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
122.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
Lycosidae				
123.	-11630 <i>Artoria flavimana</i>			
124.	-13279 <i>Tasmanicosia leuckartii</i>			
Macropodidae				
125.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
126.	24133 <i>Macropus ima</i> (Western Brush Wallaby)		P4	
127.	24145 <i>Setonix brachyurus</i> (Quokka)		T	
Maluridae				
128.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
129.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
130.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
Megapodiidae				
131.	24557 <i>Leipoa ocellata</i> (Malleefowl)		T	
Meliphagidae				
132.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
133.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
134.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
135.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
136.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
137.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
138.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
139.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
Meropidae				
140.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
Molossidae				
141.	24184 <i>Mormopterus planiceps</i> (Southern Freetail-bat)			
142.	24185 <i>Tadarida australis</i> (White-striped Freetail-bat)			
Motacillidae				
143.	24599 <i>Anthus australis</i> subsp. <i>australis</i> (Australian Pipit)			
Muridae				
144.	24215 <i>Hydromys chrysogaster</i> (Water-rat)		P4	
145.	24223 <i>Mus musculus</i> (House Mouse)	Y		
146.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
147.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
Myobatrachidae				
148.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
149.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
150.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
151.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
152.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
Myrmecobiidae				
153.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
Nannopercidae				
154.	-14551 <i>Edelia vittata</i>			
Nemesiidae				
155.	-12196 <i>Aname mainae</i>			
Neosittidae				
156.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
157.	24606 <i>Daphoenositta chrysoptera</i> subsp. <i>pileata</i> (Varied Sittella, Black-capped Sittella)			
Otididae				
158.	24610 <i>Ardeotis australis</i> (Australian Bustard)		P4	
Pachycephalidae				
159.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
160.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i> (Grey Shrike-thrush)			
161.	24616 <i>Falcunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)		P4	
162.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
163.	24623 <i>Pachycephala pectoralis</i> subsp. <i>fuliginosa</i> (Golden Whistler)			
164.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
165.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
Pardalotidae				
166.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
167.	24626 <i>Pardalotus punctatus</i> subsp. <i>xanthopyge</i> (Yellow-rumped Pardalote)			
168.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
169.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i> (Striated Pardalote)			
Pelecanidae				
170.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
Peramelidae				
171.	24153 <i>Isodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P5	
Percichthyidae				
172.	-15786 <i>Bostockia porosa</i>			
Percidae				
173.	-14927 <i>Perca fluviatilis</i>			
Petroicidae				
174.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
175.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
176.	24658 <i>Petroica cucullata</i> (Hooded Robin)			
177.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
178.	25695 <i>Petroica multicolor</i> (Scarlet Robin)			
179.	24660 <i>Petroica multicolor subsp. campbelli</i> (Scarlet Robin)			
Phalacrocoracidae				
180.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
181.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
182.	24666 <i>Phalacrocorax melanoleucos subsp. melanoleucos</i> (Little Pied Cormorant)			
183.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
184.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
Phalangeridae				
185.	24158 <i>Trichosurus vulpecula subsp. vulpecula</i> (Common Brushtail Possum)			
Podargidae				
186.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
187.	24679 <i>Podargus strigoides subsp. brachypterus</i> (Tawny Frogmouth)			
Podicipedidae				
188.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
189.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
190.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
191.	24682 <i>Tachybaptus novaehollandiae subsp. novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
Potoroidae				
192.	24162 <i>Bettongia penicillata subsp. ogilbyi</i> (Woylie, Brush-tailed Bettong)		T	
Procellariidae				
193.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
Pseudocheiridae				
194.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum)		T	
Psittacidae				
195.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
196.	24731 <i>Calyptorhynchus banksii subsp. naso</i> (Forest Red-tailed Black-Cockatoo)		T	
197.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)		T	
198.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)		T	
199.	24735 <i>Glossopsitta porphyrocephala</i> (Purple-crowned Lorikeet)			
200.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
201.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
202.	24745 <i>Platycercus icterotis subsp. icterotis</i> (Western Rosella)			
203.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
204.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
205.	24750 <i>Platycercus zonarius subsp. semitorquatus</i> (Twenty-eight Parrot)			
206.	24751 <i>Platycercus zonarius subsp. zonarius</i> (Port Lincoln Parrot)			
207.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
208.	30854 <i>Polytelis anthopeplus subsp. westralis</i> (Regent Parrot)			
Pygopodidae				
209.	24990 <i>Aprasia pulchella</i>			
Rallidae				
210.	25727 <i>Fulica atra</i> (Eurasian Coot)			
211.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
212.	24765 <i>Gallirallus philippensis subsp. mellori</i> (Buff-banded Rail)			
213.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
214.	24767 <i>Porphyrio porphyrio subsp. bellus</i> (Purple Swamphen)			
215.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
216.	24773 <i>Rallus pectoralis subsp. clelandi</i> (Lewin's Rail)		X	Y
Salticidae				
217.	-1668 <i>Ocrisiona leucocomis</i>			
Scincidae				
218.	25035 <i>Ctenotus delli</i> (Darling Range Heath Ctenotus, skink)		P4	
219.	25049 <i>Ctenotus labillardieri</i>			
220.	25100 <i>Egernia napoleonis</i>			
221.	25115 <i>Hemiergis initialis subsp. initialis</i>			
222.	25475 <i>Hemiergis peronii</i>			
223.	25117 <i>Hemiergis peronii subsp. peronii</i>			
224.	25118 <i>Hemiergis peronii subsp. tridactyla</i>			
225.	25131 <i>Lerista distinguenda</i>			
226.	25184 <i>Menetia greyii</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
227.	25191 <i>Morethia lineocellata</i>			
228.	25192 <i>Morethia obscura</i>			
229.	25206 <i>Tiliqua rugosa subsp. palarra</i>			
230.	25207 <i>Tiliqua rugosa subsp. rugosa</i>			
Strigidae				
231.	25748 <i>Ninox novaeseelandiae</i> (Boobook Owl)			
Sturnidae				
232.	25752 <i>Sturnus vulgaris</i> (Common Starling)	Y		
Suidae				
233.	24259 <i>Sus scrofa</i> (Pig)	Y		
Sylviidae				
234.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
235.	24834 <i>Cincloramphus mathewsi</i> (Rufous Songlark)			
Tachyglossidae				
236.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
Tetragnathidae				
237.	-13100 <i>Nanometa gentilis</i>			
238.	-11711 <i>Tetragnatha nitens</i>			
Tettigoniidae				
239.	33989 <i>Pachysaga strobila</i> (cricket)		P1	
Threskiornithidae				
240.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
241.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
242.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
Thylacomyidae				
243.	24168 <i>Macrotis lagotis</i> (Bilby, Dalgyte)		T	
Turnicidae				
244.	24849 <i>Turnix varia subsp. varia</i> (Painted Button-quail)			
245.	24851 <i>Turnix velox</i> (Little Button-quail)			
Typhlopidae				
246.	25271 <i>Ramphotyphlops australis</i>			
Tytonidae				
247.	24852 <i>Tyto alba subsp. delicatula</i> (Barn Owl)			
248.	25764 <i>Tyto novaehollandiae</i> (Masked Owl)			
249.	24855 <i>Tyto novaehollandiae subsp. novaehollandiae</i> (Masked Owl (southern subsp))		P3	
Urodacidae				
250.	-12778 <i>Urodacus novaehollandiae</i>			
Varanidae				
251.	25225 <i>Varanus rosenbergi</i> (Heath Monitor)			
Vespertilionidae				
252.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
253.	24187 <i>Chalinolobus morio</i> (Chocolate Wattled Bat)			
254.	24189 <i>Falsistrellus mackenziei</i> (Western False Pipistrelle)		P4	
255.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
256.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
Zosteropidae				
257.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			
258.	24856 <i>Zosterops lateralis subsp. gouldi</i> (Grey-breasted White-eye)			
paradoxosomatidae				
259.	-12082 <i>Akamptogonus novarae</i>			

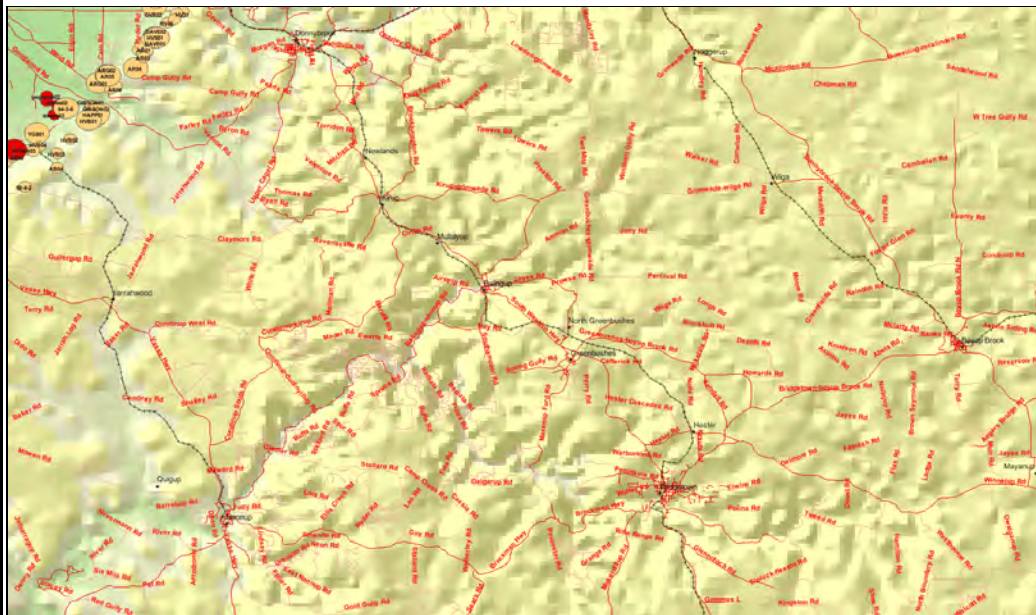
Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

TEC/PECs Within Project Area Vicinity

Printed by vanessa clarke on 26/11/2013

Query details :



- ◆ Major WA Towns
- ◆ Threated Ecological Communities
- Priority
- Threated
- State Boundaries
- Railways
- WA Roads
- Sealed
- Unsealed
- Other
- Other

Taxon	Status	Rank	IUCN	Criteria	EPBC	DEC	Region	DEC	District	Distribution	Flowering	Period	Recovery	Plan
Acacia flacelliformis		4				SWST		BLACKWOOD	WELLINGTON	Harvey, Eaton, Bunbury, Capel, Busseton, Donnybrook	Jul-Sep			
Acacia semitrullata		4				SWST		BLACKWOOD	WELLINGTON	Yallingup, Donnybrook, Harvey, Yarloop, Collie	Jun-Aug			
Banksia sp. Boyup Brook (L.W. Sage LWS 2366)		1				SWST		BLACKWOOD		Wilga S.F.				
Calothamnus rupestris		4				SWAN,SWST,WHTB		PERTH HILLS,BLACKWOOD,WELLINGTON,GREAT SOUTHERN		Red Hill, Gosnells, St Ronans N.R., Boyagin Rock, Collie, Wilga	Aug-Oct			
Causis sp. Boyanup (G.S. McCutcheon 1706)		3				SCST,SWST,WARR,WHTB		BLACKWOOD,WELLINGTON,DONNELLY,ALBANY,GREAT SOUTHERN		Boyanup State Forest, Bescabel, Kojonup, Whicher NR, Vasse, S of Stirling Ranges, Donnybrook, tutanning NR, Blackwood River NP, Shannon NP				
Corybas abditus		3				SCST,SWST,WARR		BLACKWOOD,FRANKLAND,ALBANY		Donnybrook, Walpole, Manypeaks	Oct-Nov			
Dillwynia sp. Capel (P.A. Jurjevich 1771)		1				SWST,WARR		BLACKWOOD,DONNELLY		Whicher Range, Nannup, Donnybrook, Pemberton	Sept-Oct			
Grevillea ripicola		4				SWST		BLACKWOOD,WELLINGTON		Collie, Kirup	Oct-Dec			
Platytheca anasima		2				SWST		BLACKWOOD		Capel, Donnybrook	Oct-Nov			
Senecio gilbertii		1				SWAN,SWST		PERTH HILLS,BLACKWOOD		Birdoon, York, Wooroloo, Wilga, Gooseberry Hill	Sep-Nov			
Stylidium acuminatum subsp. acuminatum		1				SWST		BLACKWOOD,WELLINGTON		Collie, Donnybrook	Oct-Nov			
Synsphaea polypodoides		3				SWST		BLACKWOOD,WELLINGTON		Dardanup, Boyanup, Donnybrook	Sep-Oct			
Tetralia sp. Blackwood River (A.R. Annels 3043) PN		3				SCST,SWST,WARR		BLACKWOOD,DONNELLY,FRANKLAND,ALBANY		Denmark, Witchescliffe, Green Range,Manjimup, Mullalyup				
Tetralia parvifolia		3				SWST		BLACKWOOD		Capel, East of Donnybrook, Collie	Oct			
Thysanotus gageoides		3				SCST,SWST,WHTB		BLACKWOOD,ALBANY,GREAT SOUTHERN		Cranbrook, Cape Riche, Stirling Range, Borden, Ongerup, Mullalyup, Corackerup, Boxwood Hill	Oct-Nov			
Thysanotus unicus		2				SWST,WARR		BLACKWOOD,WELLINGTON,DONNELLY		Boyup Brook, Collie, Unicup, Kingston, Mullalyup	Oct-Dec			

Appendix C: Vegetation Classification and Condition Scales, and Fauna Habitat Condition Scales

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Table C.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees > 30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees < 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs > 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs < 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, sedges, herbs	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses / sedges / herbs

Table C.2: Summary of adapted Vegetation condition scale as adapted from Keighery (1994).

Vegetation condition	Condition description
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
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. 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.
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 to 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.

Table C.3: Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat	These areas often have a significant human induced loss of vegetation, and / or a large number of vehicle tracks and / or have been completely cleared, and / or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

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Appendix D: Vegetation Association, Fauna Habitat and Condition Mapping

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411800

412000

412200

412400

Vegetation Condition Scale (Bush Forever Volume 2, Government of Western Australia 1994)

P - Pristine - Pristine or nearly so, no obvious signs of disturbance

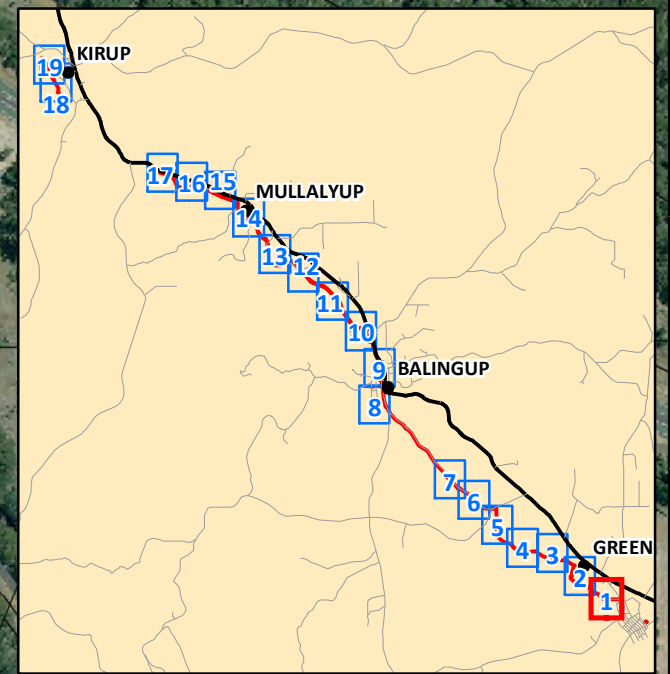
E - Excellent - Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species

VG - 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

G - Good - Vegetation structure significantly altered by very obvious signs of multiple disturbance. 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

D - 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 to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing

CD - 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



6255400

6255200

6255000

6254800

6254600



Legend

Legend		Vegetation Units	
	Survey Corridor		EmCcW
	Quadrats		EmCcOW
	River/Creek		EmCcBgPIW
	Roads		CcW
	Railway Corridor		CcEmErW
	Cadastre		CI
			PI

Jarrah-marri woodland with a mid-storey that may range in the following dominant taxa in the upper shrub layer: *Xanthorrhoea preissii*, *Macrozamia riedlei*, *Mirbelia dilatata*, *Hakea amplexicaulis*, *Acacia extensa*, *Leucopogon verticillatus*. The following as dominants in the mid-shrub layer: *Bossiaea ornata*, *B. linophylla*, *Hibbertia hypericoides*, *Phyllanthus calycinus*, *Pteridium esculentum*. Over sedges including *Tetraria capillaris* and *Patersonia umbrosa* var. *xanthina*.

Jarrah-marri open woodland with a mid-storey that may range in the following dominant taxa in the upper shrub layer: *Pteridium esculentum*, *Hakea amplexicaulis* with *Bossiaea ornata*, *Leucopogon nutans* as primary dominants in the lower shrubs; over *Tetraria* species.

Jarrah-marri with bull banksia (*Banksia grandis*) and snotty gobble (*Persoonia longifolia*) woodland with a mid-storey that may range in the following dominant taxa in the mid-shrub layer: *Bossiaea ornata*, *Hibbertia amplexicaulis* over *Tetraria capillaris* and *Desmodcladus fascicularis*.

Marri woodland over a mid-shrub layer of *Taxandria parviceps* and *Bossiaea linophylla* over lower shrubs including: *Pteridium esculentum*, *Hypocalymma angustifolia*, *Acacia pulchella*, *Bossiaea linearifolia* over sedges of *Tetraria capillaris*, *Patersonia occidentalis* and *P. pygmaea*.

Marri-jarrah-flooded gum (*Eucalyptus rudis*) woodland over a tall shrubland including *Trymalium odoratissimum* subsp. *trifidum*, *Agonis linearifolia*, *Hakea lissocarpha* over smaller shrubs such as *Phyllanthus calycinus*, *Acacia pulchella* with a dominant sedge layer of *Lepidosperma effusum*.

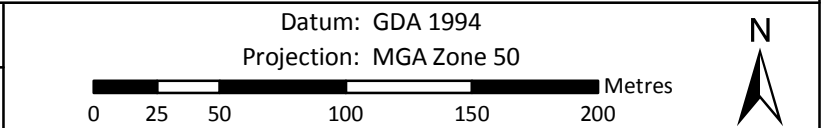
Area historically cleared of all native vegetation.

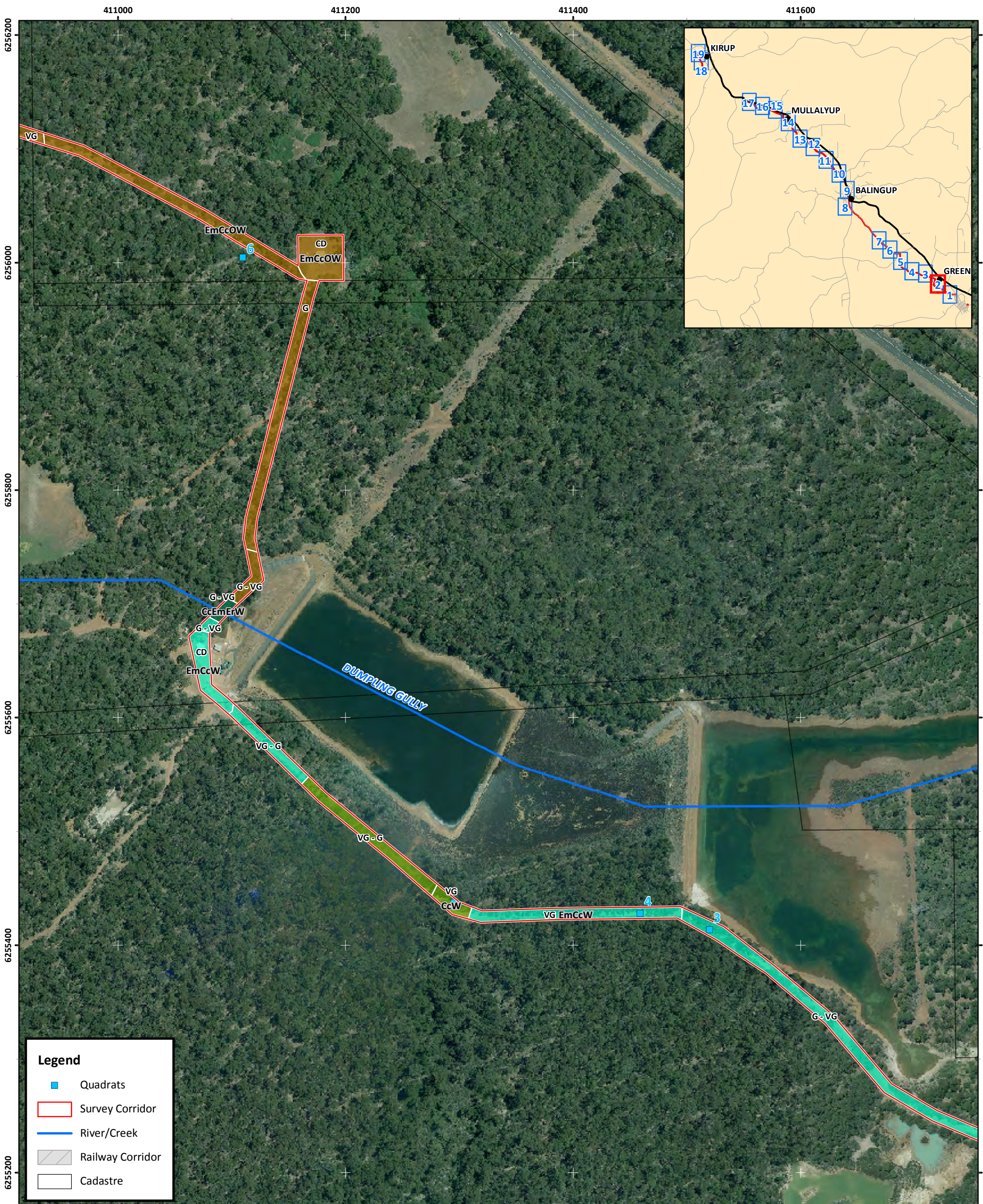
Area containing planted introduced species that are plantation or orchard.

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Figure D1: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD01





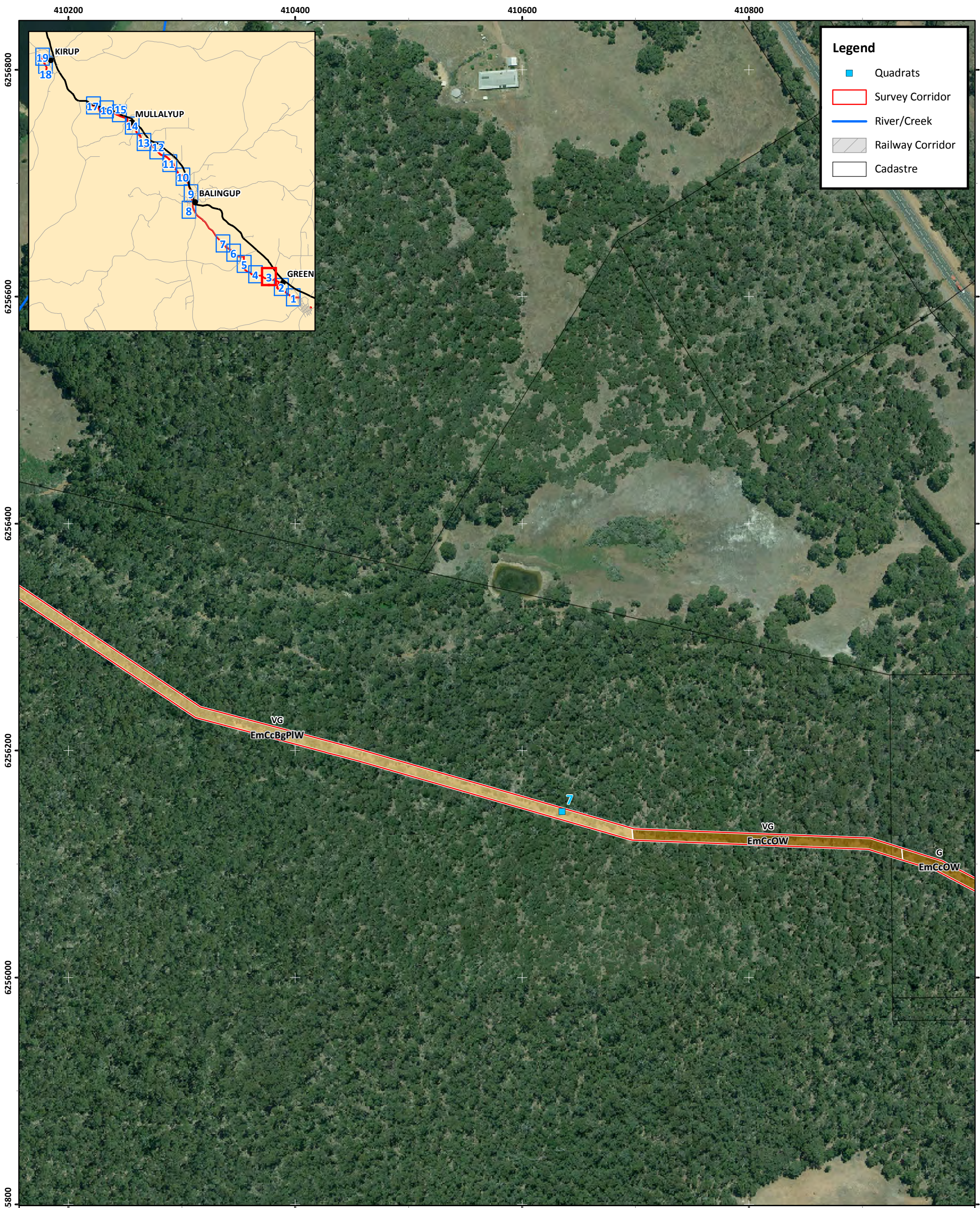
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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D2: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD02

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D3: Vegetation complexes, fauna habitat and condition mapping.

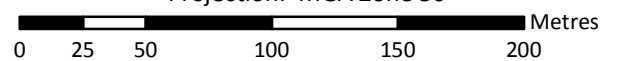
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD03

Datum: GDA 1994
 Projection: MGA Zone 50



409400

409600

409800

410000

6256800

6256600

6256400

6256200

6256000



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

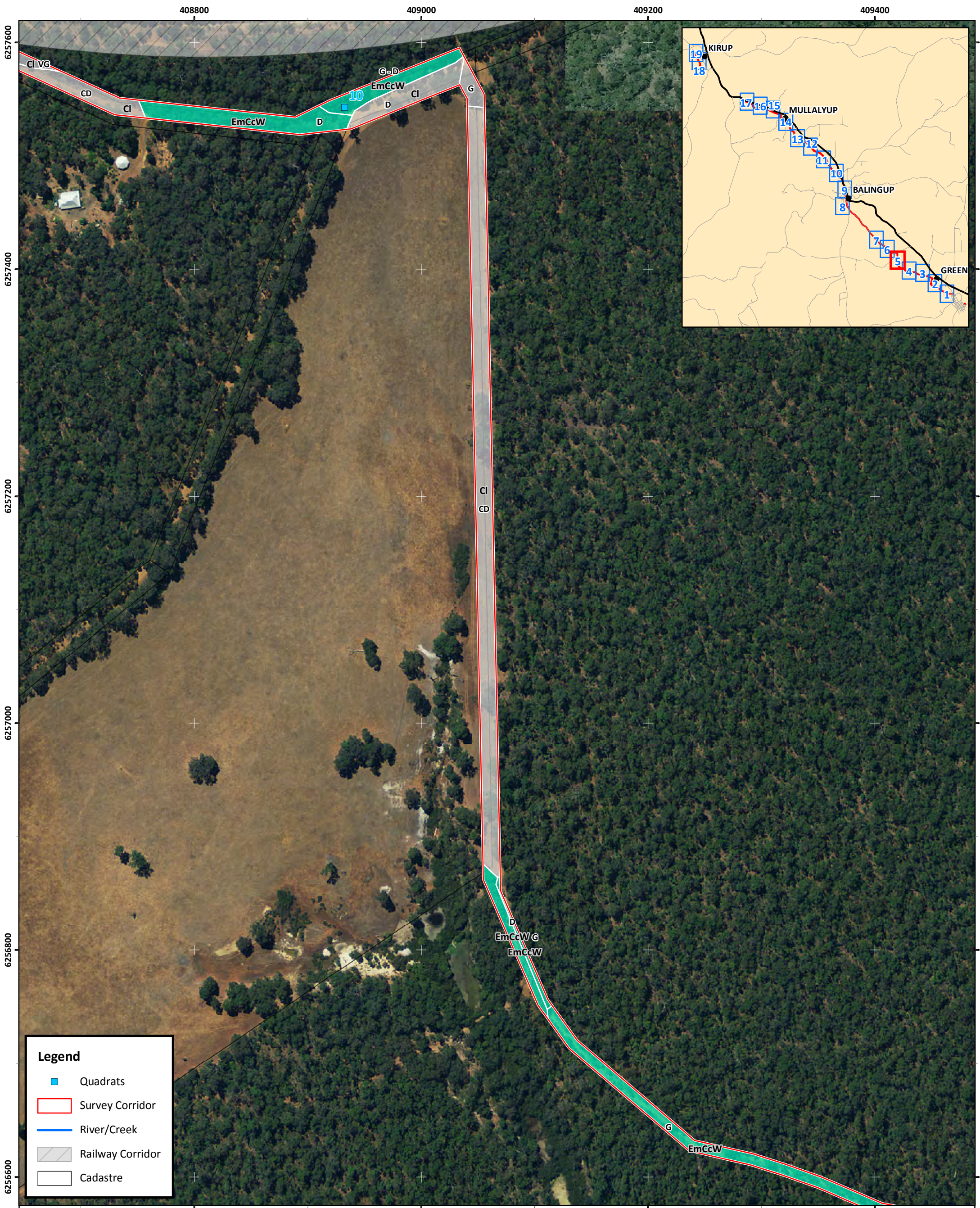
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Figure D4: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD04

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D5: Vegetation complexes, fauna habitat and condition mapping.

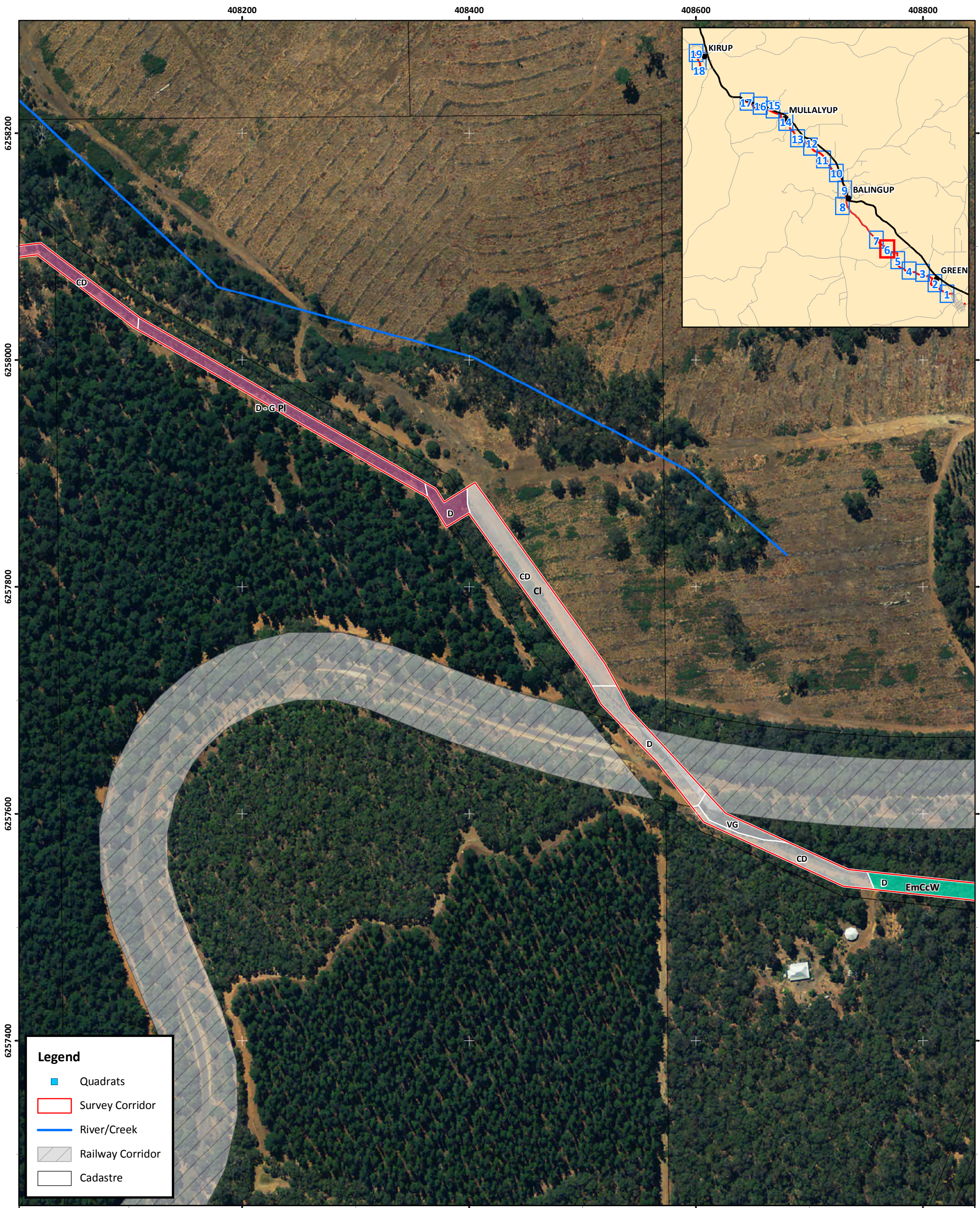
Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD05

Datum: GDA 1994
 Projection: MGA Zone 50

0
25
50
100
150
200

Metres

N



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

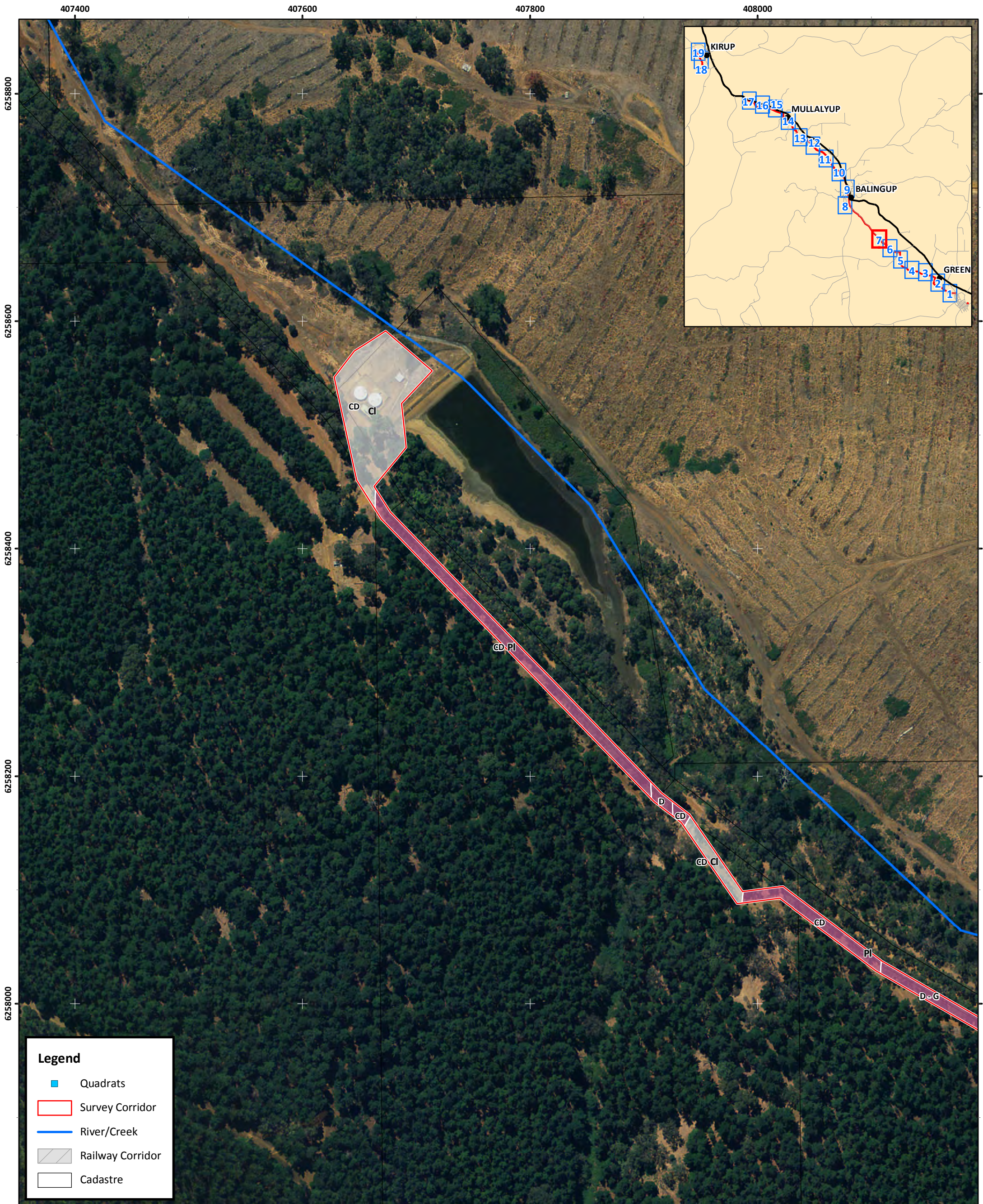
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D6: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD06

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D7: Vegetation complexes, fauna habitat and condition mapping.

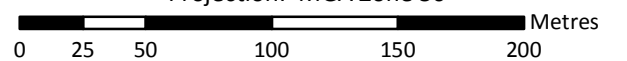
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD07

Datum: GDA 1994
 Projection: MGA Zone 50





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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D8: Vegetation complexes, fauna habitat and condition mapping.

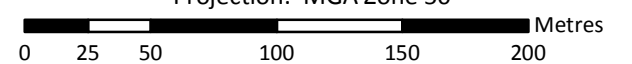
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD08

Datum: GDA 1994
 Projection: MGA Zone 50





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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment
Figure D9: Vegetation complexes, fauna habitat and condition mapping.

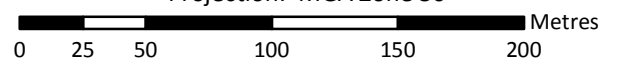
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD09

Datum: GDA 1994
 Projection: MGA Zone 50



405000

405200

405400

405600

6262800

6262600

6262400

6262200

6262000



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Figure D10: Vegetation complexes, fauna habitat and condition mapping.

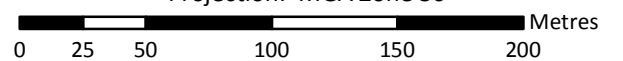
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD10

Datum: GDA 1994
 Projection: MGA Zone 50





Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

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 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

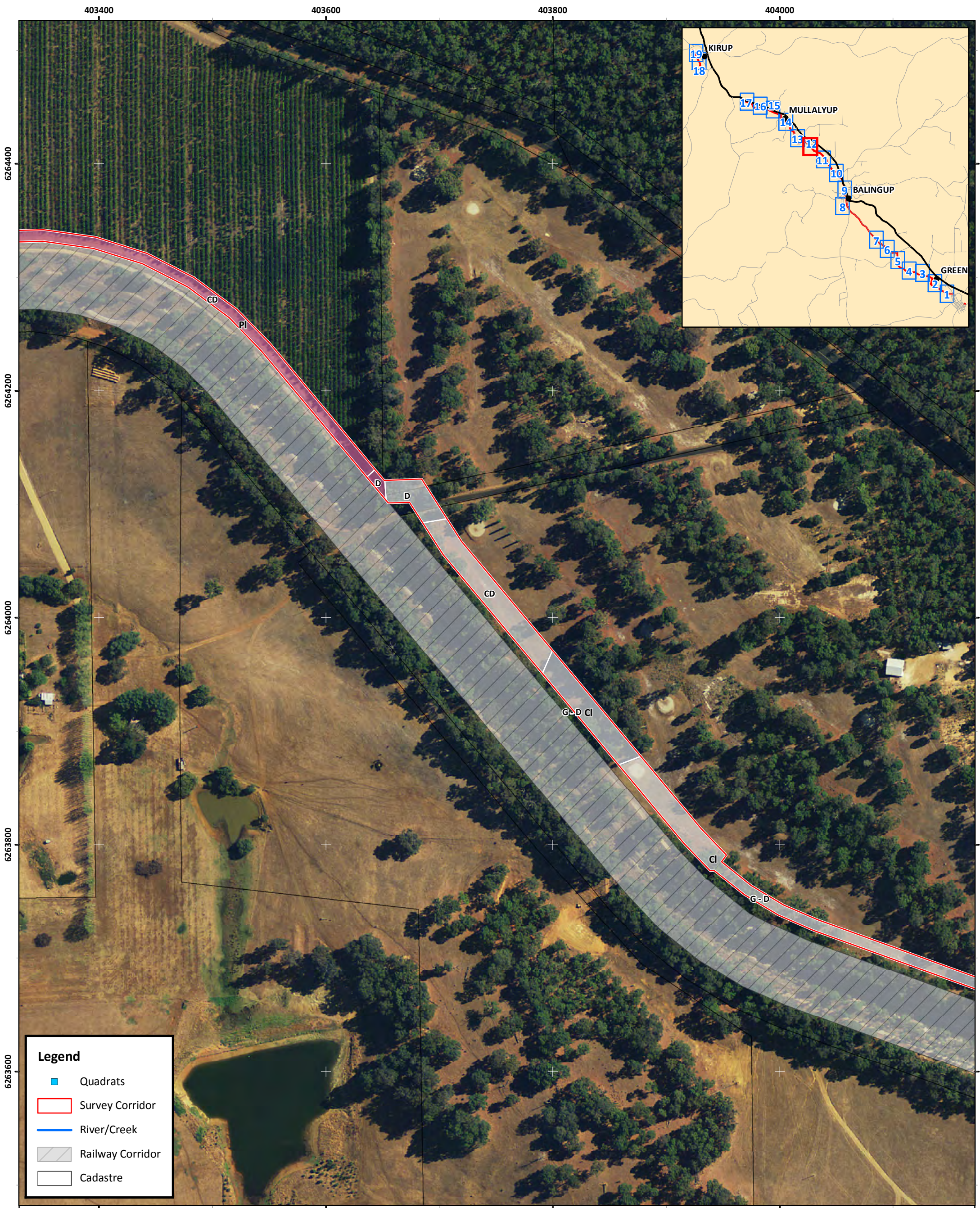
Figure D11: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD11

Datum: GDA 1994
 Projection: MGA Zone 50

0
25
50
100
150
200

Metres



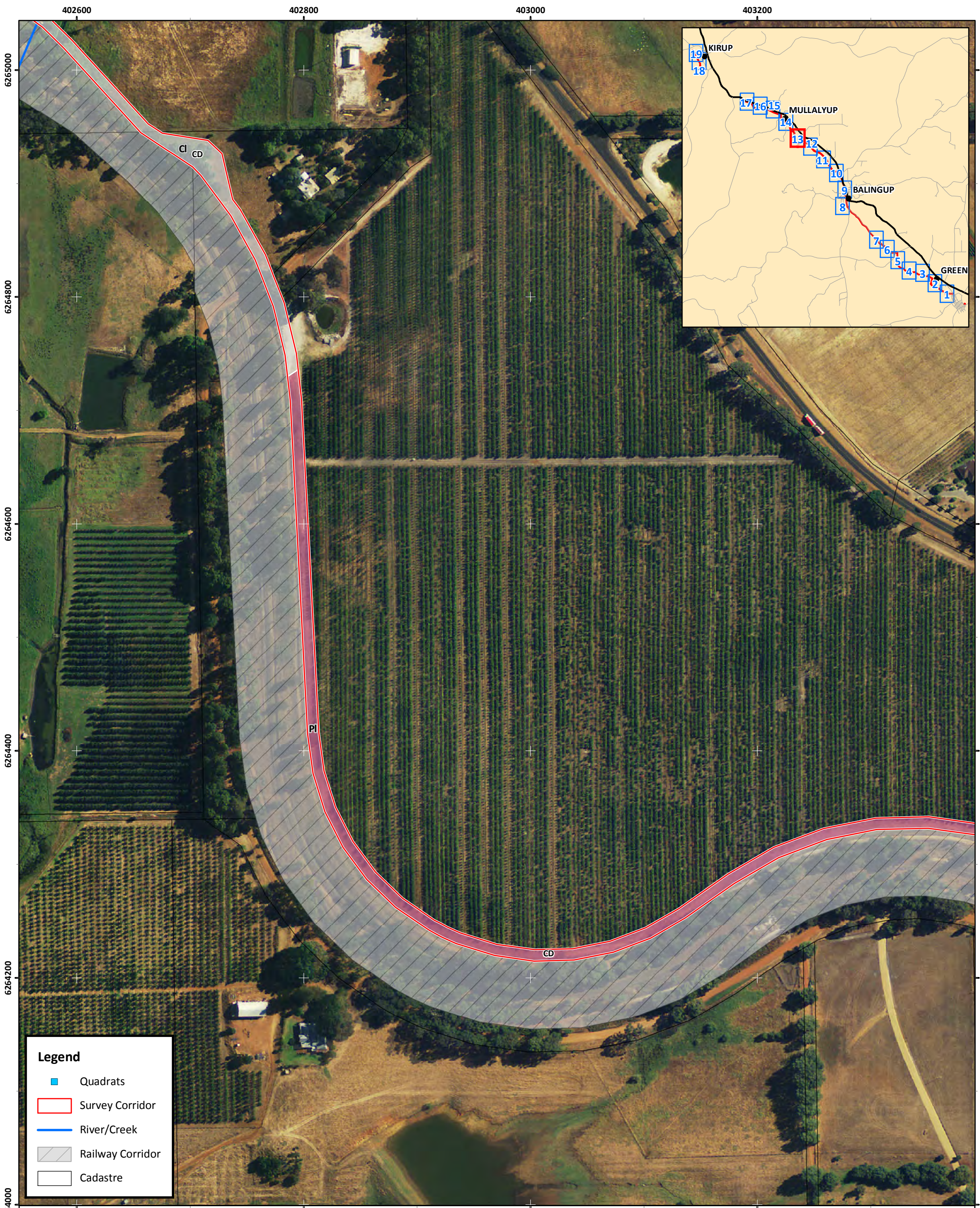
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D12: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD12

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D13: Vegetation complexes, fauna habitat and condition mapping.

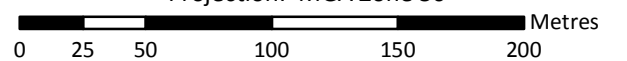
Author: V. Clarke

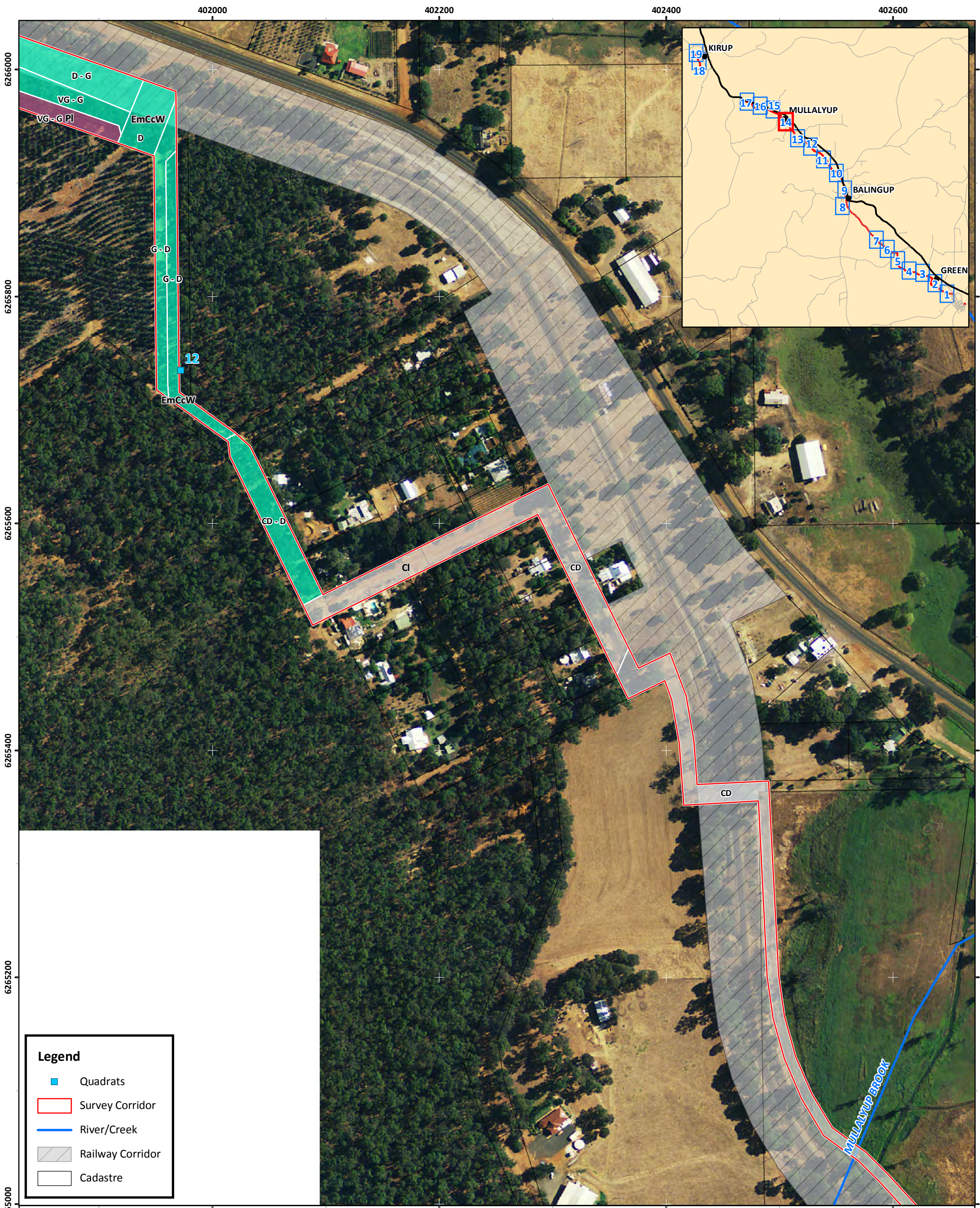
Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD13

Datum: GDA 1994
 Projection: MGA Zone 50





Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D14: Vegetation complexes, fauna habitat and condition mapping.

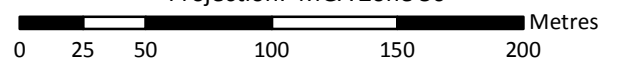
Author: V. Clarke

Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD14

Datum: GDA 1994
 Projection: MGA Zone 50



401200

401400

401600

401800

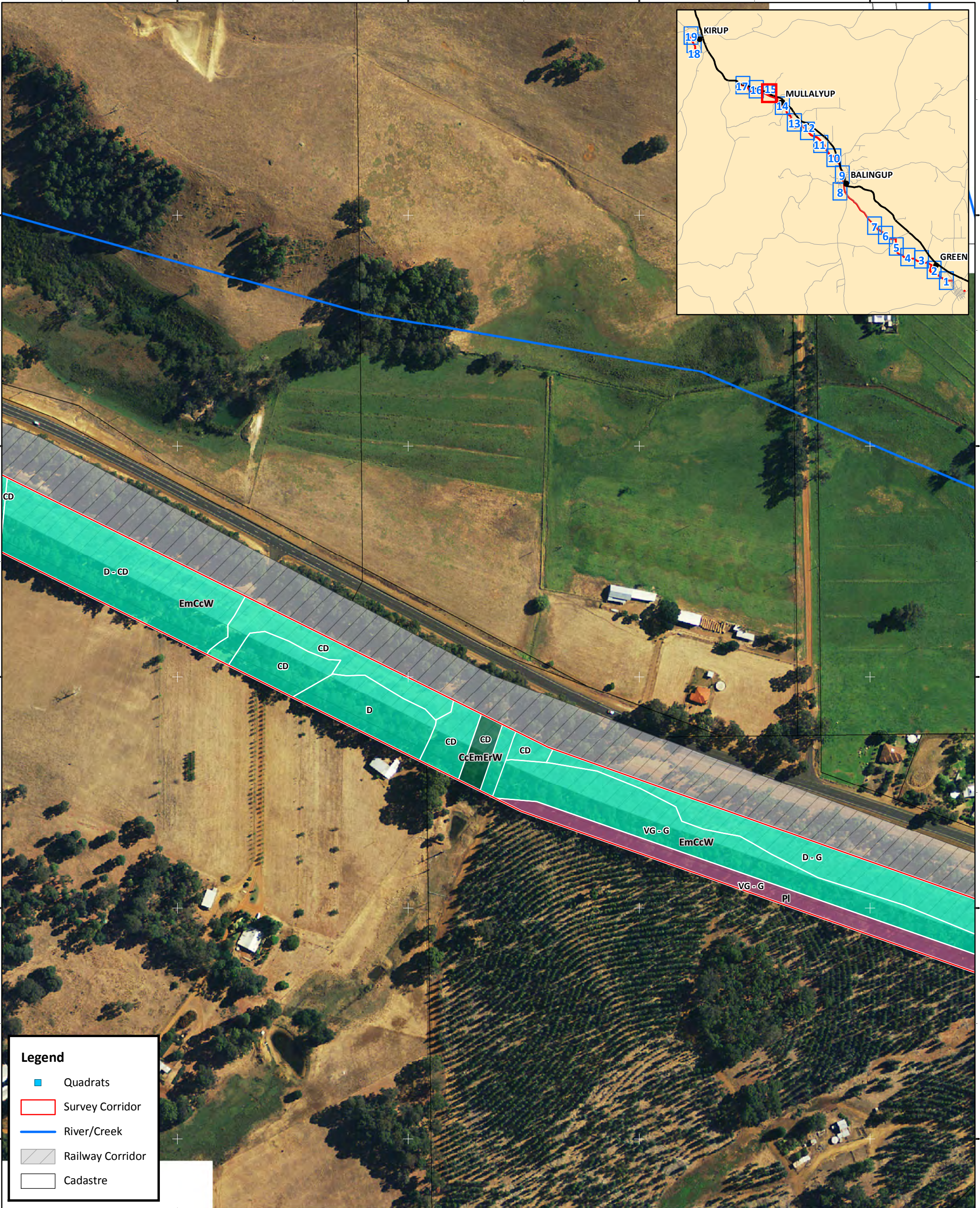
6266600

6266400

6266200

6266000

6265800



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D15: Vegetation complexes, fauna habitat and condition mapping.

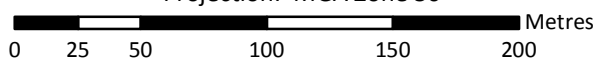
Author: V. Clarke

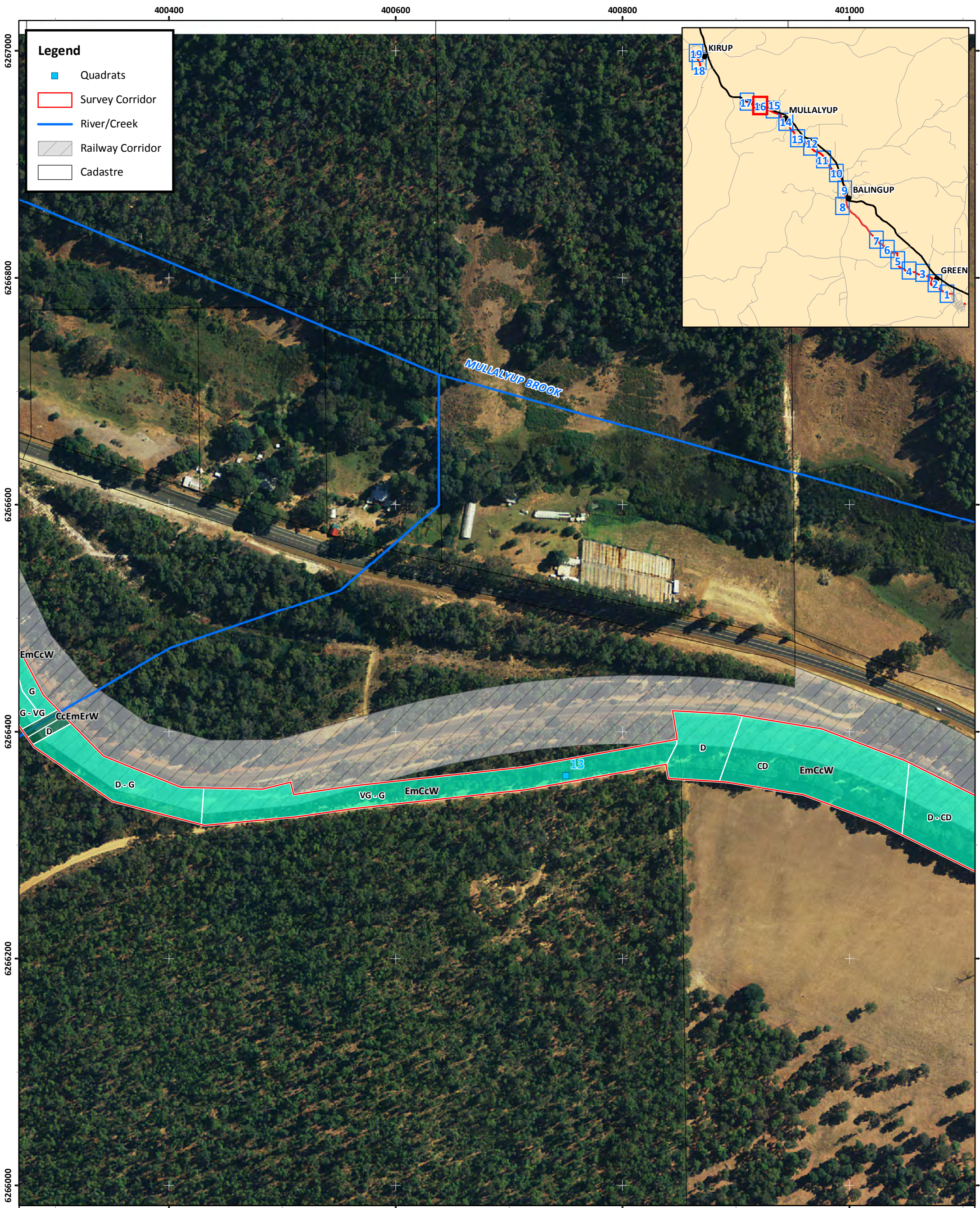
Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD15

Datum: GDA 1994
 Projection: MGA Zone 50





Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D16: Vegetation complexes, fauna habitat and condition mapping.

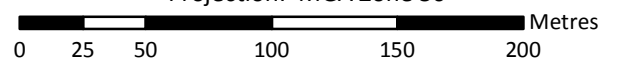
Author: V. Clarke

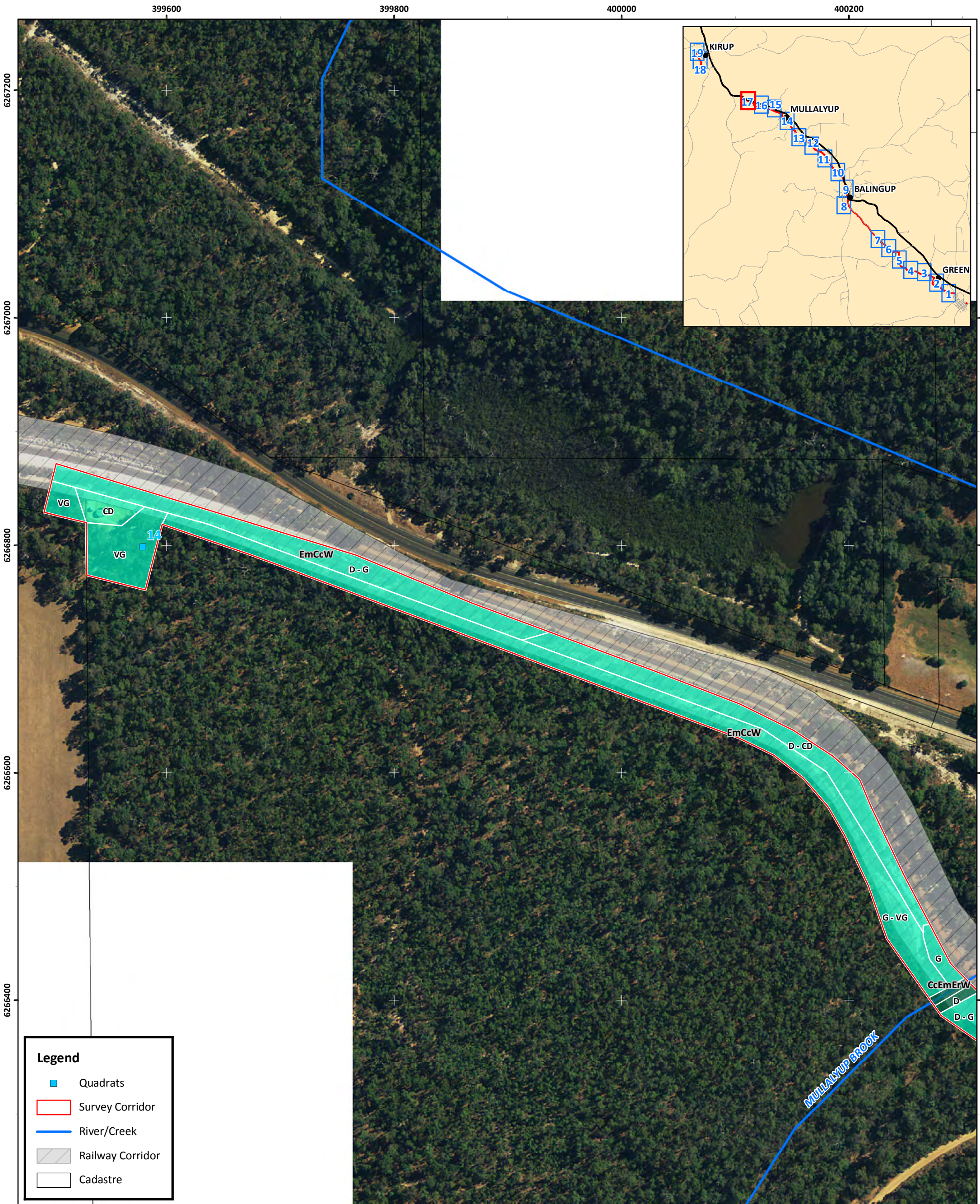
Date: 28-01-2014

Drawn: H. Thornton

4175-13_GDR_1Rev0_140128_FigD16

Datum: GDA 1994
 Projection: MGA Zone 50

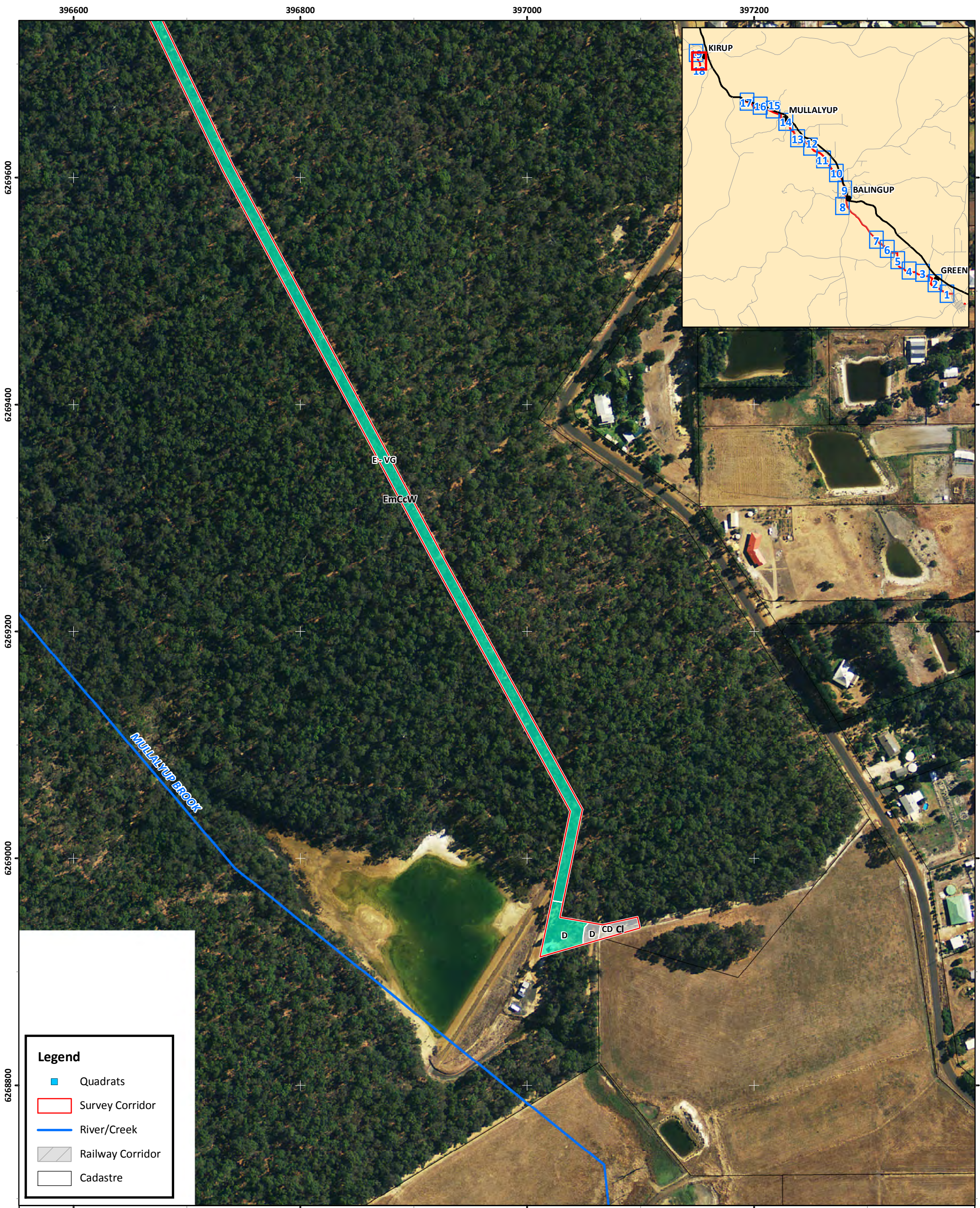




Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D17: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD17	



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

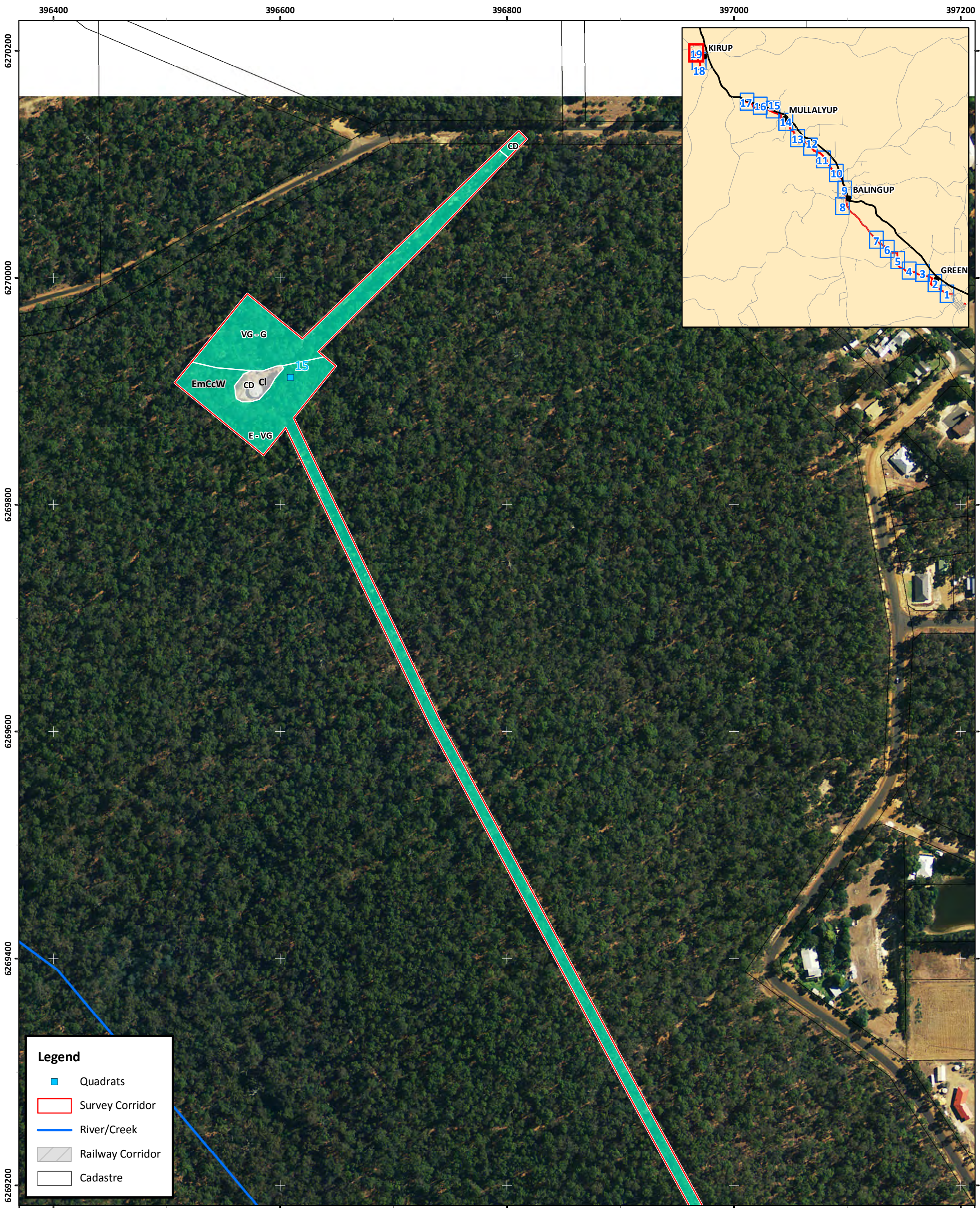
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D18: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD18

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



Legend

- Quadrats
- Survey Corridor
- River/Creek
- Railway Corridor
- Cadastre

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure D19: Vegetation complexes, fauna habitat and condition mapping.

Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigD19

Datum: GDA 1994
 Projection: MGA Zone 50

0
25
50
100
150
200

Metres

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Appendix E: Quadrat and Relevé Data

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Opportunistic Species:

**Acacia saligna*
**Avena fatua*
**Freesia* sp.
**Podocarpus drouynianus*
**Romulea rosea*
**Trifolium hirtum*
Acacia applanata
Acacia pulchella
Astroloma pallida
Bossiaea ornata
Caesia micrantha
Clematis pubescens
Conostylis aculeata subsp. *aculeata*
Dampiera alata
Daviesia decurrens
Dianella revoluta
Gompholobium marginatum
Hibbertia hypericoides
Hibbertia pilosa
Hovea chorizemifolia
Hypolaena exsulca
Lepidosperma sp. (sterile)
Leucopogon nutans
Leucopogon verticillatus
Lomandra preissii
Lomandra sericea
Macrozamia riedlei
Opercularia hispidula
Patersonia occidentalis
Pericalymma ellipticum
Persoonia longifolia
Phyllanthus calycinus
**Rubus ulmifolius*
Scaevola calliptera
Stylidium piluliferum
Tetrahaena laevis
Tetratheca setigera
Thelymitra sp. (immature)
**Watsonia* sp. (sterile)
Xanthorrhoea preissii

Site WC02

Location: Charnley Road **Type:** Quadrat
Date: 14/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 411915 mE **Northing:** 6255126 mN
Habitat: Upperslope; negligible slope and aspect.
Soil: Lateritic sandy loam.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over a *Xanthorrhoea preissii* Open Shrubland over an Open Low Heath of *Bossiaea ornata* and *Hibbertia hypericoides* over *Tetraria capillaris* Very Open Sedgeland on lateritic sandy loam.
Vegetation Complex: Mapped as Dwellingup D1.
Veg Condition: Excellent.
Fire Age: ~10 years.



WC02- Quadrat

WN02 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	30-70	10-30
<i>Corymbia calophylla</i>	30-70	10-30
<i>Persoonia longifolia</i>	2-10	1.5
<i>Xanthorrhoea preissii</i>	10	0.9
<i>Hakea amplexicaulis</i>	1	1.10
<i>Bossiaea ornata</i>	30-70	0.6
<i>Hibbertia hypericoides</i>	30-70	0.5
<i>Tetrahena laevis</i>	+	0.6
<i>Tetraria capillaris</i>	2-10	0.5
<i>Philothea spicata</i>	+	0.4
<i>Acacia extensa</i>	+	1.5
<i>Scaevola calliptera</i>	+	0.1
<i>Lomandra ?sonderi</i> (sterile)	+	0.7
<i>Hibbertia pilosa</i>	+	
<i>Hovea chorizemifolia</i>	+	
<i>Hibbertia amplexicaulis</i>	+	
<i>Grevillea</i> sp. (sterile)	+	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	
<i>Leucopogon ? capitellatus</i>	+	
<i>Dampiera linearis</i>	+	
<i>Pentapeltis peltigera</i>	+	

<i>Drosera pallida</i>	+
<i>Tetradthea setigera</i>	+
<i>Macrozamia riedlei</i>	+
<i>Desmocladius fascicularis</i>	+
<i>Lagenophora huegelii</i>	+
<i>Lepidosperma ? pubisquameum</i>	+
<i>Opercularia echinocephala</i>	+
<i>Daviesia decurrens</i>	+
<i>Pterostylis recurva</i>	+
<i>Lomandra nigricans</i>	+
<i>Leucopogon verticillatus</i>	+
<i>Conostylis setigera</i>	+
<i>Leschenaultia biloba</i>	+
<i>Billardiera variifolia</i>	+
<i>Patersonia babianoides</i>	+

Opportunistic records:

<i>Stylidium amoenum</i>
<i>Trachymene pilosa</i>
<i>Levenhookia pusilla</i>
<i>Drosera glanduligera</i>
<i>Daucus glochidiatus</i>
<i>Agrostocrinum stypandroides</i>
<i>Stylidium calcaratum</i>
<i>Comesperma ciliatum</i>
<i>Austrostipa campylachne</i>
<i>Thomasia grandiflora</i>
<i>Gompholobium ovatum</i>
<i>Neurachne alopecuroidea</i>
<i>Lyperanthus serratus</i>
<i>Lobelia heterophylla</i>
<i>Tripterococcus brunonis</i>
<i>Conostylis aculeata</i>
<i>Astroloma pallida</i>
<i>Astartea</i> sp . (sterile)

Comments:

Quadrat placed to capture maximum diversity and best condition vegetation. Vegetation condition along Charnley Road can vary from 'excellent' to 'good'.

Site WC03

Location: Charnley Road; between road and dam. **Type:** Relevé
Date: 14/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 411520 mE **Northing:** 6255413 mN
Habitat: Upper slope; negligible slope and aspect.
Soil: Brown loam.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over **Acacia podalyriifolia*
 Low Open Woodland over *Bossiaea ornata*, *Hibbertia hypericoides* Open Low Heath over *Tetraria capillaris*
 Very Open Sedgeland on brown loam.
Vegetation Complex: Mapped as Catterick CC1.
Veg Condition: Good.
Fire Age: +10 years.



WC03- Relevé

WC03 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Corymbia calophylla</i>	10-30	10-30
<i>*Acacia podalyriifolia</i>	>10	0.1
<i>Bossiaea ornata</i>	>70	0.01
<i>Acacia pulchella</i>	>10	0.6
<i>Hibbertia hypericoides</i>	10-30	0.4
<i>Tetraria capillaris</i>	10-30	0.35
<i>Caesia micrantha</i>	+	
<i>*Hypochoeris glabra</i>	+	
<i>Dampiera linearis</i>	+	
<i>Lomandra purpurea</i>	+	
<i>Tripterococcus brunonis</i>	+	
<i>Thysanotus</i> sp. (climber/sterile)	+	
<i>Tetrahena laevis</i>	+	
<i>Gompholobium marginatum</i>	+	
<i>Scaevola calliptera</i>	+	
<i>Hemigenia incana</i>	+	
<i>Drosera</i> sp. (climber/sterile)	+	
<i>Pentapeltis peltigera</i>	+	
<i>Hypocalymma angustifolia</i>	+	

<i>Desmocladus fascicularis</i>	+
<i>Austrostipa campylachne</i>	+
<i>Kennedia prostrata</i>	+
<i>Burchardia congesta</i>	+
<i>Hakea lissocarpha</i>	+
* <i>Watsonia</i> sp. (sterile)	+
<i>Tetralochea setigera</i>	+
<i>Jacksonia alata</i>	+
<i>Synaphea gracillima</i>	+
<i>Comesperma conferta</i>	+
<i>Thysanotus multiflorus</i>	+
<i>Xanthosia candida</i>	+
<i>Bossiaea linophylla</i>	+
<i>Logania serpyllifolia</i> subsp. <i>serpyllifolia</i>	+

Comments: Area is very small and linear; previously degraded but remains relatively diverse.

Site WC04

Location: Charnely Road, Greenbushes; between two dams **Type:** Quadrat
Date: 14/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 411459 mE **Northing:** 6255428 mN
Habitat: Midslope; negligible slope and aspect.
Soil: Brown loam with occasional laterite.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over *Bossiaea ornata*, *Hibbertia hypericoides*, *Leucopogon nutans* Low Shrubland over *Tetraria capillaris* Very Open Sedgeland.
Vegetation Complex: Mapped as Catterick CC1.
Veg Condition: Very good to Excellent.
Fire Age: 5-10 years.



WC04- Quadrat

WC04 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Corymbia calophylla</i>	10-30	10-30
<i>Bossiaea ornata</i>	2-10	0.4
<i>Hibbertia hypericoides</i>	10-30	0.25
<i>Leucopogon nutans</i>	2-10	0.15
<i>Tetraria capillaris</i>	2-10	0.3
<i>Xanthorrhoea preissii</i>	2-10	2.0
<i>Clematis pubescens</i>	+	cl
<i>Burchardia congesta</i>	+	
<i>Xanthosia candida</i>	+	
<i>Caladenia latifolia</i>	+	
<i>Tetrahena laevis</i>	+	
<i>Lagenophora huegelii</i>	+	
* <i>Briza maxima</i>	+	
<i>Opercularia echinocephala</i>	+	
<i>Lomandra purpurea</i>	+	
<i>Caesia micrantha</i>	+	
<i>Macrozamia riedlei</i>	+	
<i>Cassytha glabella</i>	+	
<i>Dampiera linearis</i>	+	

<i>Scaevola calliptera</i>	+
<i>Lomandra sericea</i>	+
<i>Hibbertia amplexicaulis</i>	+
<i>Stylidium amoenum</i>	+
<i>Waitzia acuminata</i>	+
* <i>Hypochaeris glabra</i>	+
<i>Hemigenia incana</i>	+
<i>Gompholobium marginatum</i>	+
<i>Levenhookia pusilla</i>	+
<i>Desmocladius fascicularis</i>	+
<i>Persoonia longifolia</i>	+

Opportunistic collections from vicinity:

Logania serpyllifolia subsp. *angustifolia*

Hybanthus calycinus

Tetraria octandra

Senecio multicaulis subsp. *multicaulis*

Comments: Nil.

Site WN05

Location: Charnley Road, Greenbushes; adjacent to second dam **Type:** Relevé
Date: 14/10/2013 **Described by:** VC **Seasonal Conditions:** Very Good
MGA Zone: 50 **Easting:** 411295 mE **Northing:** 6255437 mN
Habitat: Midslope; gentle gradient towards dam.
Soil: Brown loam with laterite.
Vegetation: *Corymbia calophylla* Woodland over *Taxandria linearifolia* Very Open Tall Shrubland over an Open Shrubland of *Pteridium esculentum*, *Bossiaea linearifolia* and *Acacia pulchella* over an Open Low Shrubland of *Hypocalymma angustifolia* over a *Tetraria capillaris* Very Open Sedgeland on brown loam.
Vegetation Complex: Mapped as Catterick CC1.
Veg Condition: Good – Very Good.
Fire Age: +10 years.



WN05 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Taxandria linearifolia</i>	2-10	2.0
<i>Pteridium esculentum</i>	2-10	1.2
<i>Bossiaea linearifolia</i>	2-10	1.0
<i>Acacia pulchella</i>	2-10	1.0
<i>Hypocalymma angustifolia</i>	2-10	0.6
<i>Tetraria capillaris</i>	<1	0.5
<i>Xanthorrhoea preissii</i>	+	
<i>Acacia extensa</i>	+	
<i>Hibbertia pilosa</i>	+	
<i>Bossiaea ornata</i>	+	
<i>Hemigenia incana</i>	+	
<i>Philothea spicatus</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Tremandra stelligera</i>	+	
<i>Neurachne alopecuroidea</i>	+	
* <i>Hypochoeris glabra</i>	+	
<i>Thysanotus</i> sp. (climber/sterile)	+	
<i>Caesia micrantha</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Lagenophora huegelii</i>	+	
* <i>Oxalis purpurea</i>	+	

<i>Patersonia occidentalis</i>	+
<i>Drosera erythrorhiza</i>	+
<i>Patersonia pygmaea</i>	+
<i>Desmodium fascicularis</i>	+
<i>Lomandra purpurea</i>	+
<i>Meeboldina scariosa</i>	+

Comments: Signs of previous disturbance and overstorey trees are regrowth.

Site WC06

Location: Tank track from Charnley Road, North Greenbushes **Type:** Quadrat
Date: 15/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 411109 mE **Northing:** 6256004 mN
Habitat: Upperslope.
Soil: Lateritic loam with extruding laterite boulders (common).
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Open Woodland over a Shrubland of *Pteridium esculentum* and *Hakea amplexicaulis* over an Low Shrubland of *Bossiaea ornata*, *Leucopogon nutans* over a very open **Briza maxima* grassland on lateritic loam.
Vegetation Complex: Mapped as Catterick CC1.
Veg Condition: Degraded.
Fire Age: ?5-10 years.



WC06- Quadrat

WN06 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	2-10	10-30
<i>Corymbia calophylla</i>	2-10	10-30
<i>Pteridium esculentum</i>	10-30	1.0
<i>Bossiaea ornata</i>	2-10	0.5
<i>Hakea amplexicaulis</i>	2-10	1.2
<i>*Hypochoeris glabra</i>	<1	0.4
<i>Leucopogon nutans</i>	2-10	0.6
<i>*Briza maxima</i>	10-30	0.5
<i>Hibbertia amplexicaulis</i>	2-10	0.5
<i>Clematis pubescens</i>	+	
<i>*Asparagus asparagoides</i>	+	
<i>Hardenbergia comptoniana</i>	+	
<i>Hibbertia pilosa</i>	+	
<i>*Watsonia</i> sp. (sterile)	+	
<i>Haemodorum</i> sp. (sterile)	+	
<i>Persoonia longifolia</i>	+	

Opportunistic collections:

Sowerbaea laxiflora

Banksia grandis
Allocasuarina fraseriana
Acacia pulchella
**Briza minor*
Thelymitra sp. (immature)
Hovea chorizemifolia
Scaevola calliptera
Caladenia sp. (immature)
Caladenia flava subsp. *flava*
Tripterococcus brunonis
Banksia nivea
Stylidium calcaratum
**Acacia podalyriifolia*

Comments: Degraded through logging and frequent fire; diversity is low in understorey and weed proliferation is high..

Site WC07

Location: Track leading from water tank; south of Hay Road, North Greenbushes **Type:** Quadrat
Date: 15/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 410635 mE **Northing:** 6256146 mN
Habitat: Midslope.
Soil: Lateritic loam.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over *Banksia grandis*, *Persoonia longifolia* Open Low Woodland over *Bossiaea ornata* Open Low Shrubland on lateritic loam.
Vegetation Complex: Mapped as Dwellingup D1.
Veg Condition: Excellent.
Fire Age: ~10 years.



WC07- Quadrat

WN07 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Corymbia calophylla</i>	10-30	10-30
<i>Banksia grandis</i>	2-10	8
<i>Persoonia longifolia</i>	2-10	4
<i>Bossiaea ornata</i>	30-70	0.6
<i>Opercularia hispidula</i>	+	
<i>Logania serpyllifolia</i> subsp. <i>angustifolia</i>	+	
<i>Xanthorrhoea gracilis</i>	+	
<i>Stylidium amoenum</i>	+	
<i>Leucopogon nutans</i>	+	
<i>Pterostylis pyramidalis</i>	+	
<i>Acacia pulchella</i>	+	
<i>Hovea chorizemifolia</i>	+	
<i>Scaevola calliptera</i>	+	
<i>Tetrahena laevis</i>	+	
<i>Tetraria capillaris</i>	+	
<i>Desmodadus fascicularis</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Hibbertia amplexicaulis</i>	+	
<i>Drosera</i> sp. (climbing/sterile)	+	

<i>Hypocalymma angustifolia</i>	+
<i>Acacia extensa</i>	+
<i>Hakea lissocarpha</i>	+
<i>Tetratheca affinis</i>	+
<i>Banksia nivea</i>	+
<i>Conostylis setigera</i>	+
<i>Philothea spicata</i>	+
<i>Hibbertia pilosa</i>	+
<i>Lomandra sp. (sterile)</i>	+
<i>Tetratheca setigera</i>	+
<i>Orchidaceae sp. (sterile)</i>	+
<i>Dampiera linearis</i>	+
<i>Daviesia decurrens</i>	+
<i>Caladenia sp. (sterile)</i>	+
<i>Patersonia pygmaea</i>	+
<i>Pterostylis recurva</i>	+
<i>Hibbertia sp. (sterile)</i>	+

Opportunistic species:

Labichea punctata
Elythranthera brunonis
Macrozamia riedlei
Acacia urophylla

Comments: Very low weeds and a diverse understorey; regrowth overstorey post-logging.

Site WC08

Location: Track leading from water tank; south of Hay Road, North Greenbushes **Type:** Relevé
Date: 15/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 409936 mE **Northing:** 6256341 mN
Habitat: Midslope.
Soil: Lateritic loamy-sand.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over *Xanthorrhoea preissii* and *Hakea lissocarpha* Shrubland over *Phyllanthus calycinus* Open Low Shrubland over a Very Open *Desmocladius fascicularis* Sedgeland on lateritic loamy-sand.
Vegetation Complex: Mapped as Catterick CC1.
Veg Condition: Very good.
Fire Age: ~5-10 years.



WN08- Releve

WN08 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Corymbia calophylla</i>	10-30	10-30
<i>Xanthorrhoea preissii</i>	2-10	1.5
<i>Hakea lissocarpha</i>	2-10	1.1
<i>Phyllanthus calycinus</i>	30-70	0.6
<i>Logania serpyllifolia</i> subsp. <i>angustifolia</i>	2-10	0.4
<i>Bossiaea ornata</i>	2-10	0.5
<i>Astroloma pallida</i>	2-10	0.3
<i>Desmocladius fascicularis</i>	2-10	0.15
<i>Banksia nivea</i>	+	
<i>Elythranthera brunonis</i>	+	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Acacia extensa</i>	+	
<i>Opercularia echinocephala</i>	+	
<i>Thysanotus</i> sp. (climbing/sterile)	+	
<i>Austrostipa campylachne</i>	+	
<i>Pimelea ciliata</i> subsp. <i>ciliata</i>	+	

Stylidium calcaratum

+

Comments: Nil.

Site WC09

Location: Track leading from water tank; south of Hay Road, North Greenbushes **Type:** Relevé
Date: 15/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 409503 mE **Northing:** 6256485 mN
Habitat: Drainage line/ephemeral creek.
Soil: Brown sandy loam.
Vegetation: *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Woodland over *Trymalium odoratissimum* and *Hakea lissocarpha* Shrubland over *Phyllanthus calycinus* Open Low Shrubland over A Very Open *Desmodcladus fascicularis* Sedgeland on lateritic loamy-sand.

Vegetation Complex: Mapped as Catterick CC1.

Veg Condition: Very good.

Fire Age: +10 years.



WC09 Releve

WC09 Species List

Name	% Cover	Height (m)
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus rudis</i>	2-10	10-30
<i>Trymalium odoratissimum</i>	2-10	1.5
<i>Acacia saligna</i>	2-10	1.5
* <i>Acacia podalyriifolia</i>	2-10	1.5
<i>Lepidosperma effusum</i>	2-10	0.4
<i>Acacia pulchella</i>	2-10	0.5
<i>Agonis linearifolia</i>	2-10	1.2
<i>Anigozanthos</i> sp. (sterile)	+	+
<i>Chorizema ilicifolia</i>	+	
<i>Hovea chorizemifolia</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Phyllanthus calycinus</i>	+	
<i>Stylidium amoenum</i>	+	
<i>Hypocalymma cordifolium</i>	+	
<i>Thysanotus</i> sp. (climbing/sterile)	+	

Opportunistic:

Caladenia ?ferruginea

Water Corporation

Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment, October 2013

Grevillea quercifolia

Site WC10

Location: Corner of Hay & Old Padbury Roads, North Greenbushes **Type:** Quadrat
Date: 15/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 408932 mE **Northing:** 6257542 mN
Habitat: Midslope; negligible slope and aspect.
Soil: Brown sandy, lateritic loam.
Vegetation: *Corymbia calophylla*, *Eucalyptus marginata* subsp. *marginata* Woodland over *Bossiaea linophylla* Open Tall Shrubland over an Open Shrubland of *Macrozamia riedlei*, *Pteridium esculentum* and *Leucopogon verticillatus* over a *Bossiaea ornata* Open Low Shrubland over a **Briza maxima* Very Open Grassland on brown sandy, lateritic loam.
Vegetation Complex: Mapped as Dwellingup D1.
Veg Condition: Good to Very Good.
Fire Age: +10 years.



WC10 Quadrat

WC10 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Bossiaea linophylla</i>	2-10	2.1
<i>Macrozamia riedlei</i>	2-10	1.5
<i>Pteridium esculentum</i>	2-10	0.9
<i>Leucopogon verticillatus</i>	2-10	0.8
<i>Bossiaea ornata</i>	2-10	0.5
<i>*Briza maxima</i>	2-10	0.5
<i>*Pinus</i> sp.	+	
<i>Persoonia longifolia</i>	+	
<i>Leucopogon capitellatus</i>	+	
<i>Tetrahena laevis</i>	+	
<i>Austrostipa campylachne</i>	+	
<i>*Plantago lanceolata</i>	+	
<i>*Hypochaeris glabra</i>	+	
<i>Burchardia congesta</i>	+	
<i>Scaevola calliptera</i>	+	
Liliaceae sp. (sterile)	+	

<i>Hardenbergia comptoniana</i>	+
<i>Caesia micrantha</i>	+
* <i>Oxalis purpurea</i>	+
<i>Opercularia hispidula</i>	+
<i>Clematis pubescens</i>	+
<i>Tetraria capillaris</i>	+
<i>Lomandra purpurea</i>	+

Opportunistic:

Kennedia prostrata

Comments:

Very weedy along the road edge but core areas intact.

Site WC11

Location: Hawterville Road, Balingup **Type:** Quadrat
Date: 16/10/2013 **Described by:** VC **Seasonal Conditions:** Very good
MGA Zone: 50 **Easting:** 404633 mE **Northing:** 6263331 mN
Habitat: Midslope; negligible slope and aspect.
Soil: Pale brown lateritic loam.
Vegetation: *Corymbia calophylla*, *Eucalyptus marginata* subsp. *marginata* Woodland over *Bossiaea linophylla* Open Tall Shrubland over an Open Shrubland of *Pteridium esculentum* over **Briza maxima* Very Open Grassland on brown sandy, lateritic loam.
Vegetation Complex: Mapped as Kirup KR.
Veg Condition: Good to Very Good.
Fire Age: ~5-10 years.



WC11 Quadrat.

WC11 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Bossiaea linophylla</i>	2-10	2.1
<i>Pteridium esculentum</i>	2-10	0.9
<i>*Briza maxima</i>	2-10	0.5
<i>Persoonia longifolia</i>	+	
<i>Tetraria octandra</i>	+	
<i>Austrostipa campylachne</i>	+	
<i>Hardenbergia comptoniana</i>	+	
<i>*Hypochaeris glabra</i>	+	
<i>*Oxalis purpurea</i>	+	
<i>Scaevola calliptera</i>	+	
<i>*Orobanche minor</i>	+	
<i>Opercularia hispidula</i>	+	
<i>Thysanotus</i> sp. (climbing/sterile)	+	
<i>*Plantago lanceolata</i>	+	
<i>Clematis pubescens</i>	+	
<i>Caesia micrantha</i>	+	
<i>Lomandra ?sericea</i>	+	

Comments:

Previously degraded or cleared with many grassy weeds and loss of diversity in the understorey.

Site WC12

Location: Cirillo Road; adjacent to blue gum plantation, Mullalyup **Type:** Relevé
Date: 16/10/2013 **Described by:** VC **Seasonal Conditions:** Very Good
MGA Zone: 50 **Easting:** 401972 mE **Northing:** 6265734 mN
Habitat: Midslope; negligible slope and aspect.
Soil: Pale brown lateritic loam.
Vegetation: *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Woodland over a *Xanthorrhoea preissii* Open Shrubland over a *Phyllanthus calycinus* Open Low Shrubland over a **Briza maxima* Very Open Grassland on pale brown lateritic loam.
Vegetation Complex: Mapped as Kirup KR.
Veg Condition: Good to Degraded.
Fire Age: <5 years.



WC12 Quadrat

WC12 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i>	10-30	10-30
<i>Phyllanthus calycinus</i>	2-10	>1
<i>Xanthorrhoea preissii</i>	2-10	>1
<i>*Briza maxima</i>	2-10	0.4
<i>Banksia dallanneyi</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Trichocline spathulata</i>	+	
<i>Hypocalymma angustifolia</i>	+	
<i>Macrozamia riedlei</i>	+	
<i>Hibbertia amplexicaulis</i>	+	
<i>Acacia pulchella</i>	+	
<i>Labichea punctata</i>	+	
<i>Hakea amplexicaulis</i>	+	
<i>*Briza minor</i>	+	
<i>*Ehrharta calycina</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>*Hypochaeris glabra</i>	+	

<i>Scaevola calliptera</i>	+
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+
<i>Dampiera linearis</i>	+
* <i>Watsonia</i> sp. (sterile)	+
<i>Desmodium fascicularis</i>	+

Comments:

Frequently burnt; resultant loss in understorey diversity. Weeds are increasing, particularly grassy weeds.
Regrowth/regenerating marri.

Site WC13

Location: Cirillo Rd Mullalyup **Type:** Quadrat
Date: 16/10/2013 **Described by:** VC **Seasonal Conditions:** Very Good
MGA Zone: 50 **Easting:** 400750mE **Northing:** 6266361 mN
Habitat: Midslope; negligible slope and aspect.
Soil: Pale brown lateritic loam.
Vegetation: *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Woodland over a **Acacia pycnantha* Low Open Woodland over a *Mirbelia dilatata* and *Podocarpus drouynianus* Open Low Shrubland over a *Pteridium esculentum* Open Shrubland over a *Patersonia umbrosa* var. *xanthina* and *Hibbertia hypericoides* Open Low Shrubland on pale brown lateritic loam.

Vegetation Complex: Mapped as Kirup KR.

Veg Condition: Good to Very Good.

Fire Age: ~10 years.



WC13 Quadrat

WC13 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>*Acacia pycnantha</i>	2-10	>10
<i>Mirbelia dilatata</i>	2-10	>2
<i>Podocarpus drouynianus</i>	2-10	>2
<i>Pteridium esculentum</i>	2-10	1-2
<i>Patersonia umbrosa</i> var. <i>xanthina</i>	2-10	>1
<i>Hibbertia hypericoides</i>	2-10	>1
<i>Hovea trisperma</i>	+	
<i>Xanthorrhoea gracilis</i>	+	
<i>Acacia extensa</i>	+	
<i>Hypocalymma angustifolia</i>	+	
<i>Mirbelia dilatata</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Leschenaultia biloba</i>	+	
<i>Hovea chorizemifolia</i>	+	
<i>Leucopogon verticillatus</i>	+	

<i>Hovea chorizemifolia</i>	+
<i>Leucopogon</i> sp. (sterile)	+
<i>Boronia fastigiata</i>	+
* <i>Briza maxima</i>	+
* <i>Aira caryophyllea</i>	+
<i>Tetrahena laevis</i>	+
<i>Austrostipa campylachne</i>	+
* <i>Hypochaeris glabra</i>	+
<i>Scaevola calliptera</i>	+
<i>Dampiera linearis</i>	+
<i>Burchardia congesta</i>	+
<i>Lagenophora huegelii</i>	+
<i>Trichocline spathulata</i>	+
<i>Lomandra ?sericea</i>	+
<i>Lomandra preissii</i>	+
<i>Tetraria octandra</i>	+
<i>Lomandra hermaphrodita</i>	+
<i>Lomandra purpurea</i>	+

Comments:

Previous logging and fire has reduced diversity; weeds are encroaching from tracks.

Site WC14**Location:** Adjacent to tank site on track from Cirillo Road towards Cundinup Road, Kirup **Type:** Quadrat**Date:** 17/10/2013 **Described by:** VC **Seasonal Conditions:** Very Good**MGA Zone:** 50 **Easting:** 399579mE **Northing:** 6266798 mN**Habitat:** Upperslope; negligible slope and aspect.**Soil:** Pale brown loam.**Vegetation:** *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Woodland over an *Acacia extensa* and *Agonis parviceps* Open Shrubland over a *Xanthorrhoea gracilis*, *Patersonia umbrosa* var. *xanthina* and *Hibbertia hypericoides* Low Shrubland over a *Pteridium esculentum* Open Shrubland over a *Patersonia umbrosa* var. *xanthina* and *Hibbertia hypericoides* Open Low Shrubland on pale brown loam.**Vegetation Complex:** Mapped as Kirup KR.**Veg Condition:** Good.**Fire Age:** <10 years.**WC14** Quadrat**WC14 Species List**

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	2-10	10-30
<i>Acacia extensa</i>	2-10	>2
<i>Agonis parviceps</i>	2-10	>2
<i>Xanthorrhoea gracilis</i>	2-10	1-2
<i>Patersonia umbrosa</i> var. <i>xanthina</i>	10-30	>1
<i>Hibbertia hypericoides</i>	2-10	>1
<i>Banksia dallanneyi</i>	2-10	>1
<i>Burchardia congesta</i>	+	
<i>Acacia pulchella</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Opercularia echinocephala</i>	+	
<i>Tetraria octandra</i>	+	
<i>Leschenaultia biloba</i>	+	
<i>Desmocladius fascicularis</i>	+	
<i>Hibbertia pilosa</i>	+	

<i>Hakea amplexicaulis</i>	+
<i>Logania serpyllifolia</i>	+
? <i>Amphipogon turbinatus</i>	+
<i>Orchidaceae</i> sp. (sterile)	+
<i>Stylidium schoenoides</i>	+
<i>Caladenia flava</i> subsp. <i>flava</i>	+
<i>Hypocalymma robustum</i>	+
<i>Stylidium</i> sp.	+
<i>Macrozamia riedlei</i>	+
<i>Lomandra ?sericea</i>	+
<i>Leucopogon nutans</i>	+
<i>Labichea punctata</i>	+
<i>Comesperma confertum</i>	+
<i>Drosera erythrorhiza</i>	+
<i>Scaevola calliptera</i>	+
<i>Platysace compressa</i>	+

Opportunistic collections in vicinity:

Podocarpus drouynianus

Johnsonia lupulina

Hovea trisperma

Comments:

Appears that frequent fires have reduced diversity of flora. Overstorey still regenerating.

Site WC15

Location: Tank site; track from Castle Street towards Kirup Dam, Kirup **Type:** Quadrat
Date: 17/10/2013 **Described by:** VC **Seasonal Conditions:** Very Good
MGA Zone: 50 **Easting:** 396609mE **Northing:** 6269911 mN
Habitat: Upperslope; negligible slope and aspect.
Soil: Pale brown lateritic loam.
Vegetation: *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Woodland over a *Hakea amplexicaulis* Open Tall Shrubland over a *Bossiaea linophylla* Open Shrubland over a *Hibbertia hypericoides* and *Podocarpus drouynianus* Open Low Heath over a *Patersonia umbrosa* var. *xanthina* Very Open Herbland on pale brown lateritic loam.
Vegetation Complex: Mapped as Hester HR.
Veg Condition: Good to Very Good.
Fire Age: ~10 years.



WC15 Quadrat

WC15 Species List

Name	% Cover	Height (m)
<i>Corymbia calophylla</i>	10-30	10-30
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	10-30	10-30
<i>Hakea amplexicaulis</i>	2-10	>2
<i>Bossiaea linophylla</i>	2-10	1-2
<i>Hibbertia hypericoides</i>	30-70	>1
<i>Podocarpus drouynianus</i>	30-70	>1
<i>Patersonia umbrosa</i> var. <i>xanthina</i>	2-10	>1
<i>Acacia pulchella</i>	+	
<i>Bossiaea ornata</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hovea chorizemifolia</i>	+	
<i>Phyllanthus calycinus</i>	+	
<i>Leucopogon propinquus</i>	+	
<i>Labichea punctata</i>	+	
<i>Xanthorrhoea gracilis</i>	+	
<i>Macrozamia riedlei</i>	+	
<i>Tetraena laevis</i>	+	
<i>Platysace compressa</i>	+	

<i>Pterostylis recurva</i>	+
<i>Pteridium esculentum</i>	+
<i>Drosera erythrorhiza</i>	+
<i>Lagenophora huegelii</i>	+
<i>Cassytha glabella</i>	+
<i>Opercularia echinocephala</i>	+
<i>Burchardia congesta</i>	+
<i>Scaevola calliptera</i>	+
<i>Thelymitra</i> sp. (immature)	+
<i>Stylidium schoenoides</i>	+
<i>Clematis pubescens</i>	+
<i>Sollya heterophylla</i>	+
<i>Tetraria capillaris</i>	+
<i>Lomandra hermaphrodita</i>	+
<i>Desmocladius fascicularis</i>	+
<i>Lomandra purpurea</i>	+
<i>Lomandra nigricans</i>	+

Opportunistic collections in vicinity:

Acacia alata

Tremandra stelligera

Comments:

Evidence of logging and frequent fire; resultant loss of understorey diversity; low weeds.

Appendix F: Vascular Flora Species List

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Plant family	Species
Apiaceae	<i>Daucus glochidiatus</i> <i>Pentapeltis peltigera</i> <i>Platysace compressa</i> <i>Trachymene pilosa</i> <i>Xanthosia candida</i>
Asparagaceae	* <i>Asparagus asparagoides</i> <i>Chamaescilla corymbosa</i> var. <i>corymbosa</i> <i>Laxmannia squarrosa</i> <i>Lomandra ?sericea</i> <i>Lomandra hermaphrodita</i> <i>Lomandra nigricans</i> <i>Lomandra preissii</i> <i>Lomandra purpurea</i> <i>Lomandra sericea</i> <i>Lomandra</i> sp. (sterile) <i>Sowerbaea laxiflora</i> <i>Thysanotus manglesianus</i> <i>Thysanotus multiflorus</i> <i>Thysanotus</i> sp. (climbing/sterile)
Asteraceae	* <i>Hypochaeris glabra</i> * <i>Ursinia anthemioides</i> <i>Craspedia variabilis</i> <i>Hyalosperma cotula</i> <i>Lagenophora huegelii</i> <i>Senecio multicaulis</i> subsp. <i>multicaulis</i> <i>Trichocline spathulata</i> <i>Waitzia acuminata</i>
Campanulaceae	<i>Lobelia heterophylla</i>
Casuarinaceae	<i>Allocasuarina fraseriana</i>
Celastraceae	<i>Tripterococcus brunonis</i>
Colchidaceae	<i>Burchardia congesta</i>
Cyperaceae	<i>Chorizanda enodis</i> <i>Gahnia aristata</i> <i>Lepidosperma ?pubisquameum</i> <i>Lepidosperma</i> sp. <i>Lepidosperma</i> sp. (sterile) <i>Tetraria ?sp. Jarrah Forest (R. Davis 7391)</i> (sterile) <i>Tetraria capillaris</i> <i>Tetraria octandra</i>
Dennstaedtiaceae	<i>Pteridium esculentum</i>
Dilleniaceae	<i>Hibbertia amplexicaulis</i> <i>Hibbertia hypericoides</i> <i>Hibbertia pilosa</i> <i>Hibbertia</i> sp. (sterile)

Droseraceae	<i>Drosera ?erythrorhiza</i> <i>Drosera erythrorhiza</i> <i>Drosera glanduligera</i> <i>Drosera pallida</i> <i>Drosera</i> sp. (climber/sterile)
Elaeocarpaceae	<i>Platytheca gallioides</i> <i>Tetratheca affinis</i> <i>Tetratheca setigera</i> <i>Tremandra stelligera</i>
Ericaceae	<i>Andersonia caerulea</i> <i>Astroloma pallida</i> <i>Leucopogon ?capitellatus</i> <i>Leucopogon capitellatus</i> <i>Leucopogon nutans</i> <i>Leucopogon propinquus</i> <i>Leucopogon</i> sp. (sterile) <i>Leucopogon verticellatus</i>
Euphorbiaceae	<i>Monotaxis occidentalis</i>
Fabaceae	<i>*Acacia baileyana</i> <i>*Acacia longifolia</i> subsp. <i>longifolia</i> <i>*Acacia podalyriifolia</i> <i>*Acacia pycnantha</i> <i>*Acacia saligna</i> <i>*Trifolium hirtum</i> <i>Acacia alata</i> <i>Acacia applanata</i> <i>Acacia extensa</i> <i>Acacia pulchella</i> <i>Acacia urophylla</i> <i>Acacia varia</i> var. <i>varia</i> <i>Bossiaea eriocarpa</i> <i>Bossiaea linearifolia</i> <i>Bossiaea linophylla</i> <i>Bossiaea ornata</i> <i>Comesperma ciliatum</i> <i>Comesperma confertum</i> <i>Daviesia decurrens</i> <i>Gastrolbium bilobum</i> <i>Gompholobium marginatum</i> <i>Gompholobium ovatum</i> <i>Hardenbergia comptoniana</i> <i>Hovea chorizemifolia</i> <i>Hovea trisperma</i> <i>Jacksonia alata</i> <i>Kennedia prostrata</i> <i>Labichea punctata</i> <i>Mirbelia diltata</i> <i>Sphaerolobium medium</i>
Goodeniaceae	<i>Dampiera alata</i> <i>Dampiera linearis</i> <i>Leschenaulita biloba</i>

	<i>Scaevola calliptera</i>
Haemodoraceae	<i>Anigozanthos manglesii</i> <i>Conostylis aculeata</i> subsp. <i>aculeata</i> <i>Conostylis setigera</i> <i>Haemodorum simplex</i> <i>Haemodorum</i> sp. (sterile)
Hemerocallidaceae	<i>Agrostocrinum stypanroides</i> <i>Caesia micrantha</i> <i>Dianella revoluta</i> <i>Johnsonia lupalina</i>
Iridaceae	* <i>Freesia</i> sp. * <i>Romulea rosea</i> * <i>Sparaxis pillansii</i> * <i>Watsonia marginata</i> * <i>Watsonia</i> sp. (sterile) <i>Patersonia babianooides</i> <i>Patersonia occidentalis</i> <i>Patersonia pygmaea</i> <i>Patersonia umbrosa</i> var. <i>xanthina</i>
Lamiaceae	<i>Hemigenia incana</i>
Lauraceae	<i>Cassytha glabella</i>
Loganiaceae	<i>Logania serpyllifolia</i> subsp. <i>angustifolia</i> <i>Logania serpyllifolia</i> subsp. <i>serpyllifolia</i>
Malvaceae	<i>Thomasia grandiflora</i>
Myrtaceae	<i>Agonis parviceps</i> <i>Astartea</i> sp. (sterile) <i>Corymbia calophylla</i> <i>Eucalyptus marginata</i> subsp. <i>marginata</i> <i>Eucalyptus patens</i> <i>Eucalyptus rudis</i> <i>Hypocalymma angustifolia</i> <i>Hypocalymma robustum</i> <i>Melaleuca preissiana</i> <i>Pericalymma ellipticum</i> <i>Taxandria linearifolia</i>
Orchidaceae	* <i>Disa bracteata</i> <i>Caladenia ?ferruginea</i> (atypical colouring) <i>Caladenia attingens</i> subsp. <i>attingens</i> <i>Caladenia flava</i> subsp. <i>flava</i> <i>Caladenia latifolia</i> <i>Caladenia macrostylis</i> <i>Caladenia</i> sp. (immature) <i>Caladenia</i> sp. (sterile) <i>Diuris longifolia</i> <i>Elythranthreya brunonis</i> <i>Lyperanthus serratus</i> <i>Orchidaceae</i> sp. (sterile) <i>Pterostylis pyramidalis</i>

	<i>Pterostylis recurva</i>
	<i>Pyrorchis nigricans</i>
	<i>Thelymitra ?canaliculata</i>
	<i>Thelymitra flexuosa</i>
	<i>Thelymitra</i> sp (immature)
Orobanchaceae	* <i>Orobanche minor</i>
Oxalidaceae	* <i>Oxalis purpurea</i>
Phyllanthaceae	<i>Phyllanthus calycinus</i>
Phyllanthaceae	<i>Poranthera huegelii</i>
Pinaceae	* <i>Pinus pinaster/radiata</i>
Pittosporaceae	<i>Billardiera variifolia</i>
Pittosporaceae	<i>Sollya heterophylla</i>
Plantaginaceae	* <i>Plantago lanceolata</i>
Poaceae	* <i>Aira caryophyllea</i>
	* <i>Avena fatua</i>
	* <i>Briza maxima</i>
	* <i>Briza minor</i>
	* <i>Cenchrus clandestinus</i>
	* <i>Ehrharta calycina</i>
	<i>Amphipogon amphipogonoides</i>
	<i>Austrostipa campylachne</i>
	<i>Neurachne alopecuroidea</i>
	<i>Tetrahaena laevis</i>
Podocarpaceae	<i>Podocarpus drouynianus</i>
Portulacaceae	<i>Rubus ulmifolius</i>
Primulaceae	* <i>Anagalis arvensis</i>
Proteaceae	<i>Banksia dallanneyi</i>
	<i>Banksia grandis</i>
	<i>Banksia nivea</i>
	<i>Banksia nivea</i>
	<i>Grevillea manglesii</i> subsp. <i>manglesii</i>
	<i>Grevillea quercifolia</i>
	<i>Grevillea</i> sp. (sterile)
	<i>Hakea amplexicaulis</i>
	<i>Hakea lissocarpha</i>
	<i>Persoonia longifolia</i>
	<i>Synaphea gracillima</i> (leaf apex atypical)
	<i>Xylomelum occidentale</i>
Ranunculaceae	<i>Clematis pubescens</i>
Restionaceae	<i>Desmocladius fascicularis</i>
	<i>Hypolaena exsulca</i>
	<i>Meeboldina scariosa</i>

Rhamnaceae	<i>Trymalium odoratissimum</i> subsp. <i>trifidum</i>
Rubiaceae	* <i>Rubus ulmifolius</i> <i>Opercularia echinocephala</i> <i>Opercularia hispidula</i>
Rutaceae	<i>Boronia fastigiata</i> <i>Philothea spicatus</i>
Salicaceae	* <i>Salix babylonica</i>
Stylidiaceae	<i>Levenhookia pusilla</i> <i>Stylidium amoenum</i> <i>Stylidium calcaratum</i> <i>Stylidium junceum</i> <i>Stylidium piluliferum</i> <i>Stylidium scandens</i> (range extension) <i>Stylidium schoenioides</i> <i>Stylidium</i> sp.
Thymeliaceae	<i>Pimelea ciliata</i> subsp. <i>ciliata</i> <i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>
Violaceae	<i>Hybanthus calycinus</i>
Xanthorrhoeaceae	<i>Xanthorrhoea gracilis</i> <i>Xanthorrhoea preissii</i>
Zamiaceae	<i>Macrozamia riedlei</i>

* denotes weed taxa

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Appendix G: Vertebrate Fauna List

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Table G.1: Vertebrate fauna species recorded in the region and during the current survey.

Amphibians

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected Matters Search	Recorded During Current Survey
			EPBC Act	WC Act	DPaW			
Hylidae								
<i>Litoria adelaidensis</i>	Slender Tree Frog					X		
<i>Litoria moorei</i>	Motorbike Frog					X		
Limnodynastidae								
<i>Heleioporus eyrei</i>	Moaning Frog					X		X
<i>Limnodynastes dorsalis</i>	Western Banjo Frog					X		
Myobatrachidae								
<i>Crinia georgiana</i>	Quacking Frog					X		X
<i>Crinia glauerti</i>	Clicking Frog					X		X
<i>Crinia pseudinsignifera</i>	Bleating Froglet					X		
<i>Geocrinia leai</i>	Ticking Frog					X		
<i>Pseudophryne guentheri</i>	Crawling Toadlet					X		

Reptiles

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected Matters Search	Recorded During Current Survey
			EPBC Act	WC Act	DPaW			
Cheluidae								
<i>Chelodina oblonga</i>	Oblong Turtle					x		
Agamidae								
<i>Pogona minor minor</i>	Dwarf Bearded Dragon					x		
Gekkonidae								
<i>Christinus marmoratus</i>	Marbled Gecko					x		
Pygopodidae								
<i>Aprasia pulchella</i>						x		
Scincidae								
<i>Ctenotus delli</i>					P4	x		
<i>Ctenotus labillardieri</i>						x		
<i>Egernia napoleonis</i>						x		
<i>Hemiergis initialis initialis</i>						x		
<i>Hemiergis peronii peronii</i>						x		
<i>Hemiergis peronii tridactyla</i>						x		
<i>Lerista distinguenda</i>						x		
<i>Menetia greyii</i>						x		
<i>Morethia lineoocellata</i>						x		
<i>Morethia obscura</i>						x		
<i>Tiliqua rugosa palarra</i>						x		
<i>Tiliqua rugosa rugosa</i>						x		
Varanidae								
<i>Varanus rosenbergi</i>	Heath Monitor					x		
Typhlopidae								
<i>Ramphotyphlops australis</i>						x		
Boidae								

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Recorded
<i>Morelia spilota imbricata</i>	Carpet Python			S4		x		
Elapidae								
<i>Notechis scutatus</i>	Tiger Snake					x		
<i>Pseudonaja affinis</i>	Dugite					x		
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					x		

Birds

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected Matters Search	Birddata	Recorded During Current Survey
			EPBC Act	WC Act	DPaW				
Casuariidae									
<i>Dromaius novaehollandiae</i>	Emu					x		x	x
Megapodiidae									
<i>Leipoa ocellata</i>	Malleefowl		VU	S1			x		
Phasianidae									
<i>Coturnix pectoralis</i>	Stubble Quail							x	
Anatidae									
<i>Biziura lobata</i>	Musk Duck					x		x	
<i>Stictonetta naevosa</i>	Freckled Duck					x			
<i>Cygnus atratus</i>	Black Swan					x		x	
<i>Tadorna tadornoides</i>	Australian Shelduck					x		x	x
<i>Chenonetta jubata</i>	Australian Wood Duck					x		x	
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck							x	
<i>Anas rhynchotis</i>	Australasian Shoveler					x		x	
<i>Anas gracilis</i>	Grey Teal					x		x	
<i>Anas castanea</i>	Chestnut Teal							x	
<i>Anas platyrhynchos</i>	Northern Mallard	x				x	x	x	
<i>Anas superciliosa</i>	Pacific Black Duck					x		x	x
<i>Aythya australis</i>	Hardhead					x		x	
<i>Oxyura australis</i>	Blue-billed Duck					x		x	
Podicipedidae									
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe					x		x	
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe					x		x	
<i>Podiceps cristatus</i>	Great Crested Grebe					x		x	
Columbidae									
<i>Columba livia</i>	Rock Dove	x					x		
<i>Streptopelia senegalensis</i>	Laughing Dove	x				x	x	x	

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Streptopelia chinensis</i>	Spotted Dove	x					x		
<i>Phaps chalcoptera</i>	Common Bronzewing					x		x	x
<i>Phaps elegans</i>	Brush Bronzewing							x	
<i>Ocyphaps lophotes</i>	Crested Pigeon					x		x	
Podargidae									
<i>Podargus strigoides</i>	Tawny Frogmouth					x		x	
Aegothelidae									
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					x		x	
Apodidae									
<i>Apus pacificus</i>	Fork-tailed Swift		Mi	S3			x		
Anhingidae									
<i>Anhinga novaehollandiae</i>	Australasian Darter							x	
Phalacrocoracidae									
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant					x		x	
<i>Phalacrocorax carbo</i>	Great Cormorant					x		x	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant					x		x	
<i>Phalacrocorax varius</i>	Pied Cormorant					x		x	
Pelecanidae									
<i>Pelecanus conspicillatus</i>	Australian Pelican					x		x	
Ardeidae									
<i>Botaurus poiciloptilus</i>	Australasian Bittern		EN	S1				x	
<i>Ixobrychus flavicollis australis</i>	Australian Black Bittern				P3	x			
<i>Ardea pacifica</i>	White-necked Heron					x		x	
<i>Ardea modesta</i>	Great Egret		Mi	S3			x	x	x
<i>Ardea ibis</i>	Cattle Egret		Mi	S3			x		
<i>Egretta novaehollandiae</i>	White-faced Heron							x	x
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron							x	x
Threskiornithidae									
<i>Threskiornis molucca</i>	Australian White Ibis					x		x	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					x		x	
<i>Platalea regia</i>	Royal Spoonbill							x	

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Platalea flavipes</i>	Yellow-billed Spoonbill					x		x	
Accipitridae									
<i>Elanus axillaris</i>	Black-shouldered Kite					x		x	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		Mi	S3		x	x		
<i>Haliastur spheonurus</i>	Whistling Kite					x		x	
<i>Accipiter fasciatus</i>	Brown Goshawk					x		x	
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					x		x	
<i>Circus assimilis</i>	Spotted Harrier					x			
<i>Circus approximans</i>	Swamp Harrier					x		x	
<i>Aquila audax</i>	Wedge-tailed Eagle					x		x	
<i>Hieraaetus morphnoides</i>	Little Eagle							x	
Falconidae									
<i>Falco cenchroides</i>	Nankeen Kestrel					x		x	
<i>Falco berigora</i>	Brown Falcon					x		x	
<i>Falco longipennis</i>	Australian Hobby					x		x	
<i>Falco peregrinus</i>	Peregrine Falcon			S4		x		x	
Rallidae									
<i>Porphyrio porphyrio</i>	Purple Swamphen					x		x	x
<i>Lewinia pectoralis</i>	Lewin's Rail					x			
<i>Gallirallus philippensis</i>	Buff-banded Rail					x			
<i>Porzana tabuensis</i>	Spotless Crane					x		x	
<i>Tribonyx ventralis</i>	Black-tailed Native-hen							x	
<i>Gallinula tenebrosa</i>	Dusky Moorhen					x		x	
<i>Fulica atra</i>	Eurasian Coot					x		x	
Turnicidae									
<i>Turnix varius</i>	Painted Button-quail					x		x	
<i>Turnix velox</i>	Little Button-quail					x		x	
Cacatuidae									
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo		VU	S1		x	x	x	x
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo		EN	S1		x	x	x	

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo		VU	S1		x	x	x	x
<i>Eolophus roseicapillus</i>	Galah							x	x
<i>Cacatua pastinator</i>	Western Corella							x	
<i>Cacatua pastinator pastinator</i>	Muir's Corella (southern)		VU	S1			x		
Psittacidae									
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet					x		x	
<i>Polytelis anthopeplus</i>	Regent Parrot					x		x	
<i>Platycercus icterotis</i>	Western Rosella					x		x	
<i>Barnardius zonarius</i>	Australian Ringneck					x		x	x
<i>Purpureicephalus spurius</i>	Red-capped Parrot					x		x	
<i>Psephotus varius</i>	Mulga Parrot							x	
<i>Neophema elegans</i>	Elegant Parrot					x		x	
Cuculidae									
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo							x	
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo					x		x	
<i>Cacomantis pallidus</i>	Pallid Cuckoo					x		x	
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo					x		x	
Strigidae									
<i>Ninox novaeseelandiae</i>	Southern Boobook					x		x	
Tytonidae									
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (southern)				P3	x		x	
<i>Tyto javanica</i>	Eastern Barn Owl					x		x	
Halcyonidae									
<i>Dacelo novaeguineae</i>	Laughing Kookaburra					x		x	x
<i>Todiramphus sanctus</i>	Sacred Kingfisher					x		x	
Meropidae									
<i>Merops ornatus</i>	Rainbow Bee-eater		Mi	S3			x	x	
Atrichornithidae									
<i>Atrichornis clamosus</i>	Noisy Scrub-bird		VU	S1				x	
Climacteridae									

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Climacteris rufa</i>	Rufous Treecreeper							x	
Maluridae									
<i>Malurus splendens</i>	Splendid Fairy-wren					x		x	x
<i>Malurus leucopterus</i>	White-winged Fairy-wren							x	
<i>Malurus elegans</i>	Red-winged Fairy-wren					x		x	
Acanthizidae									
<i>Sericornis frontalis</i>	White-browed Scrubwren					x		x	
<i>Calamanthus campestris</i>	Rufous Fieldwren							x	
<i>Smicronis brevirostris</i>	Weebill					x		x	x
<i>Gerygone fusca</i>	Western Gerygone					x		x	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					x		x	
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill							x	
<i>Acanthiza inornata</i>	Western Thornbill					x		x	
<i>Acanthiza apicalis</i>	Inland Thornbill					x		x	
Pardalotidae									
<i>Pardalotus punctatus</i>	Spotted Pardalote					x		x	
<i>Pardalotus striatus</i>	Striated Pardalote					x		x	
<i>Pardalotus rubricatus</i>	Red-browed Pardalote								x
Meliphagidae									
<i>Acanthorhynchus superciliosus</i>	Western Spinebill					x		x	x
<i>Lichenostomus virescens</i>	Singing Honeyeater							x	x
<i>Lichenostomus leucotis</i>	White-eared Honeyeater							x	
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater							x	
<i>Manorina flavigula</i>	Yellow-throated Miner							x	
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater							x	
<i>Anthochaera lunulata</i>	Western Wattlebird					x		x	
<i>Anthochaera carunculata</i>	Red Wattlebird					x		x	x
<i>Epthianura albifrons</i>	White-fronted Chat					x		x	
<i>Glyciphila melanops</i>	Tawny-crowned Honeyeater							x	

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Lichmera indistincta</i>	Brown Honeyeater					x			
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater							x	
<i>Phylidonyris niger</i>	White-cheeked Honeyeater							x	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					x		x	
<i>Melithreptus lunatus</i>	White-naped Honeyeater					x		x	
Pomatostomidae									
<i>Pomatostomus superciliosus</i>	White-browed Babbler							x	
Neosittidae									
<i>Daphoenositta chrysoptera</i>	Varied Sittella					x		x	
Campephagidae									
<i>Coracina maxima</i>	Ground Cuckoo-shrike					x			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					x		x	x
<i>Lalage sueurii</i>	White-winged Triller							x	
Pachycephalidae									
<i>Falcunculus frontatus</i>	Crested Shrike-tit							x	
<i>Falcunculus frontatus leucogaster</i>	Crested Shrike-tit (western)				P4	x			
<i>Pachycephala pectoralis</i>	Golden Whistler					x		x	x
<i>Pachycephala rufiventris</i>	Rufous Whistler					x		x	x
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					x		x	
Artamidae									
<i>Artamus cinereus</i>	Black-faced Woodswallow					x		x	
<i>Artamus cyanopterus</i>	Dusky Woodswallow					x		x	
<i>Cracticus torquatus</i>	Grey Butcherbird					x		x	
<i>Cracticus nigrogularis</i>	Pied Butcherbird							x	
<i>Cracticus tibicen</i>	Australian Magpie					x		x	x
<i>Strepera versicolor</i>	Grey Currawong					x		x	
Rhipiduridae									
<i>Rhipidura albiscapa</i>	Grey Fantail					x		x	x

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
<i>Rhipidura leucophrys</i>	Willie Wagtail					x		x	x
Corvidae									
<i>Corvus coronoides</i>	Australian Raven					x		x	x
Monarchidae									
<i>Myiagra inquieta</i>	Restless Flycatcher					x		x	
<i>Grallina cyanoleuca</i>	Magpie-lark					x		x	x
Petroicidae									
<i>Microeca fascinans</i>	Jacky Winter							x	
<i>Petroica boodang</i>	Scarlet Robin					x		x	x
<i>Petroica goodenovii</i>	Red-capped Robin					x		x	
<i>Melanodryas cucullata</i>	Hooded Robin					x		x	
<i>Eopsaltria griseogularis</i>	Western Yellow Robin							x	
<i>Eopsaltria georgiana</i>	White-breasted Robin					x		x	
Acrocephalidae									
<i>Acrocephalus australis</i>	Australian Reed-Warbler					x		x	
Megaluridae									
<i>Megalurus gramineus</i>	Little Grassbird							x	
<i>Cincloramphus mathewsi</i>	Rufous Songlark					x		x	
<i>Cincloramphus cruralis</i>	Brown Songlark							x	
Timaliidae									
<i>Zosterops lateralis</i>	Silvereeye					x		x	
Hirundinidae									
<i>Hirundo neoxena</i>	Welcome Swallow					x		x	
<i>Petrochelidon nigricans</i>	Tree Martin					x		x	
Sturnidae									
<i>Sturnus vulgaris</i>	Common Starling	x					x		
Nectariniidae									
<i>Dicaeum hirundinaceum</i>	Mistletoebird							x	
Estrildidae									
<i>Stagonopleura oculata</i>	Red-eared Firetail					x		x	

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Birdata	Recorded
Passeridae									
<i>Passer domesticus</i>	House Sparrow	x					x		
<i>Passer montanus</i>	Eurasian Tree Sparrow	x					x		
Motacillidae									
<i>Anthus novaeseelandiae</i>	Australasian Pipit					x		x	

Mammals

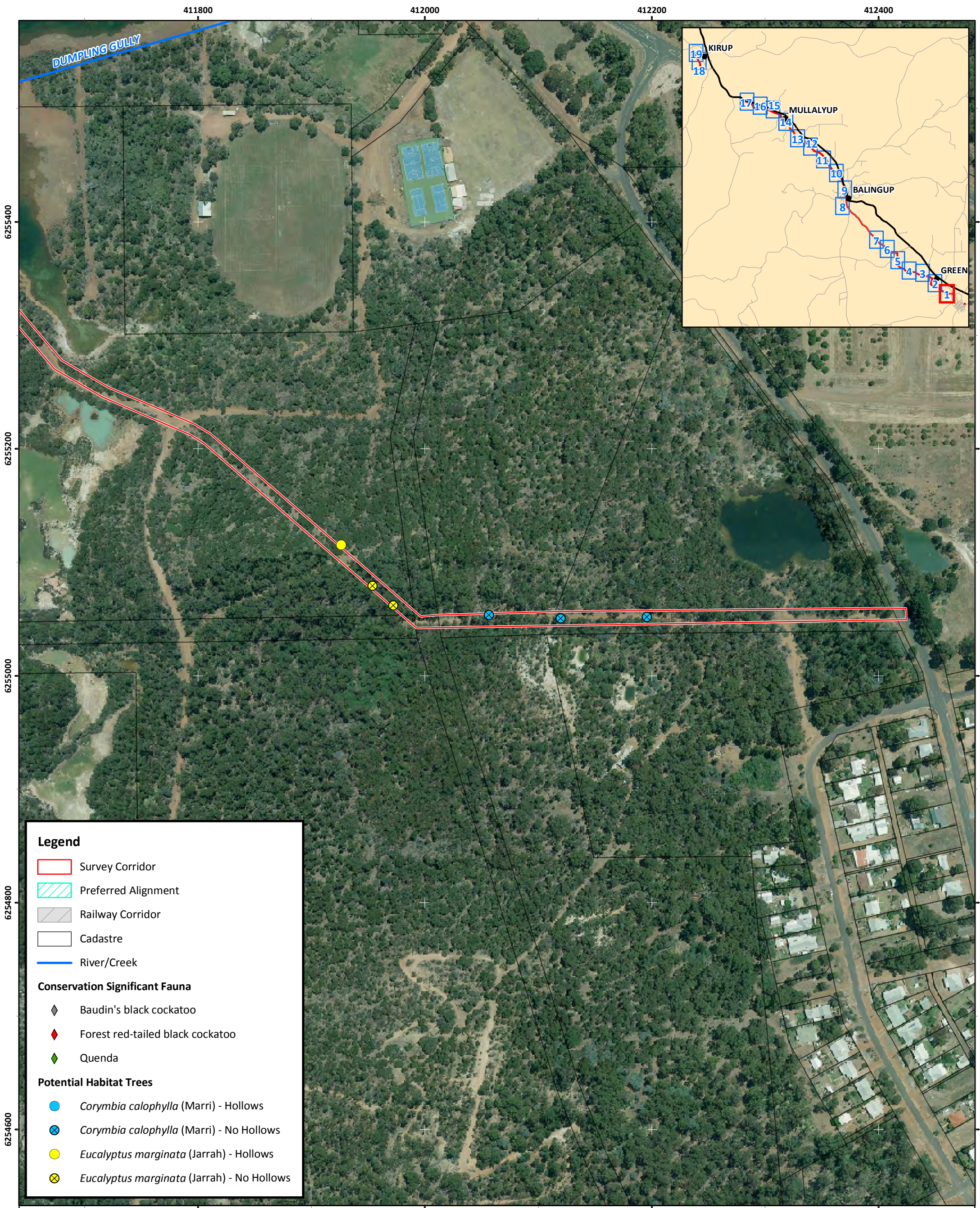
Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected Matters Search	Recorded During Current Survey
			EPBC Act	WC Act	DPaW			
Tachyglossidae								
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna					x		
Dasyuridae								
<i>Antechinus flavipes</i>	Yellow-footed Antechinus					x		
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch		VU		S1	x	x	
<i>Phascogale calura</i>	Red-tailed Phascogale		EN		S1	x		
<i>Phascogale tapoatafa tapoatafa</i>	Southern Brush-tailed Phascogale, Wambenger				S1	x		
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart					x		
Peramelidae								
<i>Isoodon obesulus fusciventer</i>	Southern Brown Bandicoot, Quenda				P5	x		x
Potoroidae								
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie		EN	S1		x	x	
Macropodidae								
<i>Macropus fuliginosus</i>	Western Grey Kangaroo					x		x
<i>Macropus irma</i>	Western Brush Wallaby				P4	x		
<i>Setonix brachyurus</i>	Quokka		VU	S1		x	x	
Phalangeridae								
<i>Trichosurus vulpecula vulpecula</i>	Common Brushtail Possum					x		
Pseudocheiridae								
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum		VU	S1		x	x	
Burramyidae								
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda					x		
Vespertilionidae								
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat					x		

Scientific Name	Common Name	Introduced	Conservation Codes			NatureMap	Protected	Recorded
<i>Chalinolobus morio</i>	Chocolate Wattled Bat					x		
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle				P4	x		
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat					x		
<i>Vespadelus regulus</i>	Southern Forest Bat					x		
Molossidae								
<i>Mormopterus planiceps</i>	Southern Freetail-bat					x		
<i>Tadarida australis</i>	White-striped Freetail-bat					x		
Muridae								
<i>Hydromys chrysogaster</i>	Water-rat				P4	x		
<i>Mus musculus</i>	House Mouse	x				x	x	
<i>Rattus fuscipes</i>	Western Bush Rat					x		
<i>Rattus rattus</i>	Black Rat					x	x	
Leporidae								
<i>Oryctolagus cuniculus</i>	Rabbit	x				x	x	
Canidae								
<i>Canis lupus familiaris</i>	Dog	x					x	
<i>Vulpes vulpes</i>	Red Fox	x				x	x	x
Felidae								
<i>Felis catus</i>	Cat	x				x	x	
Suidae								
<i>Sus scrofa</i>	Pig	x				x	x	
Bovidae								
<i>Bos taurus</i>	European Cattle	x				x	x	
<i>Capra hircus</i>	Goat	x					x	
Cervidae								
<i>Dama dama</i>	Fallow Deer	x				x	x	

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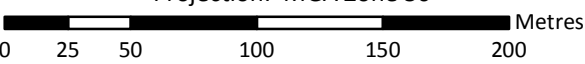
Appendix H: Potential Habitat Trees and Significant Fauna Locations

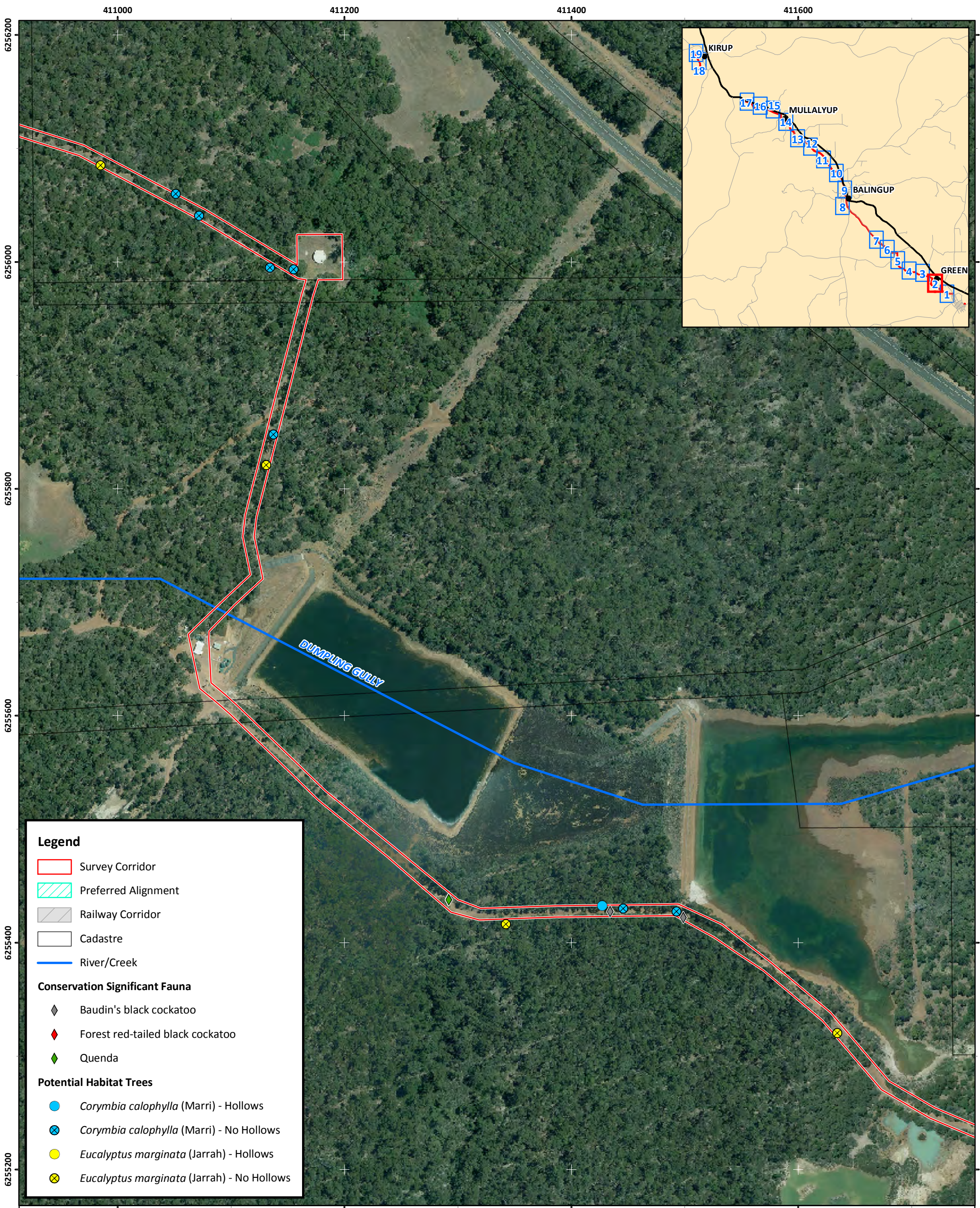
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Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H1: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50	 
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH01		



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

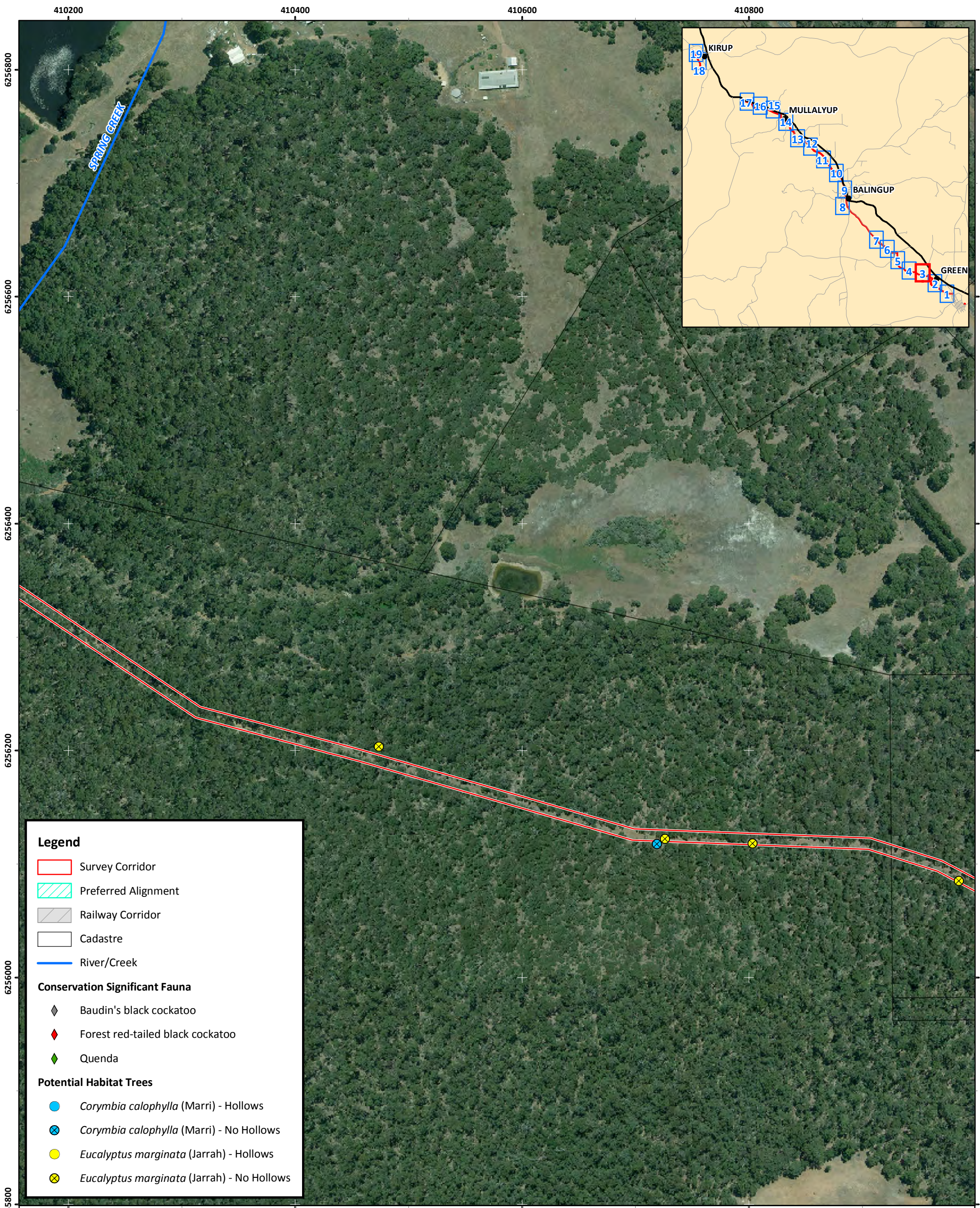
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H2: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH02

Datum: GDA 1994
 Projection: MGA Zone 50

Metres



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H3: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH03

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres

409400

409600

409800

410000

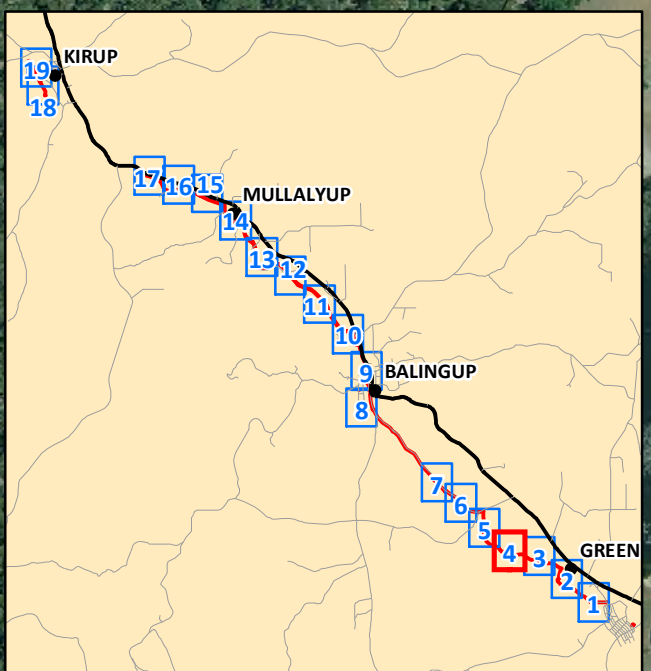
6256800

6256600

6256400

6256200

6256000



Legend

- Survey Corridor
- Preferred Alignment
- Cadastre
- Railway Corridor
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

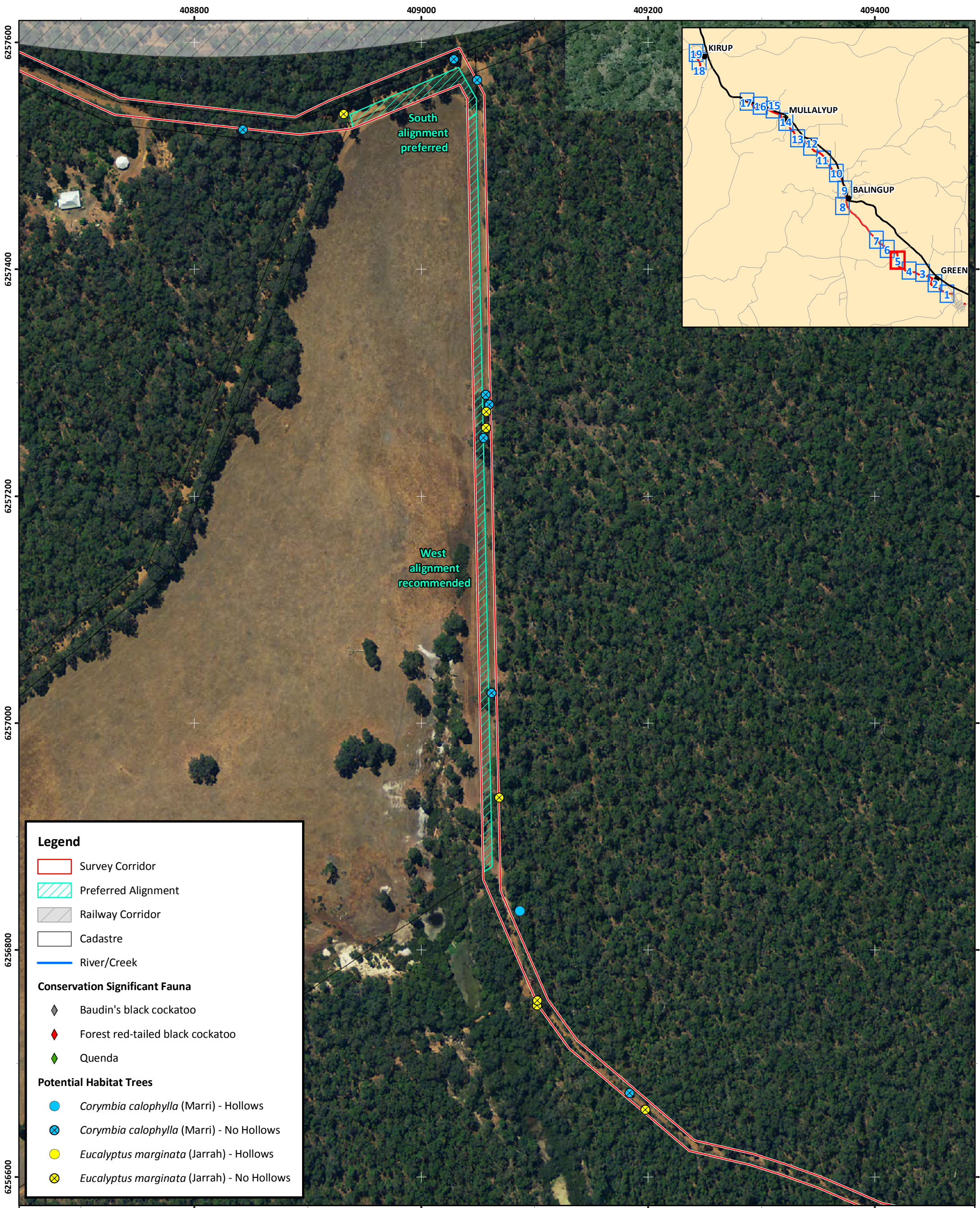
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H4: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH04

Datum: GDA 1994
 Projection: MGA Zone 50

Metres

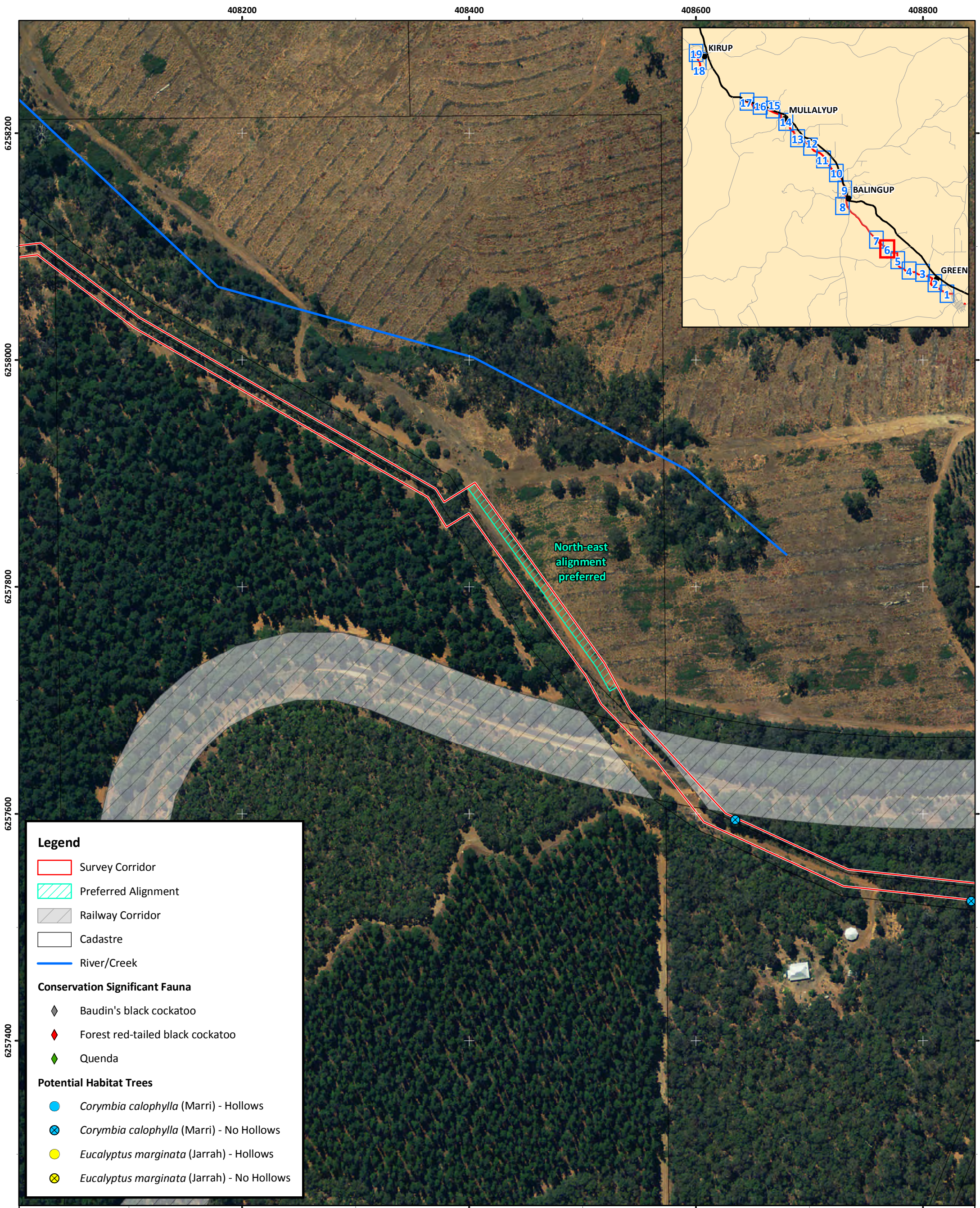


Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H5: Potential habitat trees and significant fauna locations with preferred alignment options

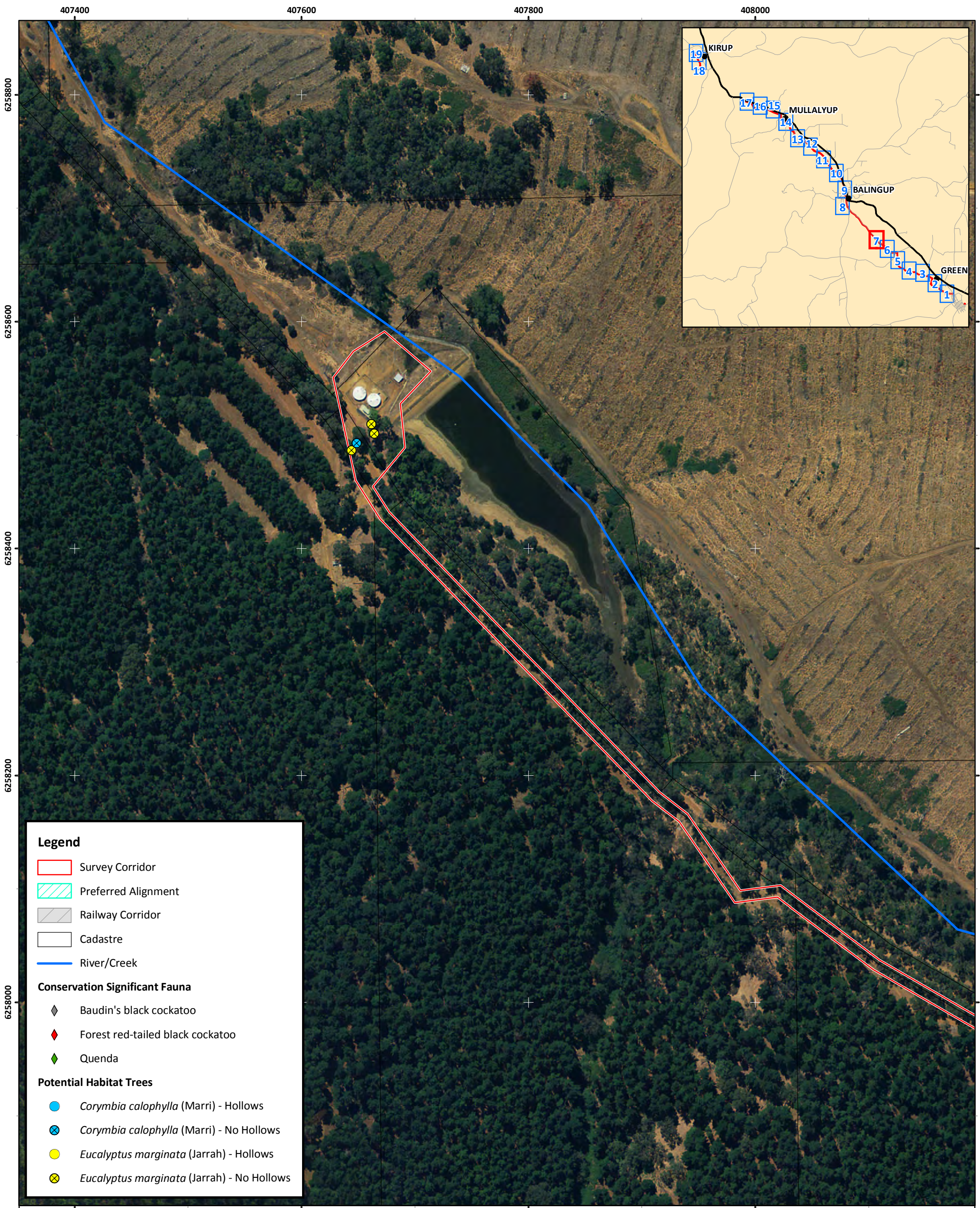
Author: V. Clarke	Date: 28-01-2014
Drawn: H. Thornton	4175-13_GDR_1Rev0_140128_FigH05

Datum: GDA 1994
 Projection: MGA Zone 50



Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H6: Potential habitat trees and significant fauna locations with preferred alignment options



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

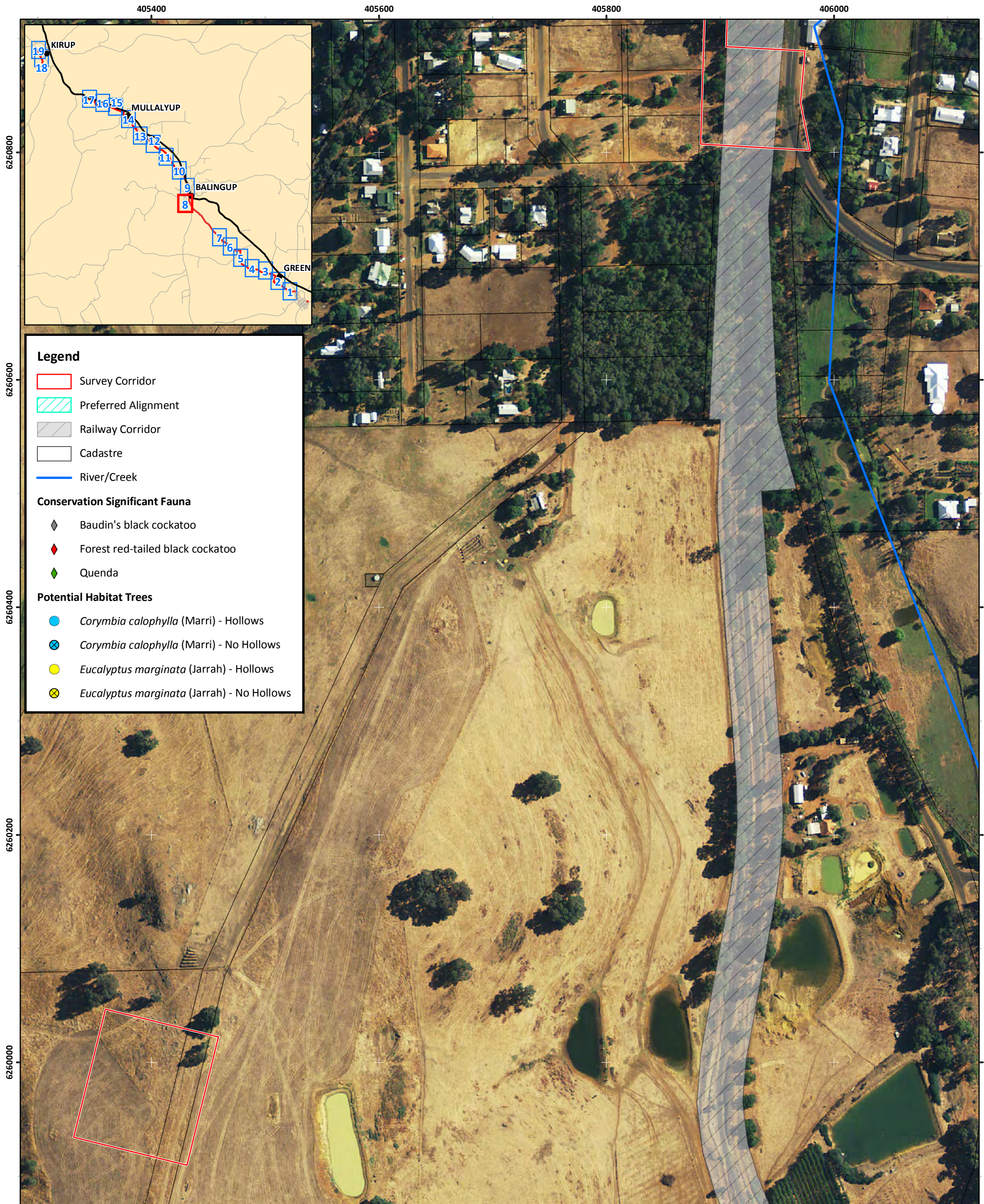
- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H7: Potential habitat trees and significant fauna locations with preferred alignment options



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H8: Potential habitat trees and significant fauna locations with preferred alignment options

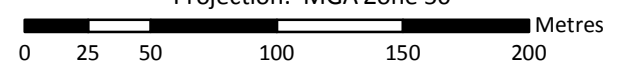
Author: V. Clarke

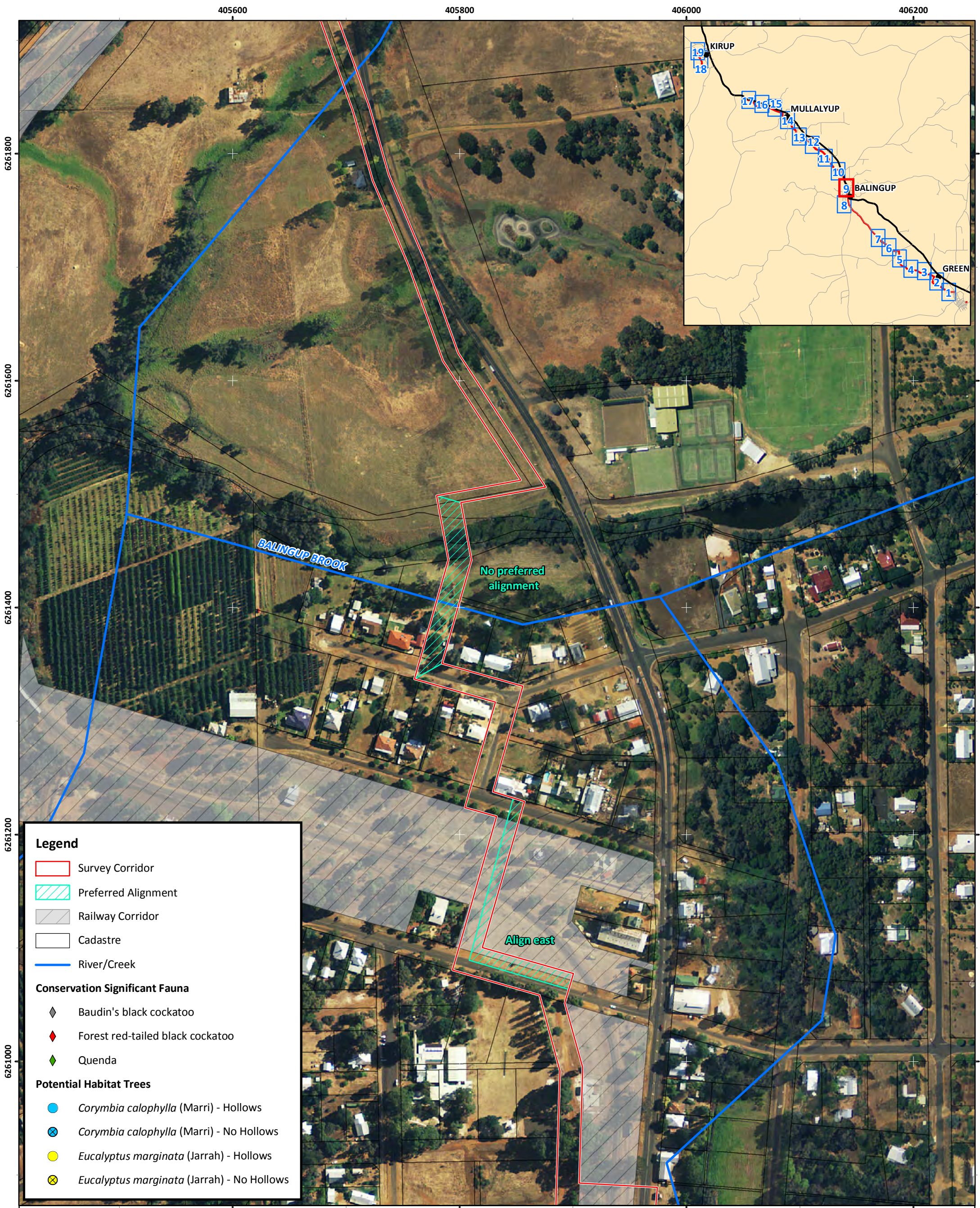
Date: 28-01-2014

Drawn: C. Smith

4175-13_GDR_1Rev0_40128_FigH08

Datum: GDA 1994
Projection: MGA Zone 50





Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H9: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50	
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH09		

405000

405200

405400

405600

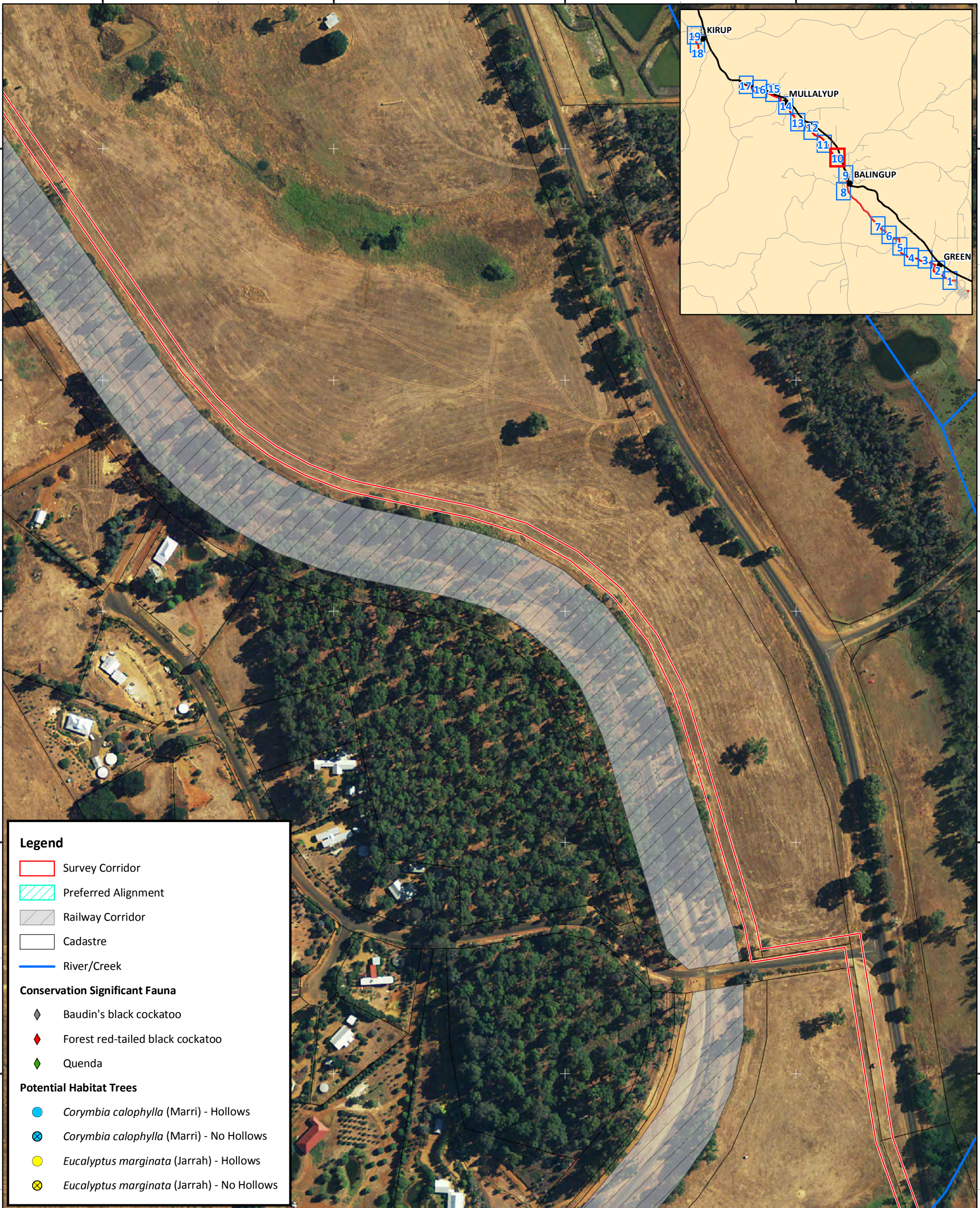
6262800

6262600

6262400

6262200

6262000



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H10: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke

Date: 28-01-2014

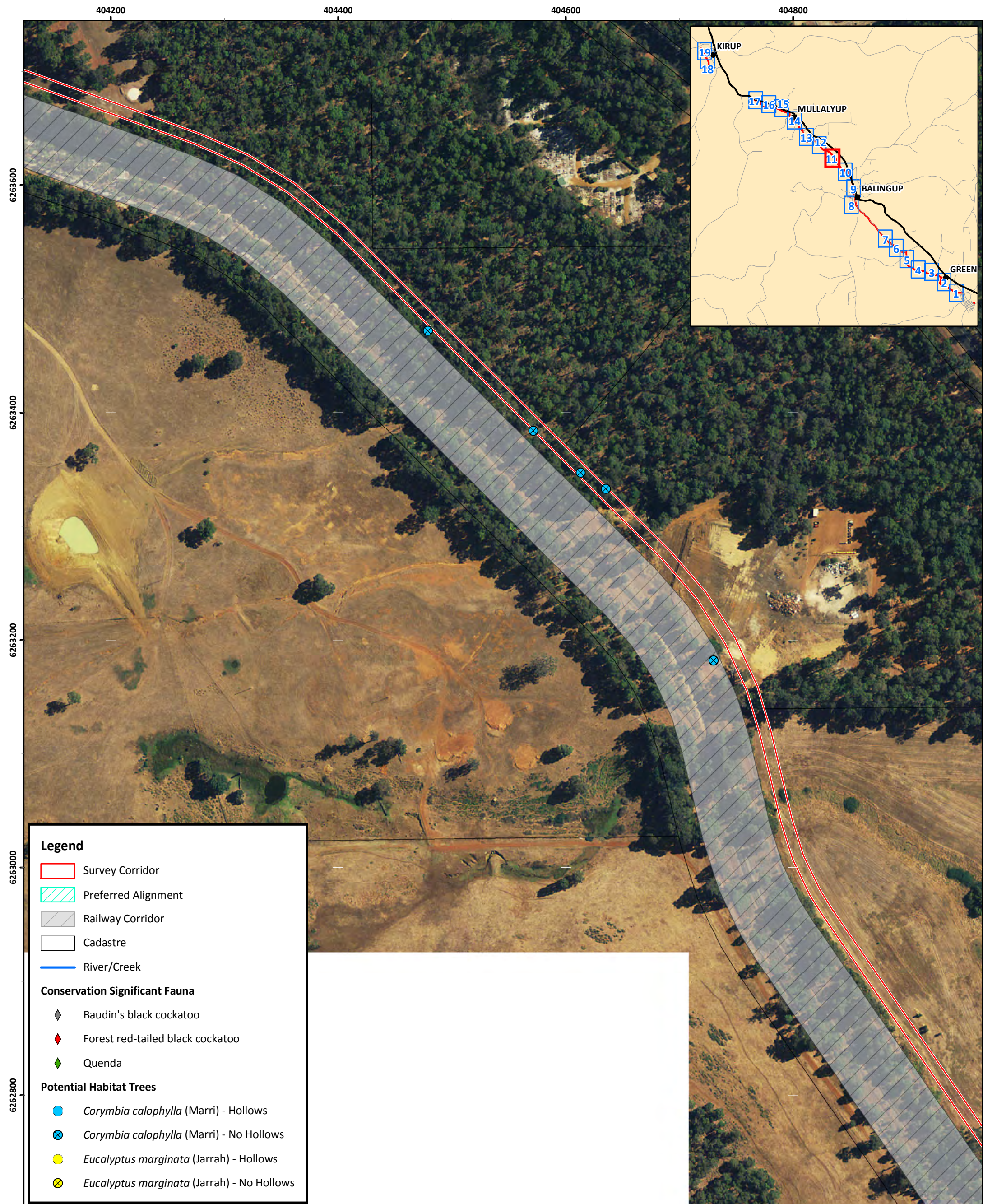
Drawn: C. Smith

4175-13_GDR_1Rev0_140128_FigH10

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres

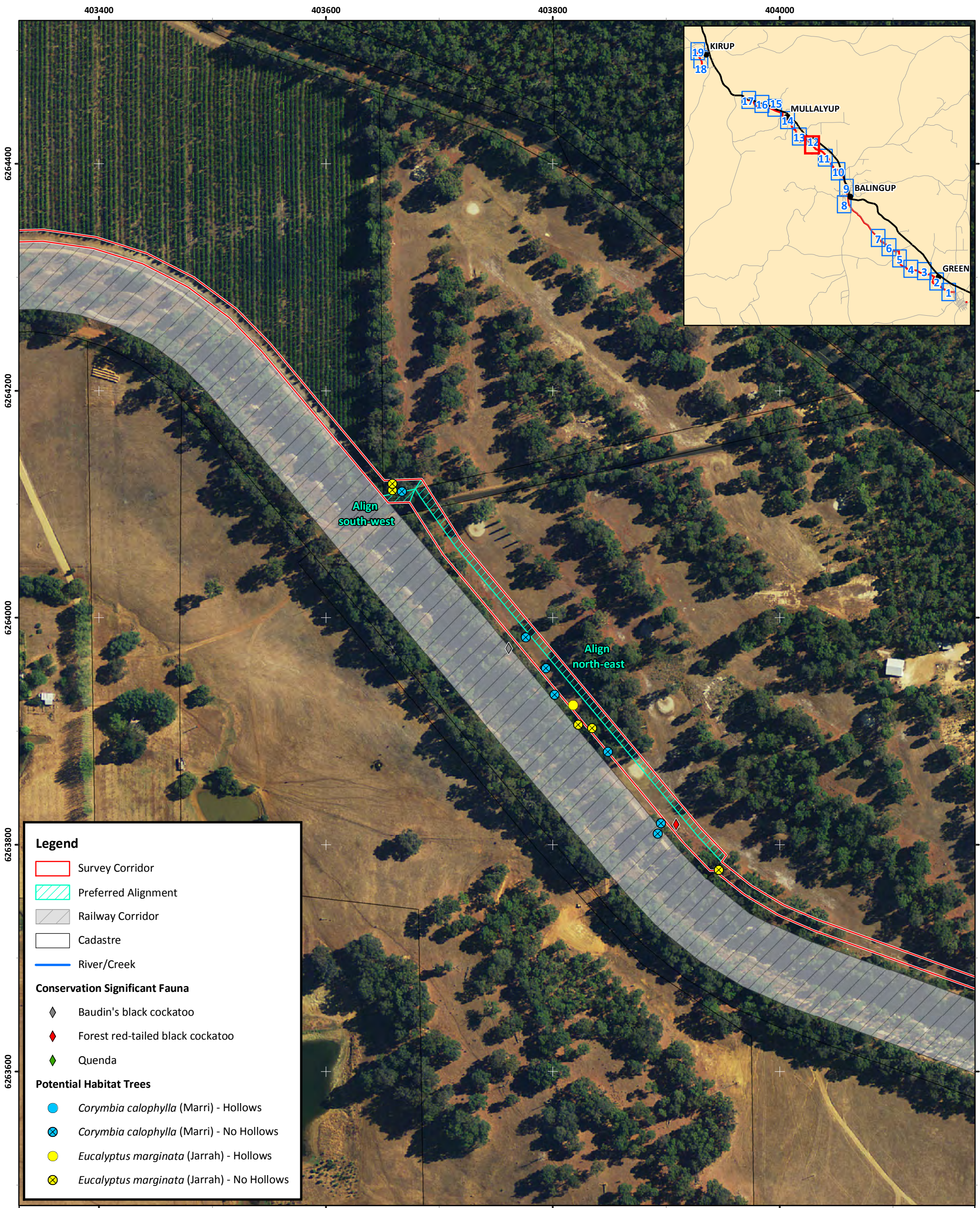




Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H11: Potential habitat trees and significant fauna locations with preferred alignment options

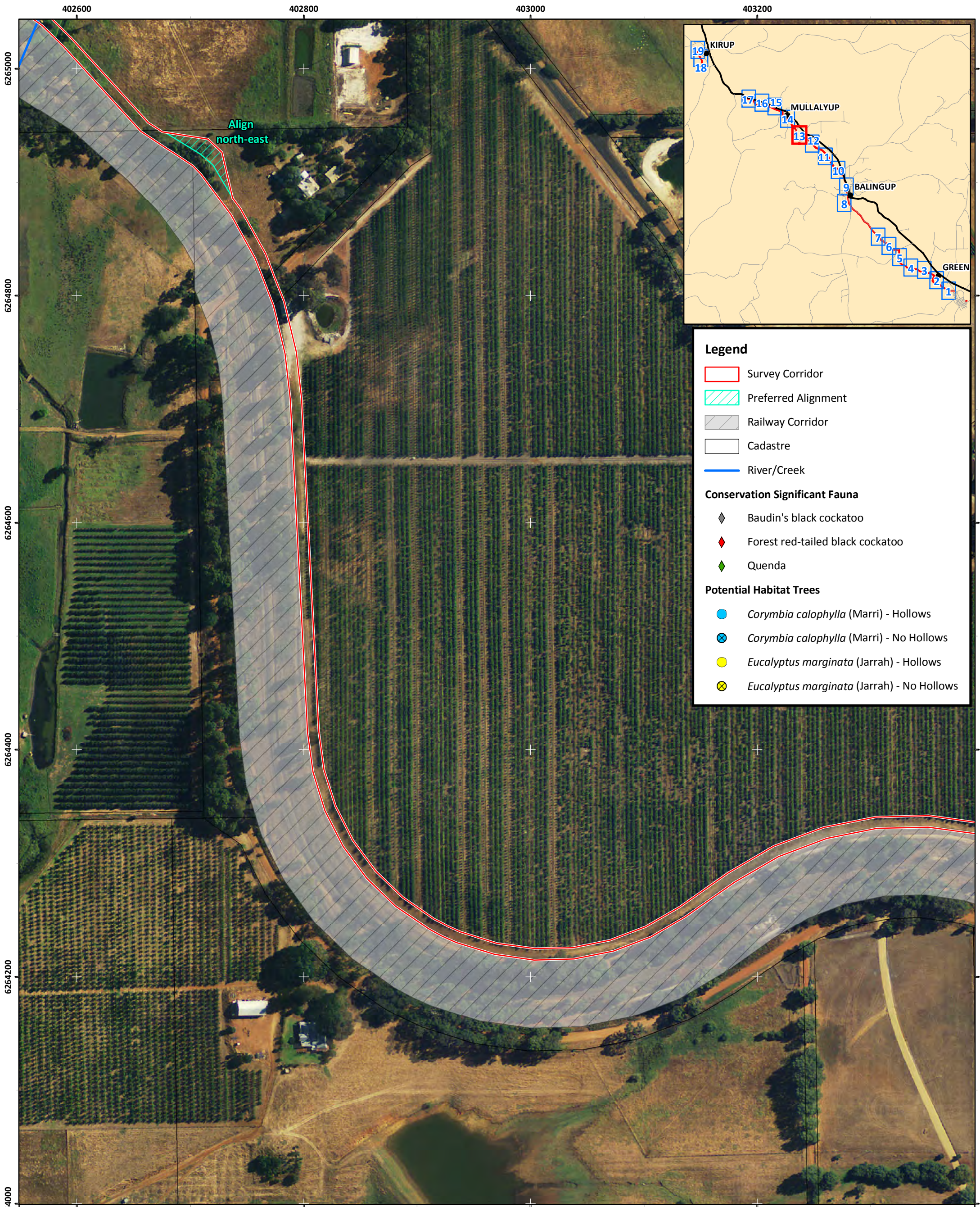
Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50	
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH11		



Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H12: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH12	



Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H13: Potential habitat trees and significant fauna locations with preferred alignment options

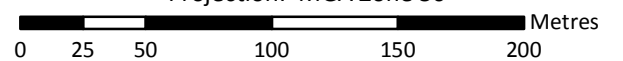
Author: V. Clarke

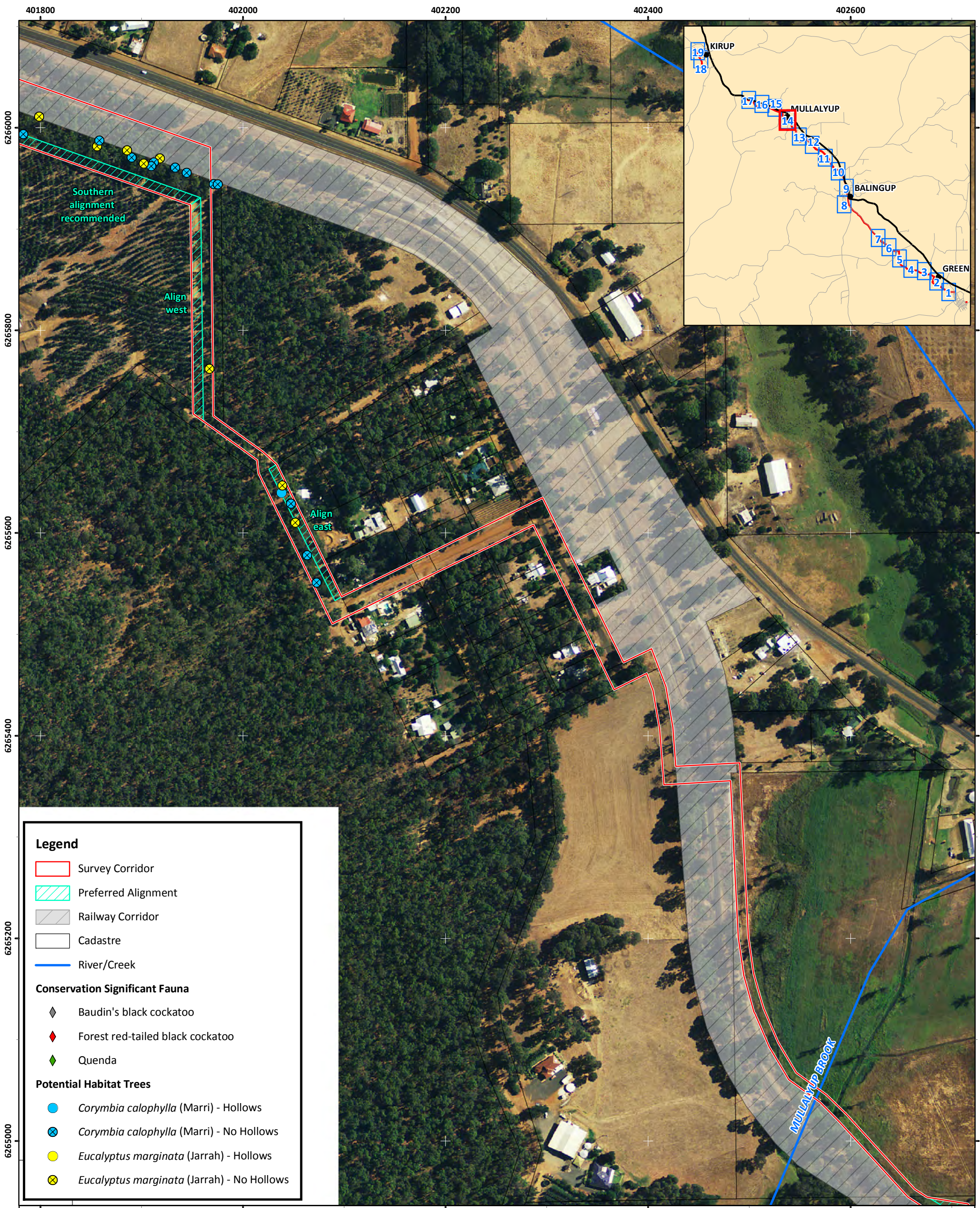
Date: 28-01-2014

Drawn: C. Smith

4175-13_GDR_1Rev0_140128_FigH13

Datum: GDA 1994
 Projection: MGA Zone 50





Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H14: Potential habitat trees and significant fauna locations with preferred alignment options

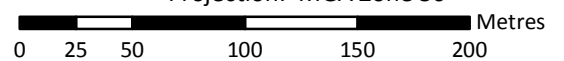
Author: V. Clarke

Date: 28-01-2014

Drawn: C. Smith

4175-13_GDR_1Rev0_140128_FigH14

Datum: GDA 1994
 Projection: MGA Zone 50



401200

401400

401600

401800

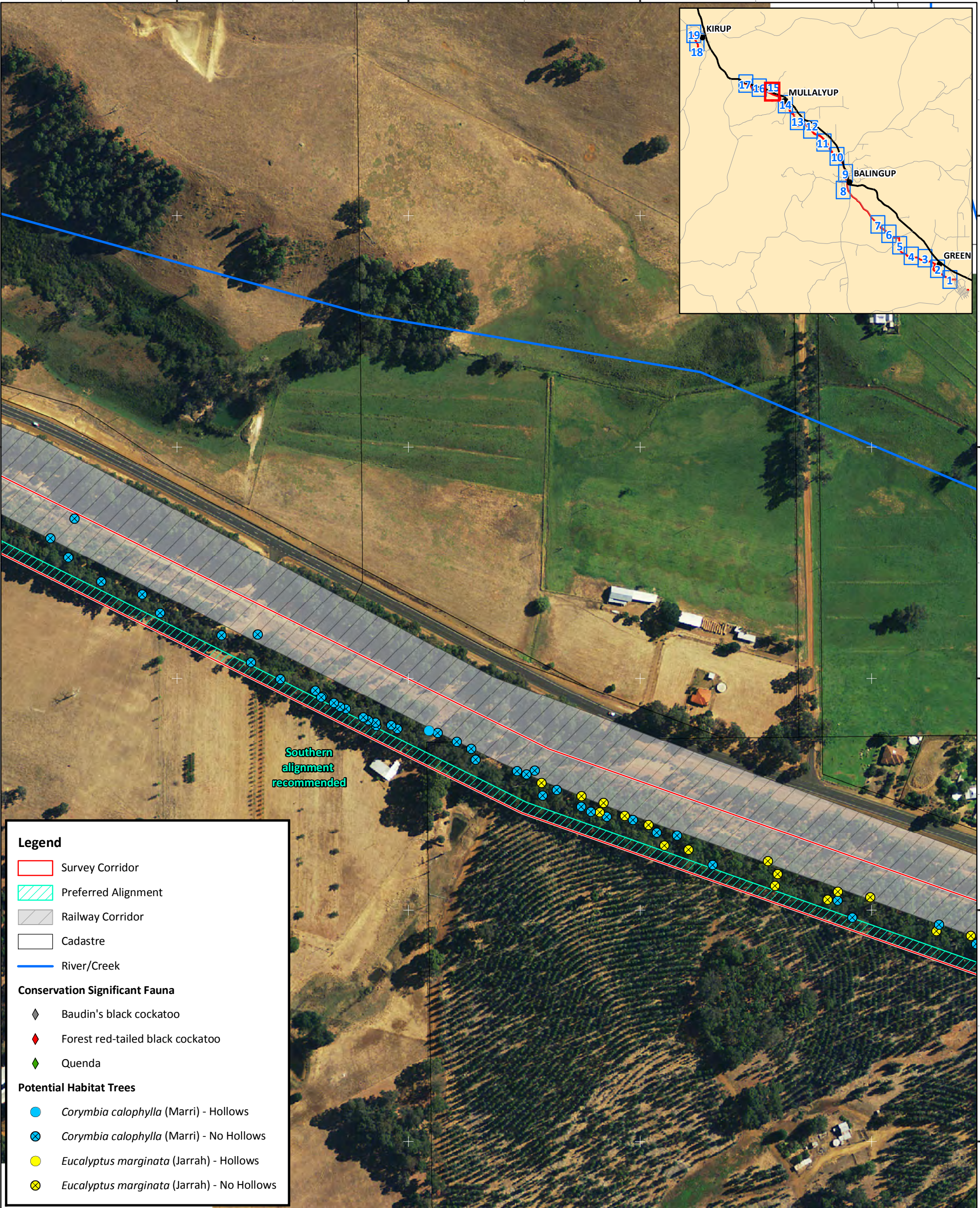
6266600

6266400

6266200

6266000

6265800



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H15: Potential habitat trees and significant fauna locations with preferred alignment options

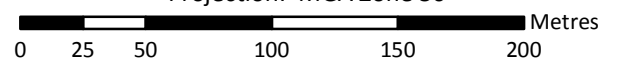
Author: V. Clarke

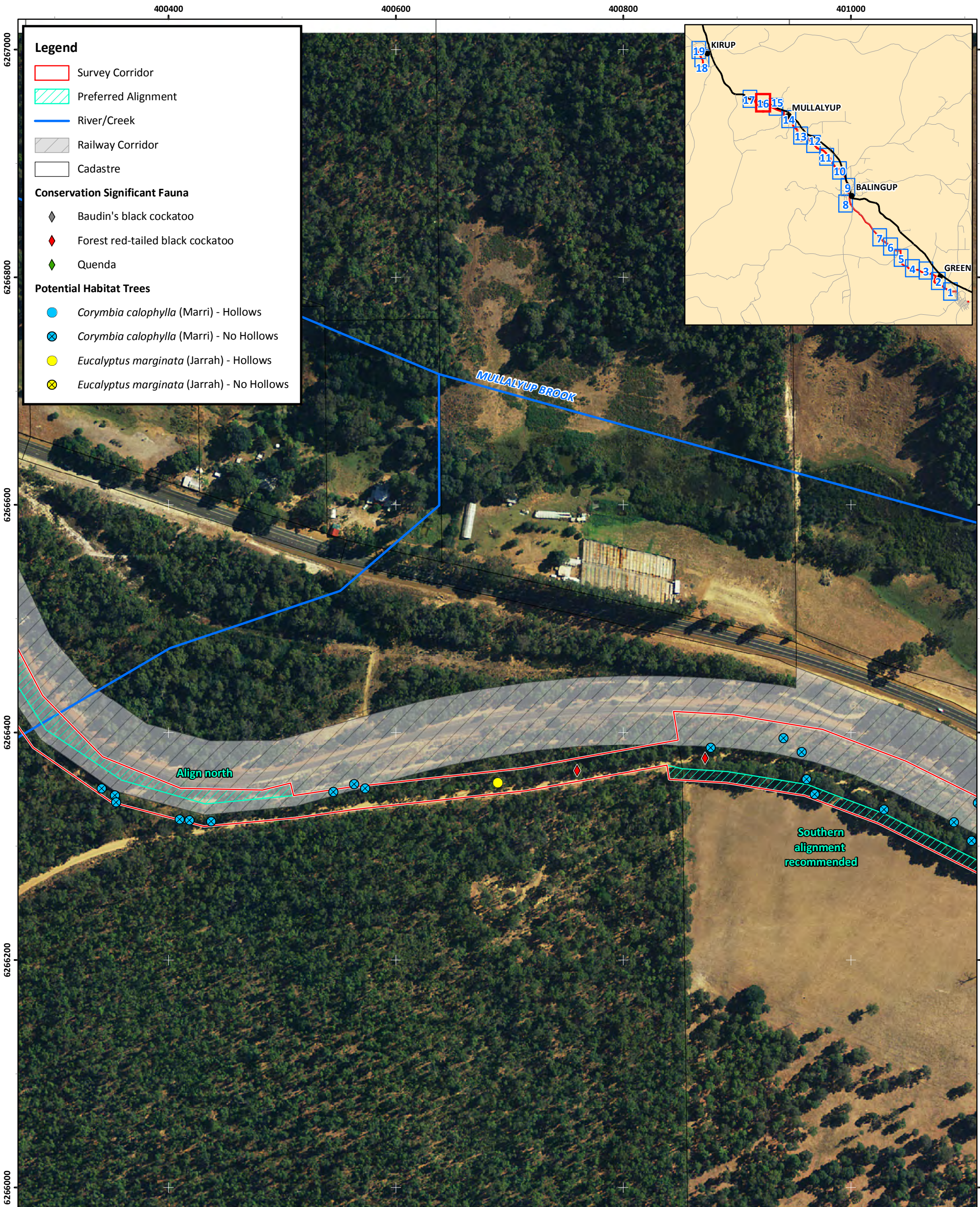
Date: 28-01-2014

Drawn: C. Smith

4175-13_GDR_1Rev0_140128_FigH15


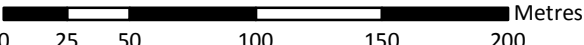
Datum: GDA 1994
 Projection: MGA Zone 50

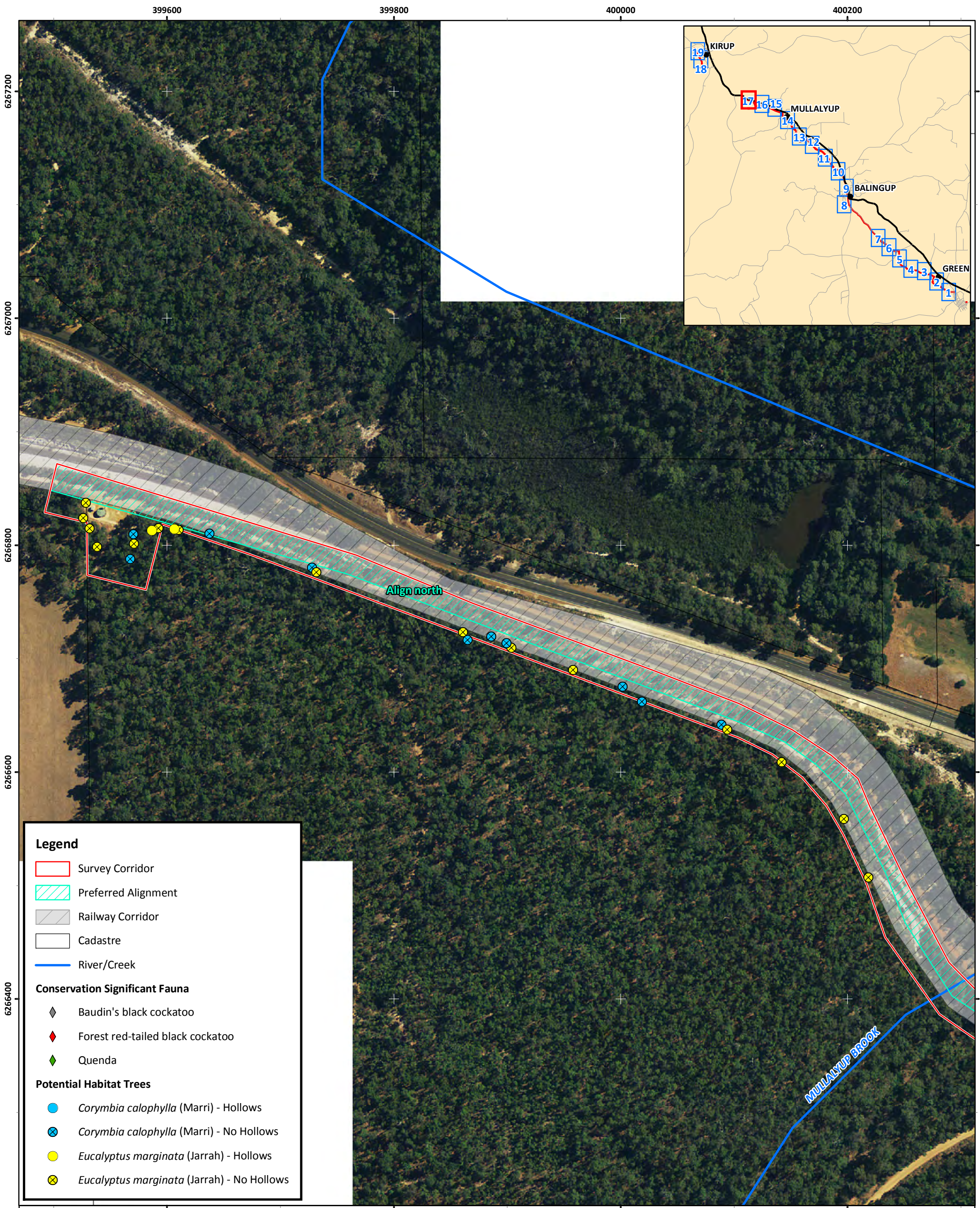




Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H16: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014	Datum: GDA 1994 Projection: MGA Zone 50	 
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH16		



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

- *Corymbia calophylla* (Marri) - Hollows
- ⊗ *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- ⊗ *Eucalyptus marginata* (Jarrah) - No Hollows

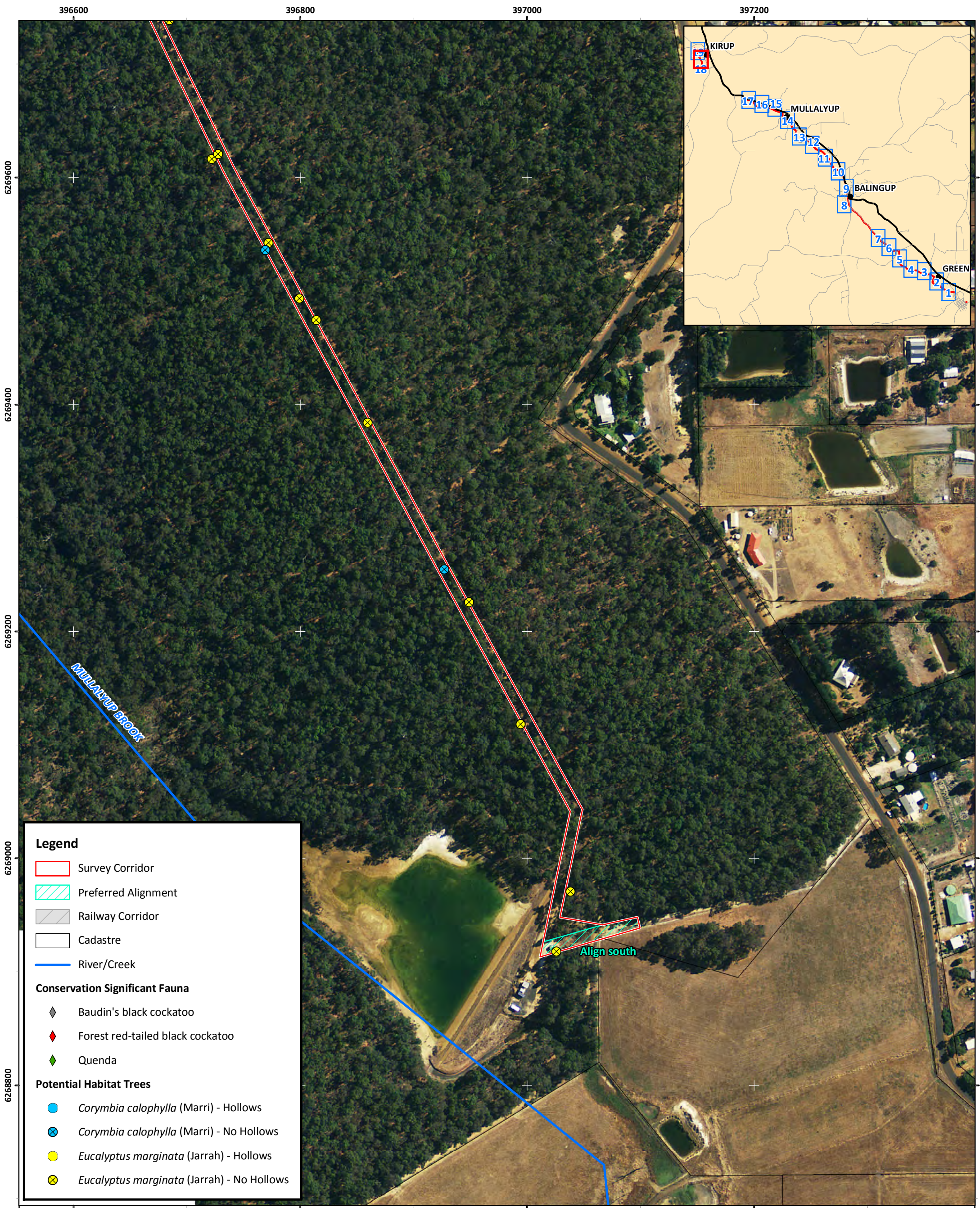
Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H17: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH17

Datum: GDA 1994
 Projection: MGA Zone 50

0 25 50 100 150 200 Metres



Legend

- Survey Corridor
- Preferred Alignment
- Railway Corridor
- Cadastre
- River/Creek

Conservation Significant Fauna

- ◆ Baudin's black cockatoo
- ◆ Forest red-tailed black cockatoo
- ◆ Quenda

Potential Habitat Trees

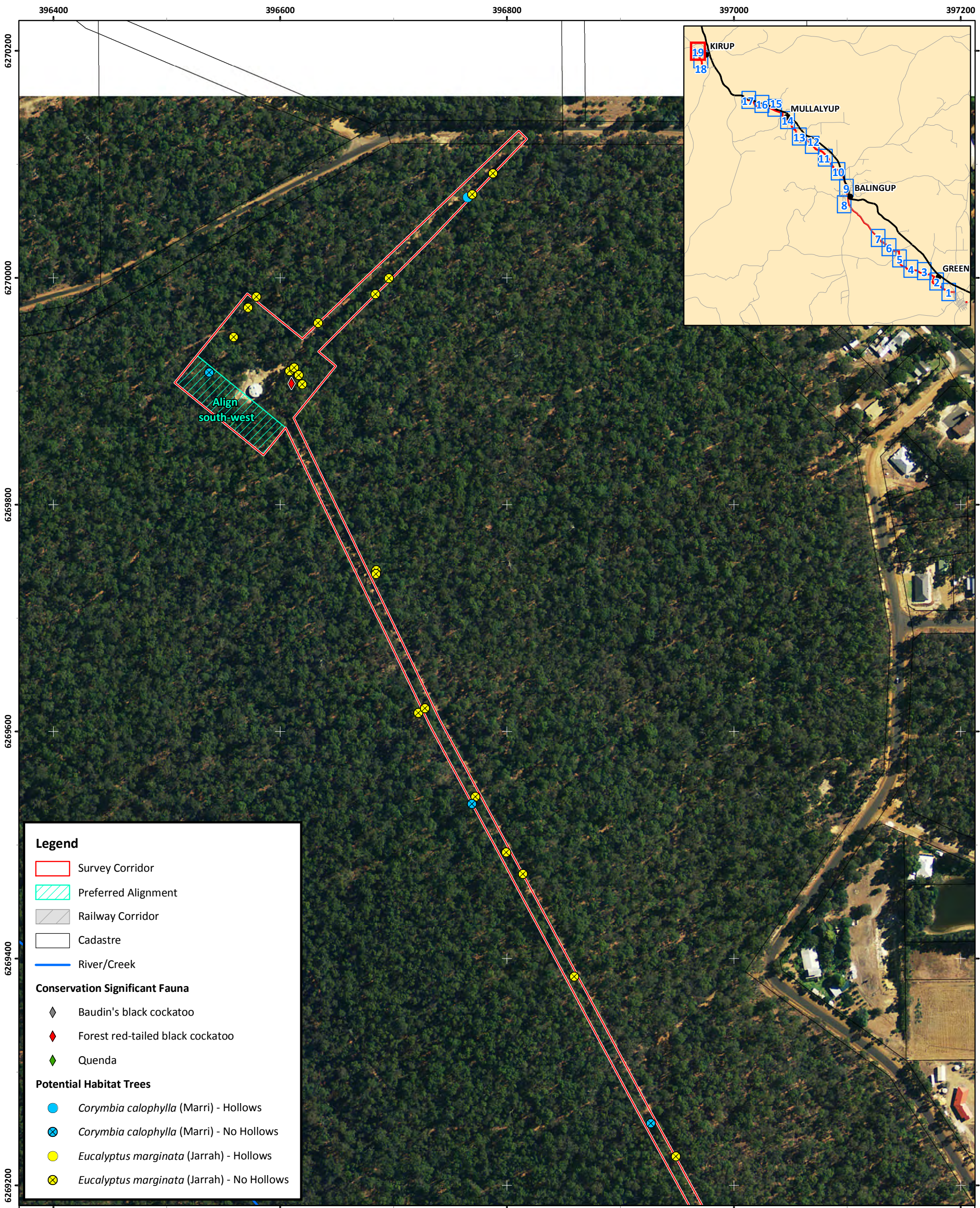
- *Corymbia calophylla* (Marri) - Hollows
- *Corymbia calophylla* (Marri) - No Hollows
- *Eucalyptus marginata* (Jarrah) - Hollows
- *Eucalyptus marginata* (Jarrah) - No Hollows

Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H18: Potential habitat trees and significant fauna locations with preferred alignment options

Author: V. Clarke	Date: 28-01-2014
Drawn: C. Smith	4175-13_GDR_1Rev0_140128_FigH18

Datum: GDA 1994
 Projection: MGA Zone 50



Water Corporation
 Greenbushes to Kirup Pipeline Route – Vegetation, Flora and Fauna Assessment

Figure H19: Potential habitat trees and significant fauna locations with preferred alignment options

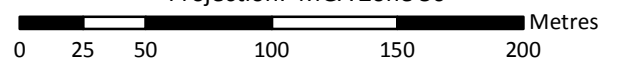
Author: V. Clarke

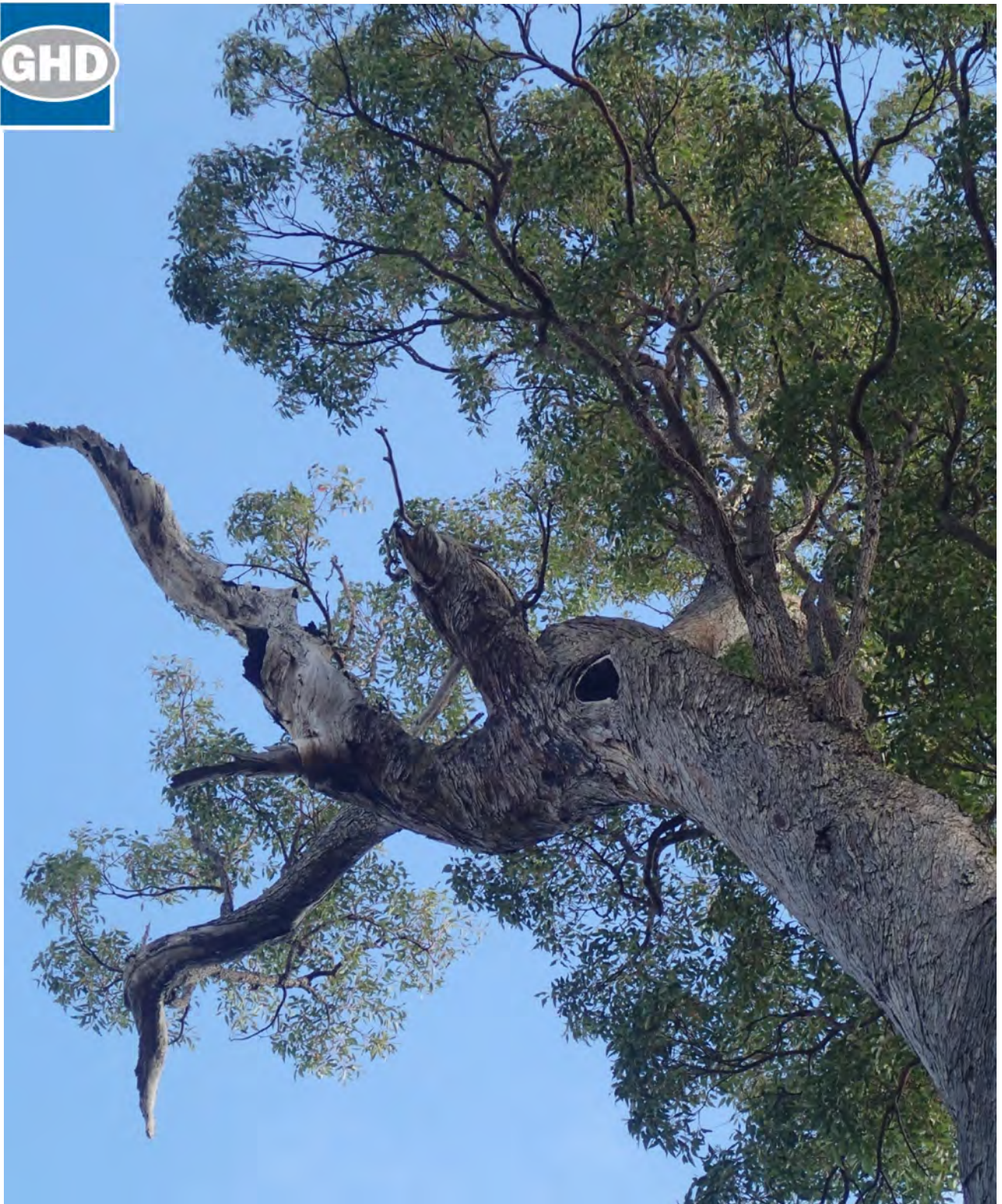
Date: 28-01-2014

Drawn: C. Smith

4175-13_GDR_1Rev0_140128_FigH19

Datum: GDA 1994
 Projection: MGA Zone 50





Water Corporation

Greenbushes to Kirup Link Biological Assessment

August 2017

Executive summary

The Water Corporation proposes to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, as a component of the broader Warren Blackwood Water Supply Scheme. This will potentially involve clearing of vegetation and fauna habitat for the construction and installation of this infrastructure.

A previous Spring Flora and Fauna Survey Report was prepared by Astron Environmental Services in 2013 covering the majority of the project area (Astron 2013), however since that time, the location of some of the components of the project has changed. As a result, further survey of the areas not previously covered is required to identify the key ecological values.

GHD was commissioned by the Water Corporation to undertake a flora and fauna survey for the project. The purpose of the flora and fauna survey is to define the quality and extents of ecological values in the survey area. The results of this assessment will be used to assess the ecological impact of the project and inform the environmental approvals process.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout this report.

Key findings

Vegetation

Regional vegetation mapped by Mattiske and Havel (1998) indicates three vegetation complexes occur within the survey area. One of these complexes, Balingup, has 30.79 % of its extent remaining within the Southern Jarrah Forest subregion. However because this complex is close to the target threshold of 30 % the Local Biodiversity Program (2013) has estimated that this complex has < 30 % of its vegetation extent remaining in the Southern Jarrah Forest subregion. The other two complexes are well represented within the Southern Jarrah Forest subregion with over 60 % of their extents remaining. Based on the statistics from GoWA (2017) the retention of the Balingup complex is considered essential to ensure that Regional Representation and Rarity Local Significance criteria are addressed within the Shires of Donnybrook – Balingup and Greenbushes – Bridgetown.

The desktop study revealed four Department of Biodiversity, Conservation and Attractions (DBCA) managed lands overlap the survey area; Greenbushes State Forest (F 20), CALM Exec Body Freehold (name: 1042/47) (P229098 2298), CALM Exec Body Freehold (name: 1117/388) (P252367 6367) and Mullalyup State Forest (F 21). The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) did not identify any Environmentally Sensitive Areas or federally listed Threatened Ecological Communities (TECs) potentially occurring within the study area. DBCA TEC and Priority Ecological Community (PEC) data obtained by the Water Corporation did not reveal any TECs or PECs occurring in the survey area.

Seven vegetation types were identified and described for the survey area. Six of these vegetation types were Eucalyptus woodlands with variations in the mid and lower storey species. The remaining vegetation type consisted of isolated stands of native and planted trees with scattered natives over weedy grasses. None of the vegetation types described for the survey area are synonymous with any TECs or PECs as defined by the EPBC Act or DBCA.

The vegetation condition within the survey area was rated as Very Good to Completely Degraded condition. The majority of the survey area (54%) was rated as Degraded and Degraded-Completely Degraded condition. Small patches of Very Good and Very Good – Good

vegetation contained a number common bushland weeds, however native vegetation dominated each strata.

Flora

One hundred and six (106) flora taxa (including subspecies and varieties) representing 40 families and 74 genera were recorded from the survey area during the field survey. This total comprised 77 native and 29 introduced flora taxa. No EPBC Act or WC Act listed flora were recorded within the survey area. In addition no DBCA Priority-listed flora or flora of conservation significance were recorded.

The likelihood of occurrence assessment post-field survey concluded that one taxon is likely to occur within the survey area; *Tetraria* sp. Blackwood River (A.R. Annels 3043) (P3). This species has previously been recorded approximately 50 m away from the Mullalyup Tank site. There is very limited suitable habitat for this species, however due to the proximity of the previous known record and its cryptic nature it is still considered to potentially occur.

Of the introduced taxa, two are listed as Declared Pests under the *Biosecurity and Management Act 2007* and as Weeds of National Significance (WONS):

- * *Asparagus asparagoides* (Bridal Creeper)
- * *Rubus ulmifolius* (Blackberry)

Fauna

The survey area comprised four fauna habitat types including Jarrah-Marri Woodland, *Eucalyptus rudis* woodland (riparian), planted vegetation, and cleared or previously disturbed areas. With the exception of the Cirillo Road Option section, these habitats are well-connected at both a local and regional scale to other areas of remnant and contiguous vegetation.

During the survey, three conservation significance fauna species were recorded:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Endangered – WC Act, Endangered – EPBC Act – observed on multiple occasions
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Vulnerable – WC Act, Vulnerable – EPBC Act – old foraging evidence recorded
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Endangered – WC Act, Vulnerable – EPBC Act

An additional nine species are considered likely to occur in the survey area based on previous records and suitability of habitat:

- Chuditch (*Dasyurus geoffroii*), Vulnerable – WC Act, Vulnerable – EPBC Act
- South western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*), Schedule 6 – WC Act
- Western Brush Wallaby (*Macropus irma*), Priority 4 – DBCA listing
- Western False Pipistrelle (*Falsistrellus mackenziei*), Priority 4 – DBCA
- Peregrine Falcon (*Falco peregrinus*), Schedule 7 – WC Act
- Quenda (*Isodon obesulus fusciventer*), Priority 4 – DBCA
- Rainbow Bee-eater (*Merops ornatus*) – Migratory
- Barking Owl (southern subspecies) (*Ninox connivens* subsp. *connivens*), Priority 2 – DBCA listing

- Masked Owl (southern subspecies) (*Tyto novaehollandiae* subsp. *novaehollandiae*), Priority 2 – DBCA listing

A total of 253 trees which are potentially suitable for Black Cockatoo breeding (Jarrah, Marri, and Flooded Gum) were recorded within the survey area, including 16 with hollows currently suitable for Black Cockatoo breeding. None of these trees had evidence of current or previous Black Cockatoo use (i.e. old chew marks). Old and fresh Black Cockatoo foraging evidence was recorded scattered throughout the survey area (on Marri nuts) and there is 2.98 ha of suitable foraging habitat.

The majority of the habitats recorded in the survey area are well represented in the immediate vicinity of the survey area and the broader Blackwood district (particularly in the conservation areas and State Forest) and would be utilised by all the conservation significant species known or likely to occur in the area. Furthermore, there is no habitat within the survey area that would be considered specific to, or solely relied upon by, any of the conservation significant species known or likely to occur within the area.

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Appendix A – Figures

Appendix B – Relevant legislation, conservation codes and background information

Appendix C – Desktop searches

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Appendix E - Fauna data

1. Introduction

1.1 Background

The Water Corporation proposes to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, as a component of the broader Warren Blackwood Water Supply Scheme (the project). This infrastructure includes:

- Approximately 5 km of 150 mm nominal diameter water supply main from the Greenbushes summit tank to the Balingup Dam tanks
- Approximately 10.4 km of 150 mm nominal diameter water supply main, from Balingup to the Mullalyup tank
- A pump station for the town of Mullalyup, located in Balingup
- Acquisition of land for a communications repeater station and the future tank site at Lot 8115, south of Dearle Street, Balingup
- A 225 m³ reinforced concrete water storage tank, overflow storage sump, pump station to Kirup, chlorination module and associated site work at the Mullalyup tank site
- A 66 m, 125 mm nominal diameter bypass main near Kirup Dam site
- A reinforced concrete water storage tank, with a capacity of 225 m³, overflow storage sump, chlorination module and associated site work at the Kirup tank site.

The construction and installation of this infrastructure will potentially involve clearing of vegetation and fauna habitat. A previous Spring Flora and Fauna Survey Report was prepared by Astron Environmental Services (Astron) in 2013 covering the majority of the project area (Astron 2013). However since that time, the location of some of the components of the project has changed. As a result, further survey of the areas not previously covered is required to identify the key ecological values.

1.2 Purpose of report

GHD Pty Ltd (GHD) was commissioned by the Water Corporation to undertake a flora and fauna survey for the project. The purpose of the flora and fauna survey is to define the quality and extents of ecological values in the survey area.

The information collected will enable the Water Corporation to consider the site's environmental constraints and opportunities. The report is likely to support a Native Vegetation Clearing Permit under the *Environmental Protection Act 1986* (EP Act) and referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report may also be included in correspondence to the Department of Water and Environmental Regulation (DWER), the Department of the Environment and Energy (DotEE) and other regulators and/ or stakeholders as required.

1.3 Project location

1.3.1 Survey area

The survey area is located within the Shires of Donnybrook – Balingup and Bridgetown – Greenbushes, between the towns of Kirup and Greenbushes (Figure 1, Appendix A) and is approximately 5.76 hectares.

The survey area comprises four distinct sections, identified as follows:

- Kirup Dam Bypass
- Mullalyup Tank
- Cirillo Road Option
- Southern Alignment

Some areas of the survey area have previously been surveyed as part of the Astron 2013 Flora and Fauna Survey (Astron 2013). GHD undertook a flora and fauna assessment of the entire survey area, which therefore included a re-survey of some of the Astron (2013) survey area.

1.3.2 Study area

The study area used for biological based desktop database searches included a 5 km buffer around the survey area in order to provide information on the context for the project within the wider area.

1.4 Scope of works

The scope of works, as undertaken by GHD, was to conduct an out of season flora and vegetation assessment (reconnaissance survey) in parallel with a Level 1 fauna assessment. The following actions were completed to fulfil the scope:

- A desktop assessment of relevant literature (as provided by the Water Corporation), databases and spatial datasets was completed to determine the environmental values and potential issues
- A field survey of the area was completed during Autumn, using quadrats where possible
- Vegetation communities, condition, conservation significant species and fauna habitat were mapped where present
- The vegetation types were described and classified to determine their conservation significance based on an analysis of the floristic data collected
- The vegetation complex mapping of the area was referenced to determine the pre-European extent remaining to assess the significance of the proposed native vegetation clearing
- The significance of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC) and any other areas of ecological importance was identified, mapped and discussed based on the results of the field survey
- An inventory of plant taxa (including weed species) was compiled
- Conservation significant flora species were actively searched for based on habitat requirements, and the population extents or locations of any potential Threatened flora, Priority flora and any other flora of local or taxonomic significance were mapped where identified
- An inventory of vertebrate fauna species was compiled through opportunistic recording of species, tracks, scats, bones, diggings and feeding areas
- Potentially occurring significant fauna species (giving specific consideration to Black Cockatoos, Western Ringtail Possum, Chuditch and the Southern Brush-tailed Phascogale) and their habitat were identified, where possible mapped and discussed
- Relevant photograph and figures were included in the reporting, with spatial shapefiles supplied separately
- A concise technical report was produced (this document).

1.5 Relevant legislation, conservation codes and background information

In Western Australia (WA) some communities, flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this Project is provided in Appendix B.

1.6 Report limitations and assumptions

This report has been prepared by GHD for Water Corporation and may only be used and relied on by Water Corporation for the purpose agreed between GHD and the Water Corporation as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Water Corporation arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Water Corporation and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey a desktop assessment was undertaken to identify relevant environmental information pertaining to the survey area and to assist in survey design. This included a review of:

- The DotEE Protected Matters Search Tool (PMST) to identify communities and species listed under the EPBC Act potentially occurring within a 5 km buffer of the survey area (DotEE 2017a) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCAs) *NatureMap* database for flora and fauna species previously recorded within a 5 km buffer of the survey area (DBCAs 2017) (Appendix C)
- DBCAs TEC and PEC database searches – provided by the Water Corporation - to determine the potential for TECs or PECs present within the survey area
- Previous report – Greenbushes to Kirup Pipeline Route Vegetation, Flora and Fauna Assessment (Astron 2013).

2.2 Field survey

2.2.1 Vegetation and flora

GHD Botanist (Angela Benkovic, SL012111) conducted a single season vegetation and flora assessment of the survey area on 16-18 May 2017. Sections of the survey area were located within DBCAs managed lands (Figure 2, Appendix A), therefore a Regulation 4 Authority was issued to Angela Benkovic (CE005559) authorising her to survey in these areas. This assessment was undertaken out of the main flowering season because the majority of the survey area had previously been surveyed (Level 2) by Astron in 2013.

The field survey was undertaken to verify the results of the desktop assessment, identify and describe the dominant vegetation units, assess vegetation condition and identify and record vascular flora taxa present at the time of survey. Searches for conservation significant or other significant ecological communities and flora taxa were also undertaken.

The survey methods employed by GHD were performed with reference to *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016a).

Data collection

Field survey methods involved a combination of sampling quadrats located in identified vegetation units and traversing the survey area by foot and vehicle. Two non-permanent quadrats and three relevés were described throughout the survey area.

Quadrats (measuring 10 metre (m) x 10 m – area of 100 m²) were located within key native vegetation units where space allowed. For areas that were either too small to establish a quadrat or too degraded to warrant one, a relevé was conducted. Field data at each quadrat was recorded on a pro-forma data sheet and included the parameters detailed in Table 1. Quadrat and relevé data are provided in Appendix D.

Table 1 Quadrat data collected during the flora and vegetation field survey

Aspect	Measurement
Collection attributes	Personnel/recorder; date, quadrat dimensions, photograph of the quadrat.
Physical features	Aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition was assessed using the condition rating scale devised by EPA and DBCA 2015.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, infrastructure works).
Flora	List of dominant flora from each structural layer. List of all species within the quadrat including average height and cover (using a modified Braun-Blanquet scale).

A flora inventory was compiled from taxa listed in described quadrats, relevés and from opportunistic floristic records throughout the survey area.

Vegetation units

Vegetation units were identified and boundaries delineated using a combination of aerial photography, topographical features and field data/observations.

Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by quadrat data and field observations. Vegetation unit descriptions follow the National Vegetation Information System (NVIS) and are consistent with NVIS Level V (Association), and are grouped within NVIS Level III (Broad Floristic Formation). At Level V up to three taxa per stratum are used to describe the association (Executive Steering Committee for Australian Vegetation Information (ESCAVI 2003).

Vegetation condition

The vegetation condition of the survey area was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016a). This scale recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels
- Extent of weed invasion
- Historical disturbance from tracks and other clearing or dumping
- The potential for natural or assisted regeneration.

The scale consists of six rating levels as outlined in Appendix B.

Flora identification

Species well known to the survey botanist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. All plant specimens collected during the field assessment were dried and processed in accordance with the requirements of the WA Herbarium. Plant species were identified by the use of taxonomic literature, electronic keys and online electronic databases.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–) and the EPBC Act Threatened species database provided by DotEE (2017b).

Nomenclature used in this report follows that used by the WA Herbarium (WAHERB) as reported on *FloraBase* (WA Herbarium 1998–).

Surveys for conservation significant flora

Prior to the field survey, information obtained from the desktop assessments (e.g. aerial photography, geology, soils and topography data, EPBC Act PMST, *NatureMap*) was reviewed to determine conservation significant flora taxa potentially present within the survey area and locations. Additionally, ecological information (e.g. habitat, associated flora taxa and phenology) was sourced from *FloraBase* (WA Herbarium 1998–) and other relevant publications where available, to provide further details.

Potential habitats were searched by opportunistic sampling. Locations within the survey area with differing hydrology, fire or disturbance history to the surrounding areas were also searched where identified.

The following data was recorded when any known or potential threatened, priority or significant flora was located: GPS location, height in metres (m), number of plants and corresponding area of population, reproductive state and plant condition.

2.2.2 Fauna

A Level 1 fauna assessment (reconnaissance survey) of the survey area was undertaken on the 16-18 May 2017. The fauna survey was undertaken in conjunction with the vegetation and flora assessment and with reference to *Technical Guide – Terrestrial Fauna Surveys* (EPA 2016b). The purpose of the reconnaissance survey was to verify the accuracy of the desktop study, and to characterise the fauna and faunal assemblages present in the survey area.

The majority of the survey area was traversed on foot and by vehicle over the course of three days to identify and describe the dominant fauna habitat types present and their condition, assess habitat connectivity, identify and record fauna species within the survey area. An assessment of the likelihood of conservation significant fauna and their habitats occurring within the survey area was also undertaken.

Habitat assessment

A fauna habitat assessment was undertaken to document the type, condition and extent of habitats within the survey area. The following information was recorded:

- Habitat structure (e.g. vegetation type, presence/absence of structural layers such as ground cover and mid storey)
- Presence/absence of refuge including: density of ground covers, fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/boulder piles, and the type and extent of each refuge
- Presence/absence of waterways including type, extent and habitat quality within waterway
- Location of the habitat within the survey area in comparison to the habitat within the surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the survey area
- Current land use and disturbance history
- Evaluation of key habitat features and types identified during the desktop assessment relevant to fauna of conservation significance
- Evaluation of the likelihood of occurrence of conservation significant fauna within the habitat (based on presence of suitable habitat).

Opportunistic fauna searches

Opportunistic fauna searches were also conducted across the survey area. Opportunistic searches involved:

- Searching the survey area for tracks, scats, bones, diggings and feeding areas for both native and feral species
- Searching through microhabitats including turning over leaf litter and examining tree hollows and hollow logs
- Visual and aural surveys for species potentially utilising the survey area.

Targeted habitat assessment for Black Cockatoo species

A habitat assessment for Black Cockatoo species was conducted in accordance with the EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso*, (Department of Sustainability, Environment, Water, Populations, and Communities (DSEWPaC 2012). The assessment included the identification, description and recording of:

- Potential and actual breeding habitat (relevant tree species with a DBH of >500 mm for Jarrah, Marri and Flooded Gum (*Eucalyptus rudis*) or DBH of >300 mm for Wandoo or Salmon Gum
- Existing tree hollows and any evidence of use by Black Cockatoos (a suitable nesting hollow currently able to support breeding was defined as a tree hollow with an entrance diameter greater than 100-150 mm which would allow entry of a Black Cockatoo)
- The diameter at breast height (DBH) of trees with existing hollows
- Potential night roosting and foraging habitat.

In addition, an inspection was undertaken of the two known existing hollows to assess for current and potential future usage by Black Cockatoos (locations as per Figure 3 in the RFQ documentation). Both of these trees are outside the survey area, and were previously assessed during the Astron (2013) survey.

Targeted habitat assessment for Western Ringtail Possum

A targeted assessment for Western Ringtail Possum habitat was also undertaken, which included identification of suitable habitat for the species where it occurred in the survey area (e.g. tree hollows, peppermint trees), searches for dreys (nests) and scats.

Camera trap survey

Motion sensor cameras (Reconyx-Hyperfire) were deployed for a period of two nights each at three locations adjacent to the survey area. Cameras were positioned in areas where good value habitat was identified, particularly for conservation significant fauna. Cameras were baited with sardines to attract fauna species, particularly carnivorous marsupials within the survey area. For each camera location the time and date deployed and recovered, a GPS coordinate, and brief habitat description were recorded. Camera locations are displayed in Figure 5, Appendix A. Data from the cameras was downloaded to a computer and analysed for the presence of animals following the field survey.

Fauna nomenclature

Nomenclature used in this report follows that used by the WA Museum and the DBCA NatureMap database (DBCA 2017) with the exception of birds, where by Christidis and Boles (2008) was used.

2.3 Limitations

2.3.1 Desktop limitations

Desktop investigations use a variety of online resources such as the WA Museum and DBCA *NatureMap* database (DBCA 2017), and the EPBC Act PMST. The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the DBCA searches of threatened flora and fauna provide more accurate information for the general area. However, some records of collections, sightings or trappings cannot be dated and often misrepresent the current range of threatened species.

2.3.2 Field survey limitations

The EPA (2016a; 2016b) Technical Guides state that flora and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2 Field survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information	Minor	Adequate information is available for the survey area; this includes: <ul style="list-style-type: none"> •Broad scale (1:250,000) mapping by Smith (1974) and digitised by Shepherd <i>et al.</i> (2002) •Regional biogeography (Hearn <i>et al.</i> 2002)
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor / moderate	The vegetation and flora survey was undertaken in late Autumn 2017. The flora recorded from the field survey is detailed in section 4.1.3 and a full flora species list is provided in Appendix D. The portion of flora collected and identified was considered moderate; and it is possible that the survey under-recorded some grass species (Poaceae) and Orchids (Orchidaceae) due to an autumn field assessment. The fauna survey was undertaken in Autumn 2017 and was a reconnaissance survey only. The fauna assessment sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings, etc. Many cryptic species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all species were identified to species level. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.
Flora determination	Minor	Flora determination was undertaken by the GHD ecologist in the field and from online and published references for collected specimens. Five native taxa could only be identified to genus level, one of these with tentative species identification due to lack of flowering or fruiting material required for identification. None are likely to be conservation significant species. Two introduced grass and a number of planted Eucalyptus species were not identified to species level as this was not considered to be necessary. The taxonomy and conservation status of WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time of report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	The entire survey area was accessed on foot or traversed by vehicle. The access tracks created as a result of infrastructure development (e.g. road, water and railway) allowed access to the entire survey area.

Aspect	Constraint	Comment
Mapping reliability	Minor	The vegetation was mapped at a scale ranging from 1:1,000 to 1:5,000 using high resolution Environmental Systems Research Institute aerial imagery obtained from Landgate, topographical features, previous broad scale mapping (Smith 1974) and field data. Data was recorded in the field using hand-held GPS tools (e.g. Nomad Juno and Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ± 5 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/season/cycle	Minor	The field survey was conducted during autumn (16-18 May 2017). In the three months prior to the survey (February-April), Donnybrook weather station (No. 009534, BoM 2017) recorded a total of 112 mm of rainfall. This total is approximately 20% higher than the long term average of 89.7 mm for the same period (BoM 2017). The weather conditions recorded during the field survey were: <ul style="list-style-type: none"> •Daily maximum temperature of 21.9 °C (Donnybrook weather station No. 009534; 19 km north-west from survey area). •Daily minimum temperature of 9.1 °C (Donnybrook weather station) •Daily rainfall 0.8 mm.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	Much of the survey area has been subjected to historical disturbance events (e.g. clearing); however, these disturbances did not impact the survey.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled in accordance with EPA (2016a) and terrestrial fauna sampled in accordance to EPA (2016b). The survey area was sufficiently covered during the survey.
Resources	Nil	Adequate resources were employed during the field survey. A total of 6 person days was spent undertaking the survey.
Access restrictions	Nil	No access problems were encountered during the survey.
Experience levels	Nil	The GHD staff who executed the survey are practitioners suitably qualified and experienced in their respective fields. Angela Benkovic (Botanist) has 10 years' and Laura Zimmermann (Zoologist) has over 5 years' experience undertaking surveys within WA.

3. Desktop assessment

3.1 Climate

The study area is located in the South Western Province of WA and experiences a temperate climate with distinctly dry, hot summers and cool, wet winters.

The BoM Donnybrook station (site number 009534) is the nearest weather station to the study area with continuous long-term data (19.0 km from the study area). Climatic data from this site indicates the mean maximum temperature of the area ranges from 16.5 °C in July to 30.6 °C in January and the mean minimum temperature ranges from 5.7 °C in July to 14.4 °C in February. The mean annual rainfall is 974 mm with an average of 134.5 rain days per year (BoM 2017). Climate statistics for the region are summarised in Plate 1.

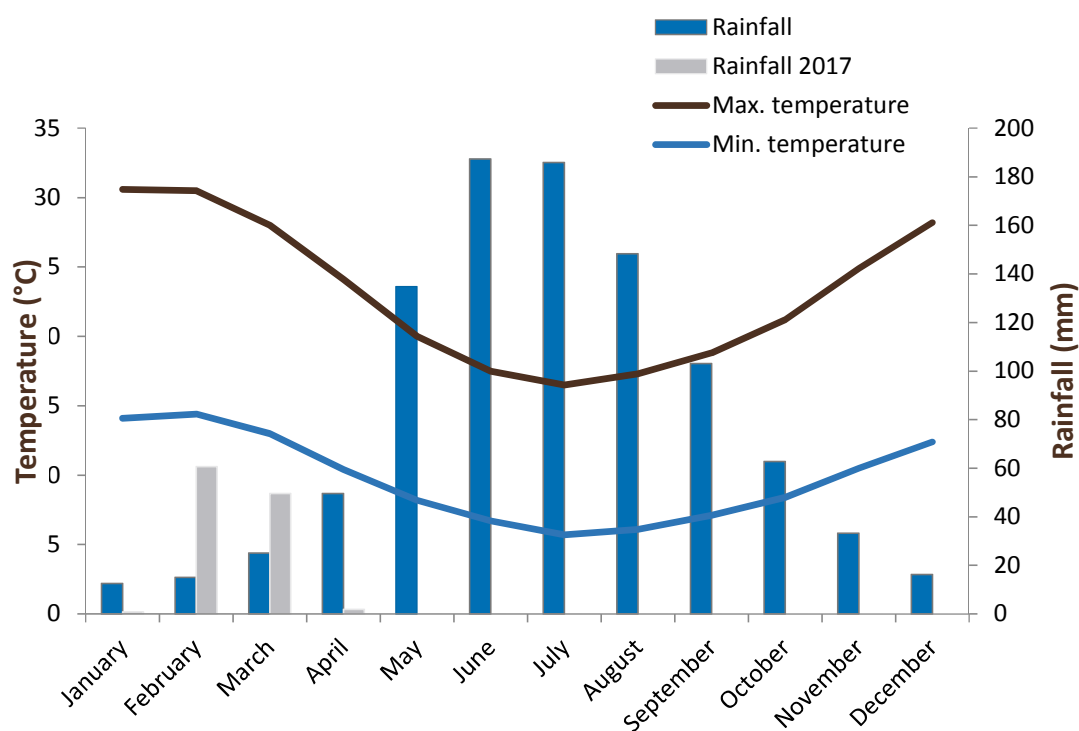


Plate 1 Mean climate statistics for Donnybrook

3.2 Geology, Landform and Soils

The survey area is situated in the South West Botanical Province of WA (Beard 1990) within the Jarrah Forest Bioregion and Southern Jarrah Forest sub-region described by the Interim Biogeographic Regionalisation of Australia (IBRA) (DotEE 2016c).

The Southern Jarrah Forest is described as duricrusted plateau of the Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part by Wandoo – Marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearn *et al.* 2002).

The Department of Agriculture and Food Western Australia (DAFWA) (2007) soil mapping indicates there are four different soil types within the survey area:

1. Kirup low slopes phase; duplex sandy gravels, Loamy gravels and Yellow deep sands (255LvKR3)

2. Mumballup upstream flats phase; Wet soils, Semi-wet soils, Friable red/brown loamy earths and Brown loamy earths (255LvMLu)
3. Balingup moderate slopes phase; Friable red-brown loamy earths, Brown loamy earths, Brown deep loamy duplexes and Loamy gravels (255LvBL4)
4. Dwellingup subsystem; Duplex sandy gravels and Loamy gravels with pockets of deep sands, often gravelly, and minor Shallow gravels (255DpDW)

3.3 Hydrology

A summary of the Department of Water (DoW) Geographic Data Atlas (DoW 2017) queries for the survey area are provided in Table 3.

Table 3 Department of Water geographic atlas queries for the survey area

Aspect	Details	Result
Groundwater areas	Groundwater areas proclaimed under the <i>Rights in Water and Irrigation Act 1914 (RIWI Act)</i>	None present
Surface water areas	Surface water areas proclaimed under the RIWI Act.	Dumpling Gully Surface Water Area and Mullalyup Surface Water Area
Irrigation district	Irrigation Districts proclaimed under the RIWI Act.	None present
Rivers	Rivers proclaimed under the RIWI Act.	None present
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the <i>Metropolitan Water Supply, Sewage and Drainage Act 1909</i> or the <i>Country Area Water Supply Act 1947</i> .	Mullalyup Water Reserve and Greenbushes Catchment Area
Waterway Management Areas	Areas proclaimed under the <i>Waterway Conservation Act 1976</i> .	None present

3.3.1 Watercourses

Watercourses that occur in or around the survey area are listed in Table 4.

Table 4 Watercourse occurrences in and around the survey area

Site	Watercourses
Kirup Dam Bypass	Closest watercourse occurs ~95 m south of site
Mullalyup Tank	Closest watercourse occurs ~260 m north east of site
Cirillo Road Option	Mullalyup Brook intersects ~200 m from the northern end of the site Balingup Brook intersects at the southern end of the site
South Alignment West	Intersects ~320 m from the northern end of the site
South Alignment East	Intersects ~60 m from the southern end of the site

3.3.2 Wetlands

The EPBC Act PMST did not identify any International significant listed wetlands within 5 km of the survey area (DotEE 2017a).

3.4 Land use

3.4.1 DBCA managed lands

There are four DBCA managed lands which overlap with the survey area, mapped in Figure 2, Appendix A:

- Greenbushes State Forest (F 20)
- CALM Exec Body Freehold (name: 1042/47) (P229098 2298)
- CALM Exec Body Freehold (name: 1117/388) (P252367 6367)
- Mullalyup State Forest (F 21).

3.4.2 Environmentally Sensitive Areas

There are no Environmentally Sensitive Areas (ESAs) within the survey area. The nearest ESA is located approximately 8.5 km to the south-west (Figure 2, Appendix A).

3.5 Vegetation and flora

3.5.1 Broad vegetation mapping and extents

Broad scale (1:250,000) pre-European vegetation mapping of the survey area was completed by Smith (1974) at an association level. The mapping indicates that one vegetation association is present within the survey area:

- Medium forest; jarrah-marri (association 3)

As part of the Regional Forest Agreement, Mattiske and Havel (1998) mapped vegetation complexes of the forest regions of south west WA at a scale of 1:50,000. Mattiske and Havel (1998) mapping indicates three vegetation complexes are present within the survey area:

- Swamp (S) Mosaic of low open woodland of *Melaleuca preissiana*-*Banksia littoralis*, closed scrub of Myrtaceae sp. closed heath of Myrtaceae sp. and sedgeland of *Baumea* and *Leptocarpus* sp. on seasonally wet or moist sand, peat and clay soils on valley floors in climatic zones
- Kirup (KR) Open forest to woodland of *Eucalyptus marginata* subsp. *marginata*-*Corymbia calophylla*-*Banksia attenuata*-*Xylomelum occidentale* on sandy slopes in the humid zone
- Balingup (BL) Open forest of *Eucalyptus marginata* subsp. *marginata*-*Corymbia calophylla* on slopes and woodland of *Eucalyptus rudis* on the valley floor in the humid zone

The Smith (1974) pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of the vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update October 2016 – Government of WA (GoWA) 2016). As shown in Table 5, the current extent of vegetation association 3 is greater than 50 % of its pre-European extent at all levels (State, IBRA bioregion, IBRA subregion and LGA), and is therefore above the 30 % threshold level ¹.

¹ The 30 % threshold level is the level below which species loss appears to accelerate exponentially at an ecosystem level (ANZECC 2000).

The Local Biodiversity Program (2013) and Molloy *et al.*, (2007) have assessed vegetation complexes described and mapped by Mattiske and Havel (1998) against presumed pre-European extents within the Southern Jarrah Forest IBRA subregion. In Table 6 the vegetation extents of all three complexes are shown to be above the 30 % threshold level¹ for the Southern Jarrah Forest region. However the BL complex is close to the target threshold, therefore the Local Biodiversity Program (2013) has classified it as having < 30% of its extent remaining within the Southern Jarrah Forest region.

Recently, Webb *et al.* (2016) reviewed the vegetation complex mapping datasets of the Swan Coastal Plain (Hedde *et al.* 1980) and the South West Forest Region (Mattiske and Havel 1998). The reviewed mapping (referred to as GoWA 2017) does not extend to IBRA sub-region boundaries, but can be used for vegetation complex extents within the Local Government Area.

Based on this updated data, vegetation complex S is below the 30 % threshold level for the Shire of Donnybrook-Balingup but has not been classified as essential to retain (Table 7). Complexes close to meeting the regional criteria target thresholds are indicated with an N and are not essential to retain. This is in comparison to the BL complex that does have over 30 % of its extent remaining within the Shire, yet has been classed essential to retain due to its regional representation (Table 6). Table 8 shows the extents for complexes BL and KR within the Shire of Bridgetown-Greenbushes. Both complexes have less than the 30 % remaining within the Shire, however only the BL complex is essential to retain.

3.5.2 Conservation significant ecological communities

The EPBC Act PMST did not identify any federally listed TECs potentially occurring within the study area (DotEE 2017a) (Appendix C). DBCA TEC and PEC data obtained by the Water Corporation did not reveal any TECs or PECs occurring near the survey area. The closest known records of TECs and PECs occur approximately 27 km north-west and 25 km east of the survey area respectively.

Table 5 Extents of vegetation associations mapped within the survey area (Smith 1974, GoWA 2016)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DBCA managed lands
Jarrah Forest IBRA bioregion		4,506,660.26	2,422,782.9	53.61	69.01
Southern Jarrah Forest IBRA sub-region		2,607,879.53	1,312,477.9	50.33	68.87
3	State: WA	2,661,405.06	1,806,812.2	67.89	81.22
	IBRA bioregion: Jarrah Forest	2,390,591.42	1,607,399.7	67.24	80.70
	IBRA sub-region: Southern Jarrah Forest	1,482,491.74	884,324.68	59.65	78.12
	LGA: Donnybrook-Balingup	93,347.33	61,205.73	65.57	89.96
	LGA: Bridgetown-Greenbushes	121,152.70	68,442.75	56.49	86.65

Table 6 Extent of vegetation complexes in the Southern Jarrah Forest subregion within the project area (Mattiske and Havel 1998, Local Biodiversity Program 2013)

Vegetation Complex	Pre-European extent (ha)	2013 extent (ha)	% of pre-European extent	% of pre-European extent with formal protection
BL	59446.57	18303.33	30.79*	1.51
KR	3459.18	2082.40	60.2	3.91
S	53658.36	40934.28	76.29	21.73

Table 7 Extent of vegetation complexes in the Shire of Donnybrook-Balingup within the project area (GoWA 2017)

Vegetation complex	Pre-European total (ha)	Remaining extent total (ha)	Remaining extent (%)	Proportion of the Vegetation Complex within the LGA (%)	Complexes that meet Regional Representation and Rarity, Local Significance Criteria [†]
BL	42835	13097	30.58	72.06	Y
KR	3424	2031	59.34	98.98	N
S	425	35	8.35	0.79	N

Table 8 Extent of vegetation complexes in the Shire of Bridgetown-Greenbushes within the project area (GoWA 2017)

Vegetation complex	Pre-European total (ha)	Remaining extent total (ha)	Remaining extent (%)	Proportion of the Vegetation Complex within the LGA (%)	Complexes that meet Regional Representation and Rarity, Local Significance Criteria [†]
BL	12913	2830	21.92	21.72	Y
KR	35	5	15.31	1.02	N

* Complex is close to the criteria target threshold, therefore it is estimated <30 % of its extent remains (Local Biodiversity Program 2013)

[†] Vegetation complexes that are considered essential for retention to ensure that Regional Representation and Rarity Local Significance criteria are addressed are indicated with Y

3.5.3 Flora diversity

The *Naturemap* (DBCA 2007-) database identified 295 flora taxa representing 74 families and 178 genera that have previously been recorded within the study area. This total comprised 239 native taxa and 56 naturalised (introduced) taxa. Dominant families included Fabaceae (43 taxa), Orchidaceae (19 taxa) and Myrtaceae (17 taxa). The *NatureMap* database search is provided in Appendix C.

3.5.4 Conservation significant flora

Desktop searches of the EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 12 conservation significant flora taxa within the study area. The desktop searches recorded:

- Six taxa listed as Threatened under the EPBC Act and/or as Declared Rare Flora under the WC Act
- One Priority 2 taxon
- Four Priority 3 taxa
- One Priority 4 taxon

The locations of eight conservation significant flora registered on the DBCA databases and provided by the Water Corporation are mapped in Figure 2, Appendix A- species names were not provided with the data.

3.6 Fauna

3.6.1 Fauna diversity

NatureMap (DBCA 2007-) identified 152 native fauna taxa previously recorded within the study area. This total included six amphibians, 107 birds, 17 mammals and nine reptiles, the remaining native fauna were non-vertebrate taxa and fish which were excluded from this assessment.

3.6.2 Conservation significant fauna

The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 18 conservation significant fauna species (Appendix C). Species identified by the PMST as marine, migratory marine or migratory wetland were excluded from this assessment as no marine or wetland habitat was present within or nearby the survey area. However, species identified by the PMST as migratory terrestrial were considered as part of this assessment.

3.7 Previous survey results

A previous field survey by Astron (2013) was completed in October 2013 to identify the environmental values of a similar alignment to the current survey area.

Vegetation and flora

The previous survey did not identify any TECs or PECs within the survey area. Additionally no Threatened or Priority flora were recorded. A total of 206 plant taxa were recorded, comprising of 178 natives and 28 introduced species.

Fauna

The previous survey (Astron 2013) identified 34 vertebrate fauna species including 28 birds, three amphibians and three mammal species in the survey area. Of these, one species, the red fox was introduced.

Four species of conservation significance were recorded in 2013 including Baudin's Black Cockatoo, Forest Red-tailed Black Cockatoo, Quenda and the Eastern Great Egret. Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo are listed as Vulnerable under the EPBC Act and WC Act. Quenda is listed Priority 4 under DBCA and the Eastern Great Egret is migratory S3 under the EPBC Act and WC Act. The Eastern Great Egret has since been removed from the migratory list under the EPBC Act (June 2016) and is now only listed as marine.

4. Field survey results

4.1 Vegetation and flora



4.1.1 Vegetation types



Seven vegetation types were mapped and described for the survey area (Table 9 and Figures 3.1 –3.5, Appendix A). Six vegetation types were variations in *Eucalyptus* dominated woodlands; five of these were Jarrah-Marri woodlands differentiated by mid and lower storey species and one was a small pocket of Flooded Gum woodland. The seventh vegetation type consisted of isolated stands of native and planted trees with scattered natives over weedy grasses.



All vegetation types were consistent with the vegetation mapped by Smith (1974); medium forest Jarrah-Marri (association 3). *Eucalyptus* spp. - Marri - Pine isolated trees (VT07), located at Cirillo Road was the dominant vegetation type within the survey area (2.04 ha). Jarrah-Marri woodland over *Hibbertia* shrubland (VT01) located at the Kirup Dam Bypass was the most restricted vegetation type within the survey area, occupying less than 0.03 ha.



Areas identified as cleared are devoid of native vegetation. These areas are represented by gravel roads and/or fire breaks.

Table 9 Vegetation types recorded within the survey area

Vegetation type	Vegetation type description (NIVIS)	Extent (ha)	Vegetation complex alignment and quadrat/relevé reference	Photograph
Jarrah-Marri woodland over <i>Hibbertia</i> shrubland (VT01)	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> open forest <i>Hibbertia hypericoides</i> <i>Hakea lissocarpha</i> shrubland <i>Patersonia occidentalis</i> <i>Lepidosperma leptostachyum</i> open herbland	0.03 ha	Kirup complex Relevé 1	
Marri-Jarrah woodland over <i>Taxandria</i> shrubland (VT02)	<i>Corymbia calophylla</i> <i>Eucalyptus marginata</i> open forest <i>Banksia grandis</i> isolated trees <i>Taxandria parviceps</i> <i>Hibbertia hypericoides</i> <i>Podocarpus drouynianus</i> shrubland <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open herbland	0.29 ha	Kirup complex Quadrat 1	

Vegetation type	Vegetation type description (NIVIS)	Extent (ha)	Vegetation complex alignment and quadrat/relevé reference	Photograph
Jarrah-Marri woodland over <i>Bossiaea</i> shrubland (VT03)	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> <i>Banksia grandis</i> open forest <i>Bossiaea linophylla</i> shrubland <i>Pteridium esculentum</i> <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open fernland/herbland.	0.46 ha	Balingup complex Quadrat 2	
Jarrah-Marri woodland over blackberry (VT04)	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> * <i>Pinus radiata</i> open forest <i>Xanthorrhoea preissii</i> isolated shrubs * <i>Rubus ulmifolius</i> shrubland	1.79 ha	Balingup complex Relevé 2	

Vegetation type	Vegetation type description (NIVIS)	Extent (ha)	Vegetation complex alignment and quadrat/relevé reference	Photograph
Flooded gum woodland over blackberry (VT05)	<i>Eucalyptus rudis</i> open woodland <i>Xanthorrhoea preissii</i> isolated shrubs * <i>Rubus ulmifolius</i> shrubland.	0.12 ha	Balingup complex Relevé 3	
Jarraah-Marri woodland over Bugle Lily (VT06)	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> * <i>Pinus radiata</i> woodland <i>Xanthorrhoea preissii</i> isolated shrubs <i>Watsonia meriana</i> var. <i>bulbillifera</i> herbland	0.29 ha	Balingup complex Relevé 4	

Vegetation type	Vegetation type description (NIVIS)	Extent (ha)	Vegetation complex alignment and quadrat/relevé reference	Photograph
Eucalyptus spp.- Marri-Pine isolated trees (VT07)	<i>Eucalyptus</i> spp. <i>Corymbia calophylla</i> * <i>Pinus radiata</i> isolated trees	0.64 ha	Too altered by disturbance to align with a complex Relevé 5	
Cleared	Areas devoid of native vegetation – turf, roads, gravel and firebreaks	2.15 ha	NA	

4.1.2 Vegetation condition

The vegetation condition within the survey area was rated as Very Good to Completely Degraded condition. The extents of the vegetation condition ratings mapped within the survey area are detailed in Table 10 and mapped in Figures 4.1 – 4.5, Appendix A.

The majority of the survey area (54%) was rated as Degraded and Degraded-Completely Degraded condition. Degraded areas were dominated by weeds, whilst Degraded-Completely Degraded areas lacked a native mid and lower storey; these areas were commonly characterised by isolated stands of native and introduced trees over grass.

The small patches of Very Good and Very Good – Good vegetation contained a number common bushland weeds, however native vegetation dominated each strata. Good – Degraded vegetation were areas that had been affected by ‘edge effects’ due to the proximity to roads and other disturbance. The Completely Degraded/Cleared areas were devoid of native vegetation and are associated with firebreaks and gravel roads (33 % of the survey area).

Table 10 Extent of vegetation condition ratings mapped within the survey area

Vegetation Condition	Kirup Dam Bypass	Mullalyup Tank	Cirillo Road Option	South Alignment East	South Alignment West	Total
Very Good	-	0.149	-	-	-	0.149
Very Good - Good	-	-	-	0.157	-	0.157
Good - Degraded	0.027	0.060	-	0.308	-	0.402
Degraded	-	0.077	0.326	0.051	1.796	2.25
Degraded – Completely Degraded	-	-	0.885	-	-	0.885
Completely Degraded/Cleared	0.093	0.053	1.40	0.358	0.021	1.915
Total	0.12 ha	0.34 ha	2.61 ha	0.87 ha	1.82 ha	5.76 ha

4.1.3 Flora diversity

One hundred and six (106) flora taxa (including subspecies and varieties) representing 40 families and 74 genera were recorded from the survey area during the field survey. This total comprised 77 native and 29 introduced flora taxa (Appendix D contains the flora species list). Dominant families recorded from the survey area included:

- Fabaceae (17 taxa)
- Myrtaceae (10 taxa)
- Asparagaceae (8 taxa).

Only two sites within the survey area were of suitable size and condition to establish quadrats, the remaining sites were surveyed by relevés. Species diversity from relevés ranged from 8 – 38 species (average 22). However high diversity in some of these relevés was due to opportunistic weeds and/or planted species. The species diversity of the two quadrats was 24 species in quadrat 1 (VT03) and 43 species in quadrat 2 (VT02). The species diversity of the quadrats is comparative to that recorded by Astron (2013) within the same area (26 species WC10 and 35 species in WC14, respectively) and a previous survey in the Balingup area that averaged 32 species per quadrat (Sandiford & Wildflower Society of WA 2001). Based on these comparisons the survey assessment was considered representative of the floristic diversity in the survey area.

The highest floristic diversity for the survey area was recorded in VT02, with 43 species. Quadrat and relevé data is presented in Appendix D.

4.1.4 Conservation significant flora

No EPBC Act or WC Act listed flora were recorded within the survey area. In addition no DBCA Priority-listed flora or flora of conservation significance, as defined in EPA 2016c, were recorded within the survey area during the field survey,

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment (Appendix D). This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that one taxon is likely to occur, one taxon may possibly occur and the remaining 10 taxa are unlikely or highly unlikely to occur within the survey area. The taxon likely to occur, *Tetraria* sp. Blackwood River (A.R. Annels 3043) (P3) is a cryptic species that has previously been recorded approximately 50 m away from the Mullalyup Tank site. This species is known to occur in wetlands and on river edges, so has the potential to occur in parts of the survey area in these habitats.

4.1.5 Introduced flora

Twenty nine (29) introduced flora taxa were recorded in the survey area. Of the introduced taxa, two are listed as Declared Pests under the *Biosecurity and Management Act 2007* and as Weeds of National Significance (WONS):

- * *Asparagus asparagoides* (Bridal Creeper)
- * *Rubus ulmifolius* (Blackberry)

The remaining introduced taxa are considered environmental weeds and all have been previously recorded on in the Jarrah Forest. The locations of * *Asparagus asparagoides* and * *Rubus ulmifolius* within the survey area are mapped in Figure 4.4 Appendix A

4.2 Fauna


4.2.1 Fauna habitats




Four fauna habitat types were identified and described within the survey area (Table 11), and include Jarrah-Marri woodland, *Eucalyptus rudis* woodland (riparian), planted vegetation and existing cleared areas. The majority of the survey area comprises Jarrah-Marri Woodland in relatively good condition (Kirup Dam Bypass, Mullalyup Tank site and Southern Alignment), with a small section of *Eucalyptus rudis* woodland along the minor drainage line in the Southern Alignment. The habitat in the Cirillo Road Option section is highly altered and transitions between planted roadside vegetation, cleared areas and Jarrah-Marri over a weedy understorey.

The Jarrah-Marri Woodland is well represented in the local area, as well as in the broader region (including throughout the surrounding State Forest). The *Eucalyptus rudis* woodland occurs along watercourses, drainage lines and lower lying areas in the region and therefore is less common at both a local and regional scale.

Habitat types are mapped in Figure 5, Appendix A and the value of each type discussed below in Table 11.

Table 11 Fauna habitat types

Habitat description	Indicative images
<p>Jarrah-Marri woodland</p> <p>This habitat is comprised of: VT01, VT02, VT03, VT04, VT06. Jarrah/Marri woodland is the dominant habitat type throughout the survey area and typically comprises Jarrah and Marri trees of multiple age classes, over Peppermint trees along the mid and upper slopes. The canopy is open, with a relatively sparse mid-storey shrub layer (e.g. <i>Banksia</i>, <i>Acacia</i> and <i>Xanthorrhoea</i>) over a moderately open lower shrub layer and understorey of grasses/herbs. The leaf litter is thick (~10 cm) in places. There are numerous micro-habitat features such as hollow logs, woody debris, hollow bearing trees, embedded rocks (mostly small), and moss. Scattered larger tree hollows were also recorded (mainly stags). The area is long unburnt (>10 years).</p> <p>The quality of this habitat is variable throughout the survey area, depending on the level of previous disturbance. Disturbances include previous clearing (roads, tracks and agriculture), weeds and historical logging. There is evidence of timber harvesting throughout this habitat, which has limited the number of mature trees (particularly with hollows) in some parts of the survey area. Areas of high quality habitat have minimal impacts from weeds.</p> <p>Jarrah and Marri are recognised as valuable habitat for Black Cockatoos for breeding, feeding and roosting. Scattered large hollows were observed within this habitat type.</p> <p><u>Conservation Significant Species</u></p> <p>All three species of Black Cockatoos (Forest Red-tailed, Carnaby’s and Baudin’s Black Cockatoos) were observed feeding and loafing in this habitat type.</p> <p>This habitat could also support several other conservation significant fauna species: Chuditch (<i>Dasyurus geoffroii</i>), Southern Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>), Western Brush Wallaby (<i>Macropus irma</i>), Southern Brown Bandicoot (<i>Isodon obesulus fusciventer</i>), Western False Pipistrelle (<i>Falsistrellus mackenziei</i>) and the Masked Owl (southern subspecies) (<i>Tyto novaehollandiae</i> subsp. <i>novae-hollandiae</i>). The Peregrine Falcon (<i>Falco peregrinus</i>) may utilise the area opportunistically.</p> <p>This fauna habitat type covers approximately 2.86 ha and is of high value to fauna.</p>	

Habitat description	Indicative images
<p><i>Eucalyptus rudis</i> woodland</p> <p>This habitat is comprised of: VT05.</p> <p>A small area of the Southern Alignment West comprises Flooded Gum (<i>Eucalyptus rudis</i>) woodland along a minor drainage line north of the railway crossing. This habitat consists of predominantly Flooded Gum and scattered Marri trees over an understorey dominated by weeds and grasses.</p> <p>This habitat type is very degraded, with high weed occurrence and density. In particular, this area is substantially impacted by Blackberry (<i>*Rubus ulmifolius</i>). Although degraded, this woodland provides moderate value to fauna including a dense understorey as cover for ground dwelling species (e.g. Southern Brown Bandicoot).</p> <p>Flooded Gum and Marri are recognised as valuable habitat for Black Cockatoos for breeding, feeding and roosting. No large hollows suitable for nesting were observed within this habitat type.</p> <p><u>Conservation Significant Species</u></p> <p>No conservation significant fauna species were observed in this habitat, however it provides resources for several species including Chuditch, Southern Brush-tailed Phascogale, Western Brush Wallaby and Southern Brown Bandicoot.</p> <p>This fauna habitat type covers approximately 0.12 ha and is of moderate value to fauna.</p>	
<p>Planted</p> <p>This habitat is comprised of: VT07.</p> <p>Some sections of the survey area contain planted vegetation (introduced species), including pine plantation, orchards and garden plants (e.g. in Cirillo Road section). These areas provide some habitat value to fauna species such as foraging and refuge for birds. There was also the occasional isolated Eucalyptus species, including Marri (<i>C. calophylla</i>).</p> <p>The planted vegetation may also be used as corridors for fauna movement throughout the landscape e.g. Western Grey Kangaroos (<i>Macropus fuliginosus</i>).</p> <p><u>Conservation Significant Species</u></p> <p>This habitat provides suitable foraging species for Black Cockatoos (Forest Red-tailed, Carnaby's and Baudin's Black Cockatoos) including <i>Pinus</i> sp., <i>C. calophylla</i> and <i>Eucalyptus</i> spp.</p> <p>This fauna habitat type covers approximately 0.64 ha and is of low value to fauna.</p>	
<p>Cleared areas</p> <p>This habitat type is comprised of previously cleared areas for roads and tracks</p> <p>This habitat provides very few resources for fauna, although may be used for foraging by mammals, reptiles and birds.</p> <p>This fauna habitat type covers approximately 2.15 ha and is of low value to fauna.</p>	

4.2.2 Habitat connectivity and linkages

The majority of the habitats present in the survey area are well-connected at both a local and regional scale to the large tracts of vegetation in the vicinity and other surrounding remnant vegetation (including State Forest). The survey area forms part of a large regional area of remnant forest in the Blackwood region and is well-connected to other remnant vegetation to the south and east. At a fine scale, the Cirillo Road Option section does not retain good connectivity to surrounding areas of remnant vegetation, due to previous clearing and infrastructure development.

4.2.3 Fauna diversity

During the field survey 46 fauna species were recorded, including 33 birds, nine mammals, and four amphibians. Eight of these species are introduced.

The fauna species list is provided in Appendix E.

4.2.4 Conservation significant fauna

Three conservation significant species were recorded during the field survey. These were:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Endangered – WC Act, Endangered – EPBC Act – observed on multiple occasions, old foraging evidence recorded (see Plate 1)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Vulnerable – WC Act, Vulnerable – EPBC Act – observed on multiple occasions, old and fresh foraging evidence recorded throughout survey area (see Plate 1)
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Endangered – WC Act, Vulnerable – EPBC Act – observed on one occasion



Plate 1 Old Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo foraging evidence on Marri nuts

Black Cockatoos

All three species of Black Cockatoo were observed in the survey area during the survey, and may utilise the habitats present for feeding or breeding. Information regarding the species distribution and breeding are provided below, with the outcome of the targeted Cockatoo habitat assessment presented in Section 4.3.

Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is endemic to the south-west of WA with a wide-spread distribution. Carnaby's Black Cockatoo nest in hollows of live or dead eucalypts, primarily smooth-barked Salmon Gum and Wandoo (Saunders 1979, 1982) though breeding has been reported in other wheatbelt tree species and some tree species on the Coastal Plain and Jarrah forest (Saunders 1979, 1982; Storr 1991; Johnstone and Storr 1998). Success in breeding is dependent on the quality and proximity of feeding habitat within 12 km of nesting sites (Saunders 1977, 1986; Saunders and Ingram 1987). Along with the trees that provide nest hollows, the protection, management and increase of this feeding habitat that supports the breeding of Carnaby's Black Cockatoo is a critical requirement for the conservation of the species.

J	F	M	A	M	J	J	A	S	O	N	D

- Period in which breeding is most likely to commence
- Period during which fledging could extend

Baudin's Black Cockatoo

Baudin's Black Cockatoo is endemic to a 2,000 km² area (Garnett and Crowley 2000) of the humid and sub-humid zones of south-west WA (Johnstone and Storr 1998). The current distribution of Baudin's Cockatoo is from Albany extending north to Gidgegannup, east to Mount Helena, Wandering, Quindanning, Kojonup, Frankland and King River and to the eastern margin of the Swan Coastal Plain. Baudin's Cockatoo mainly feeds on the seeds of Marri, in the forested regions of south-west WA (Saunders 1974). In addition to Marri, Baudin's Cockatoo feeds on the seeds of Bull Banksia (*Banksia grandis*), Swamp Banksia (*B. littoralis*), Holly-leaved Banksia (*B. ilicifolia*), Wavy-leaved Hakea (*Hakea undulata*), Harsh Hakea (*H. prostrata*), Two-leaf Hakea (*H. trifurcata*), Long Storksbill (*Erodium botrys*) (Saunders 1979) and Jarrah (Sedgwick 1964). Baudin's Cockatoo nests in mature trees such as Marri, Karri (*E. diversicolor*), Jarrah and Wandoo in the lower south-west of WA.

J	F	M	A	M	J	J	A	S	O	N	D

- Period in which breeding is most likely to commence
- Period during which fledging could extend

Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo is endemic to the south-west humid and sub-humid zones of WA (Mawson and Johnstone 1997). It inhabits the dense Jarrah, Karri and Marri forests receiving more than 600 mm of annual average rainfall. The current distribution is north of Perth and east to Mount Helena, Christmas Tree Well, North Banister, Mt Saddleback, Rocky Gully and the upper King River (Johnstone and Storr 1998). Habitats in which the Forest Red-tailed Black Cockatoo occurs at Bungendore Park and Jarrahdale have an understorey of Bull Banksia, Snottygobble (*Persoonia longifolia*), Sheoak (*Allocasuarina fraseriana*) and *Hakea* spp., with scattered Blackbutt (*E. patens*) and Wandoo (Johnstone and Kirkby 1999). The Forest Red-tailed Black Cockatoo roosts in Jarrah-Marri-Blackbutt habitat on roadsides, paddocks or forest blocks. While the Forest Red-tailed Black Cockatoo feeds on the seeds of other species, around 90 % of its diet is made up of the seeds from Marri and Jarrah fruits (Johnstone and Kirkby 1999).

J	F	M	A	M	J	J	A	S	O	N	D

■ Period in which breeding is most likely to commence

□ Period during which fledging could extend

Likelihood of occurrence assessment

An assessment on the likelihood of conservation significant fauna species occurring in the survey area was conducted (Appendix E). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat. The likelihood of occurrence assessment and parameters used to determine it is described in Appendix E.

In addition to the species identified during the field survey (the three species of Black Cockatoo), the assessment identified the likely presence of nine (Table 12) fauna species of conservation significance within the survey area. The likelihood of occurrence assessment revealed that other fauna species of conservation significance could occasionally occur within the habitats of the survey area (e.g. species deemed unlikely). However, it is considered unlikely the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of these species and that these other species may occasional use the habitats of the survey area for temporary refuge and dispersal between other areas of habitat.

Table 12 Summary of fauna species considered likely to occur within the survey area

Name	Status		Likelihood of occurrence justification
	EPBC Act	WC Act / DBCA Priority	
Birds			
Baudin's Black Cockatoo <i>Calyptorhynchus baudinii</i>	Vulnerable	Endangered	Known – observed loafing during field survey
Carnaby's Black Cockatoo <i>Calyptorhynchus latirostris</i>	Endangered	Endangered	Known – observed foraging and loafing during field survey
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksia naso</i>	Vulnerable	Vulnerable	Known – observed loafing and numerous foraging evidence recorded during field survey
Australian Peregrine Falcon <i>Falco peregrinus subsp. macropus</i>		Schedule 7 - Other Specially Protected Fauna	Likely – hunting habitat, irregular visitor
Rainbow Bee-eater <i>Merops ornatus</i>		Schedule 5 - Migratory	Likely – seasonal visitor
Barking Owl (southern subspecies) <i>Ninox connivens subsp. connivens</i>		Priority 2	Likely – occasional visitor, low value habitat
Masked Owl (southern subspecies) <i>Tyto novaehollandiae subsp. novaehollandiae</i>		Priority 3	Likely – foraging habitat, limited nesting habitat
Mammals			
Chuditch, Western Quoll <i>Dasyurus geoffroyi</i>	Vulnerable	Vulnerable	Likely – potential habitat

Name	Status		Likelihood of occurrence justification
	EPBC Act	WC Act / DBCA Priority	
South-western Brush-tailed Phascogale <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i>		Schedule 6 – Conservation Dependent	Likely – potential habitat
Quenda or Southern Brown Bandicoot <i>Isoodon obesulus</i> subsp. <i>fusciventer</i>		Priority 4	Likely – potential habitat (limited to areas with dense groundcover)
Western Brush Wallaby <i>Macropus Irma</i>		Priority 4	Likely – potential habitat
Western False Pipistrelle <i>Falsistrellus mackenziei</i>		Priority 4	Likely – foraging habitat and may potential use tree hollows for roosting

Chuditch (*Dasyurus geoffroi*), Schedule 3, Vulnerable (WC Act) Vulnerable (EPBC Act)

The Chuditch inhabits eucalypt forest (especially Jarrah), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke and Strahan 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.

The Chuditch is known from Wellington National Park and inhabits forests and woodlands in the Blackwood region. The Jarrah-Marri woodland and riparian area within the survey area would provide habitat for the Chuditch. The *Naturemap* database identified nine records of Chuditch occurring within 5 km of the survey area, of which one of the records occurs less than 300 m south of the Cirillo Road Option (roadkill along SW Highway 1992) and another approximately 700 m east of South Alignment (SW Highway 1987). There are numerous records in the surrounding region.

There is 2.98 ha of potential Chuditch habitat within the survey area.

Quenda (*Isoodon obesulus fusciventer*), Priority 4 – DBCA listing

The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Van Dyck and Strahan 2008).

The Quenda was not recorded during the field assessment, however was previously recorded during the Astron (2013) survey. The species is likely to utilise areas with dense understorey within the survey area (particularly in the riparian zone in the Southern Alignment).

There is 2.98 ha of potential Quenda habitat.

Peregrine Falcon (*Falco peregrinus*), Schedule 7 – WC Act

The Peregrine Falcon is seen occasionally anywhere in the south-west of WA. It is found in a range of habitats from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, in shallow tree hollows, and on ledges of building in cities (Morcombe 2004).

This species was not recorded during the field assessment, however is likely to utilise all habitats within the survey area as a foraging resource.

Western Southern Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*), Schedule 6 – WC Act

Southern Brush-tailed Phascogale prefers dry sclerophyll forests and open woodlands with a generally sparse ground-storey, which contain suitable nesting resources such as tree hollows, rotted stumps and tree cavities (Van Dyck and Strahan 2008). The species is widespread in the south west, ranging from Perth and the hills to the Albany region.

Phascogales are known from the region, and within the survey area would primarily utilise the woodland areas as habitat. No nocturnal surveys were undertaken for this species.

There is 2.98 ha of potential phascogale habitat.

Western Brush Wallaby (*Macropus irma*), Priority 4 – DBCA listing

The Western Brush Wallaby is a grazer found primarily in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest. This species was once very common in the south-west of WA but has undergone a reduction in range and a significant decline in abundance (Van Dyke and Strahan 2008).

The Western Brush Wallaby is known to occur in the region and would utilise all the terrestrial habitats within the survey area. The Western Brush Wallaby is likely to utilise the Jarrah-Marri woodland and riparian area within the survey area (2.98 ha).

Western False Pipistrelle (*Falsistrellus mackenziei*), Priority 4 – DBCA

The Western False Pipistrelle is listed as Priority 4 by the DBCA and is confined to the southwest of WA. The species occurs in wet sclerophyll forest dominated by Karri, and in the high rainfall zones of the Jarrah and Tuart forests. The species is restricted to areas in or adjacent to stands of old growth forest. It has also been recorded in mixed Tuart-Jarrah tall woodlands on the adjacent coastal plain. Marri, Sheoak and Peppermint trees are often co-dominant at its collection localities (Churchill 2008; McKenzie and Start 1999).

The Western False Pipistrelle is known to occur in the region and is likely to utilise the Jarrah-Marri woodland within the survey area (2.86 ha).

Rainbow Bee-eater (*Merops ornatus*) – Migratory

The Rainbow Bee-eater inhabits a variety of habitat types including open forests and woodlands, sandpits, riverbanks, mangroves, rainforest shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. They also inhabit sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe 2004; Pizzey and Knight 2012). They dig out nests in open areas where there is relatively soft but firm sands, either on flat ground or in the side of a sandy bank (Nevill 2013). The Bee-eater is a seasonal breeding migrant to the south-west of WA.

The Rainbow Bee-eater is likely to seasonally utilise the Jarrah-Marri woodland and riparian area within the survey area (2.98 ha).

Barking Owl (southern subspecies) (*Ninox connivens* subsp. *connivens*), Priority 2 – DBCA listing

The southwest subspecies of the Barking Owl is found in the deep south-west region and is very scarce (Nevill 2013). Barking Owls are found in open woodlands and the edges of forests, often adjacent to farmland. They are less likely to use the interior of forested habitat. They are usually

found in habitats that are dominated by eucalyptus species, particularly Marri. Barking Owls prefer woodlands and forests with a high density of large trees and particularly sites with hollows that are used by the owls as well as their prey.

The Barking Owl is known to occur in the region and is likely to utilise the Jarrah-Marri woodland within the survey area (2.98 ha). The low density of hollow-bearing trees in the survey area would limit the occurrence of this species.

Masked Owl (southern subspecies) (*Tyto novaehollandiae* subsp. *novaehollandiae*), Priority 3 – DBCA listing

The Masked Owl is found across a range of habitats from wet sclerophyll forest, dry sclerophyll forest, non-eucalypt dominated forest, scrub and cleared land with remnant old growth trees. The species typically large hollows in old growth eucalypts for nesting and often favours areas with dense understorey or ecotones comprising dense and sparse ground cover (Bell and Mooney 2002).

The Masked Owl is known to occur in the region and is likely to utilise the Jarrah-Marri woodland within the survey area (2.98 ha). The low density of hollow-bearing trees in the survey area would limit the nesting of this species in the survey area.

4.3 Targeted Cockatoo Habitat Assessment

4.3.1 Foraging habitat

The majority of the survey area contains native vegetation representing suitable foraging habitat for Black Cockatoos, including Jarrah-Marri woodland and *Eucalyptus rudis* woodland. Overall there is approximately 2.98 ha of suitable foraging habitat in the survey area.

4.3.2 Potential breeding habitat

The habitat assessment identified 253 potential breeding trees of suitable DBH (Jarrah, Marri, Flooded Gum > 500 mm) from within the survey area (see Table 13). Trees of this size are considered to have nesting potential now, or will develop hollows within 100 years. Of the 253 trees, 16 were identified with potentially suitable hollows for Black Cockatoo nesting (with a hollow diameter greater than 100-150 mm, to allow entry of Black Cockatoo). The size of a hollow is an estimate as the assessment was undertaken from ground level, there is the potential for the actual hollow size to be greater than 100 mm. None of these trees showed signs of Black Cockatoo use.

Inspection of two known existing hollows revealed no evidence of current usage by Black Cockatoos (e.g. chew marks around the edge of the hollow). Both of these hollows still have the potential for future usage by Black Cockatoos (Coordinates – 402038.43E, 6265639.63N and 403818.01E, 6263922.82N).

Examples of tree hollows from the survey area are shown in Plate 2.



Plate 2 Tree hollows potentially suitable for Black Cockatoo nesting in the survey area

Table 13 Summary of the different types of Black Cockatoo habitat within the survey area

Habitat type	Presence within survey area	Evidence
Foraging habitat	Yes	<p>There is 2.98 ha of foraging habitat for Black Cockatoos within the survey area consisting of the following:</p> <ul style="list-style-type: none"> • Jarrah-Marri woodland = high quality • <i>Eucalyptus rudis</i> woodland = low quality <p>Plentiful old and fresh foraging evidence was recorded throughout the survey area (Forest Red-tailed Black Cockatoo feeding evidence on Marri nuts).</p>
Actual breeding habitat	No	<p>No breeding events were recorded within the survey area of any species of Black Cockatoo during the current survey. It is noted that the survey was conducted outside the main known breeding season for Carnaby's, Baudin's and Forest Red-tailed Black Cockatoos, and a survey would need to be conducted during breeding season to determine known breeding in the area.</p>
Potential breeding habitat	Yes	<p>253 potential breeding habitat trees with DBH \geq 500 mm (2.98 ha for Jarrah/Marri/Flooded Gum). Of the 253 trees, 16 had hollows suitable for Black Cockatoo nesting.</p> <p>No evidence of recent use of suitable hollows by Black Cockatoo (e.g. chews) was recorded.</p>
Roosting habitat	No	<p>No roosting sites were recorded as being used by Black Cockatoos within the survey area.</p> <p>The survey area provides limited potential roosting habitat</p>

4.4 Targeted Western Ringtail Possum Habitat Assessment

The majority of the survey area provides suitable habitat for the Western Ringtail Possum. Jarrah-marri woodland (with hollow-bearing trees) is known to support the Western Ringtail Possum, particularly where peppermint trees (*Agonis flexuosa*) are present. No individuals were recorded on the camera traps during the survey. The survey area was thoroughly searched for dreys (nests) and scats however no evidence of Western Ringtail Possum was observed during the survey.

Previous records of Western Ringtail Possums are sparsely scattered in the local region, with populations more densely concentrated along the coast between Bunbury and Augusta and further south of Bridgetown, around Manjimup (DBCA 2007-). There are three known records of this species within 5 km of the survey area, one approximately 4 km south-west of Mullalyup (recorded in 1997) and two approximately 4.5 km south of the southern end of the survey area (recorded in 2014) (DBCA 2007-).

The Western Ringtail Possum potentially occurs in native vegetation surrounding the survey area however the population density is likely to be low. Given the linear and fragmented nature of the survey area and lack of evidence recorded during the survey, the survey area is not considered significant habitat for this species.

5. Conclusions

5.1 Key findings

5.1.1 Vegetation and flora

Vegetation

Seven vegetation types were identified and described for the survey area. Six of these vegetation types were Eucalyptus woodlands with variations in the mid and lower storey species. The remaining vegetation type consisted of isolated stands of native and planted trees with scattered natives over weedy grasses. None of the vegetation types described for the survey area are synonymous with any TECs or PECs as defined by the EPBC Act or DBCA.

The vegetation condition within the survey area was rated as Very Good to Completely Degraded condition. The majority of the survey area (54%) was rated as Degraded and Degraded-Completely Degraded condition. Small patches of Very Good and Very Good – Good vegetation contained a number common bushland weeds, however native vegetation dominated each strata.

Flora

One hundred and six (106) flora taxa (including subspecies and varieties) representing 40 families and 74 genera were recorded from the survey area during the field survey. This total comprised of 77 native taxa and 29 introduced flora taxa. No EPBC Act or WC Act listed flora were recorded within the survey area. In addition no DBCA Priority-listed flora or flora of conservation significance were recorded.

The likelihood of occurrence assessment post-field survey concluded that one taxon is likely to occur within the survey area; *Tetraria* sp. Blackwood River (A.R. Annels 3043) (P3). This species has previously been recorded approximately 50 m away from the Mullalyup Tank site. There is very limited suitable habitat for this species, however due to the proximity of the previous known record and its cryptic nature it is still considered to potentially occur.

Of the introduced taxa, two are listed as Declared Pests under the *Biosecurity and Management Act 2007* and as WONS:

- * *Asparagus asparagoides* (Bridal Creeper)
- * *Rubus ulmifolius* (Blackberry)

5.1.2 Fauna

The survey area comprised four fauna habitat types including Jarrah-Marri Woodland, *Eucalyptus rudis* woodland (riparian), planted vegetation, and cleared or previously disturbed areas. With the exception of the Cirillo Road Option section, these habitats are well-connected at both a local and regional scale to other areas of remnant and contiguous vegetation.

During the survey, three conservation significance fauna species were recorded:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Endangered – WC Act, Endangered – EPBC Act – observed on multiple occasions
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Vulnerable – WC Act, Vulnerable – EPBC Act – old foraging evidence recorded
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Endangered – WC Act, Vulnerable – EPBC Act

An additional nine species are considered likely to occur in the survey area based on previous records and suitability of habitat:

- Chuditch (*Dasyurus geoffroi*), Vulnerable – WC Act, Vulnerable – EPBC Act
- South western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*), Schedule 6 – WC Act
- Western Brush Wallaby (*Macropus irma*), Priority 4 – DBCA listing
- Western False Pipistrelle (*Falsistrellus mackenziei*), Priority 4 – DBCA
- Peregrine Falcon (*Falco peregrinus*), Schedule 7 – WC Act
- Quenda (*Isoodon obesulus fusciventer*), Priority 4 – DBCA
- Rainbow Bee-eater (*Merops ornatus*) – Migratory
- Barking Owl (southern subspecies) (*Ninox connivens* subsp. *connivens*), Priority 2 – DBCA listing
- Masked Owl (southern subspecies) (*Tyto novaehollandiae* subsp. *novaehollandiae*), Priority 2 – DBCA listing

A total of 253 trees which are potentially suitable for Black Cockatoo breeding (Jarrah, Marri, and Flooded Gum) were recorded within the survey area, including 16 with hollows currently suitable for Black Cockatoo breeding. None of these trees had evidence of current or previous Black Cockatoo use (i.e. old chew marks). Old and fresh Black Cockatoo foraging evidence was recorded scattered throughout the survey area (on Marri nuts) and there is 2.98 ha of suitable foraging habitat.

The majority of the habitats recorded in the survey area are well represented in the immediate vicinity of the survey area and the broader Blackwood district (particularly in the conservation areas and State Forest) and would be utilised by all the conservation significant species known or likely to occur in the area. Furthermore, there is no habitat within the survey area that would be considered specific to, or solely relied upon by, any of the conservation significant species known or likely to occur within the area.

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Appendices

Appendix A – Figures

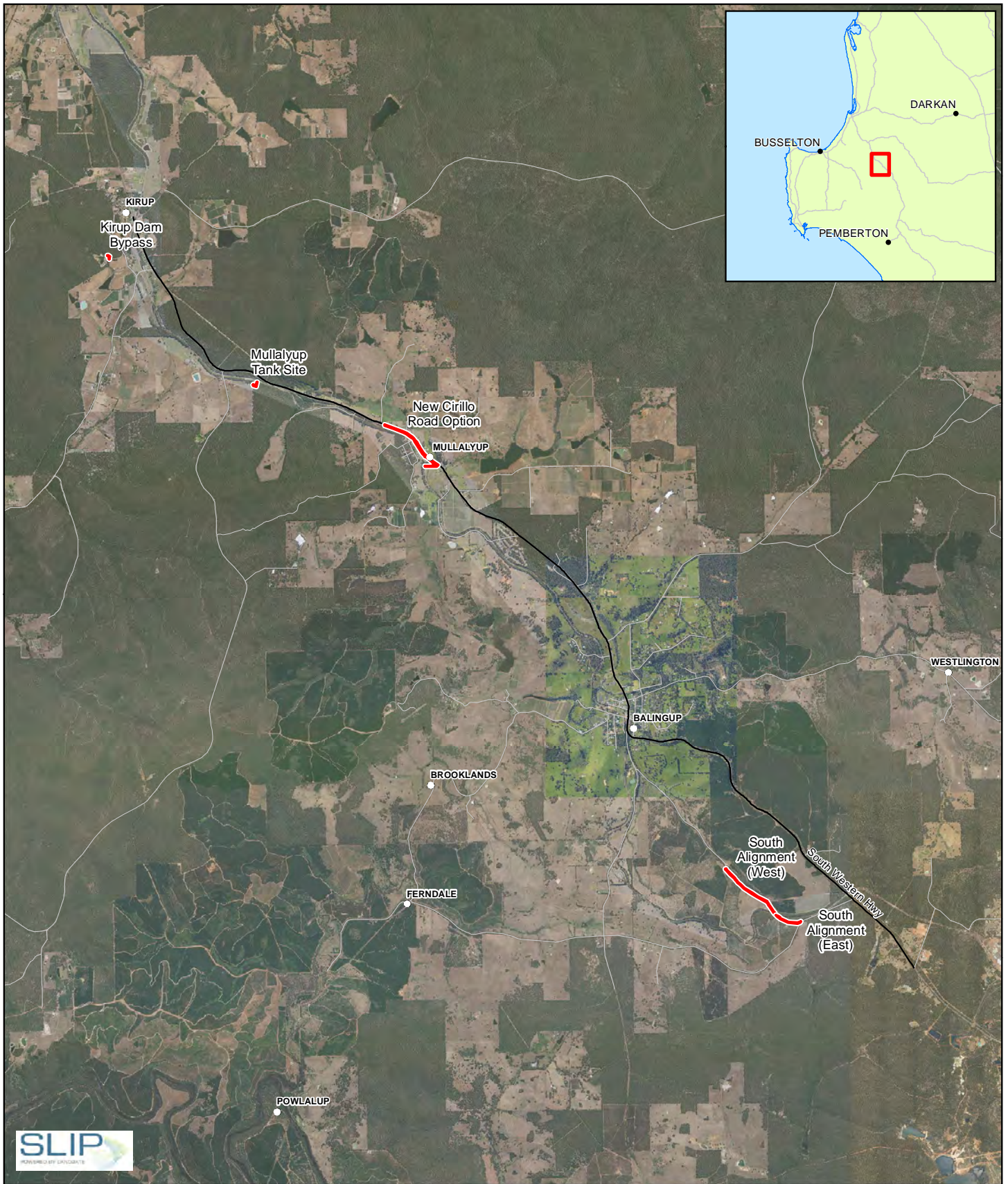
Figure 1 Project locality

Figure 2 Biological constraints


Figure 3 Vegetation types and sample locations

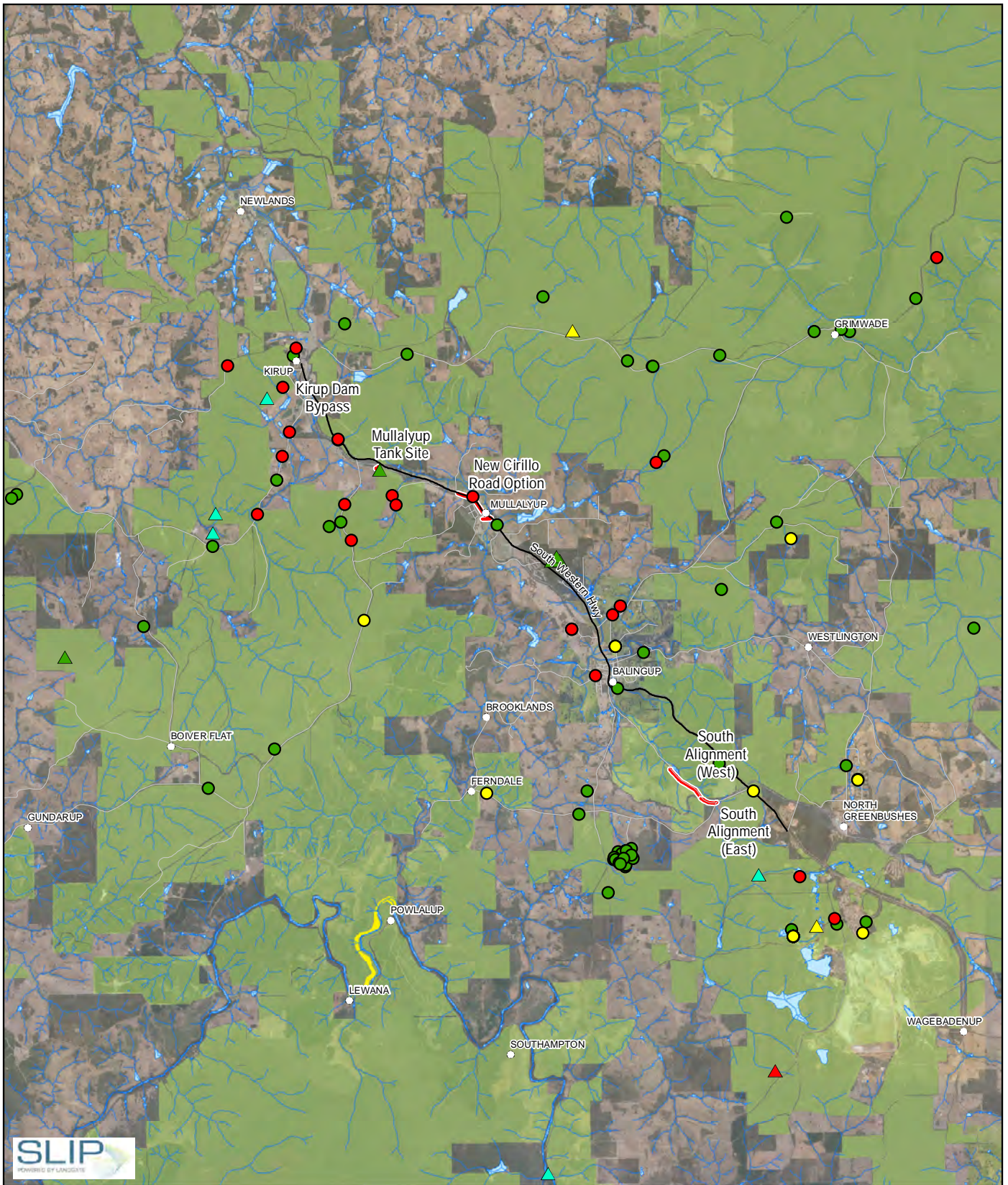
Figure 4 Vegetation condition

Figure 5 Fauna observations and Black Cockatoo habitat



LEGEND

 Survey Area



LEGEND

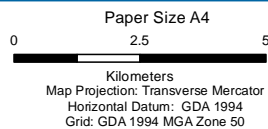
Declared Rare and Priority Flora

- ▲ (T) Threatened Flora - Extant Taxa
- ▲ Priority 1 - Poorly Known Taxa
- ▲ Priority 2 - Poorly Known Taxa
- ▲ Priority 3 - Poorly Known Taxa
- ▲ Priority 4 - Rare Taxa

Threatened Fauna

- Priority Fauna
- Schedule 2 - Fauna that is rare or is likely to become extinct as endangered fauna
- Schedule 3 - Fauna that is rare or is likely to become extinct as vulnerable fauna

- Watercourses & drainage lines
- Local Road
- State Road
- ESA
- Waterbody
- DPaW Managed Lands



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Biological Constraints

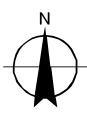
Figure 2



LEGEND

- Relevé
 - Cleared
 - Survey Area
- Vegetation Type**
- Jarrah-Marri woodland over Hibbertia shrubland (VT01)

Paper Size A4
 0 5 10 20
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



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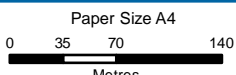
**Vegetation Type
 Kirup Dam Bypass**

Figure 3. 1

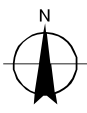


LEGEND

- Relevé
- Local Road
- Survey Area
- Vegetation Type**
- Eucalyptus spp.-Marri-Pine isolated trees (VT07)
- Jarrah-Marri woodland over Bugle Lily (VT06)
- Cleared



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



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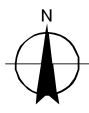
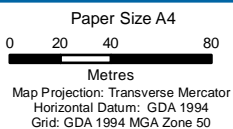
Vegetation Type
New Cirillo Road Option

Figure 3. 3



LEGEND

- Quadrat
- Local Road
- Survey Area
- Vegetation Type**
- Jarrah-Marri woodland over Blackberry (VT04)
- Jarrah-Marri woodland over Bossiaea shrubland (VT03)
- Cleared



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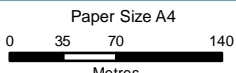
**Vegetation Type
South Alignment (East)**

Figure 3. 5

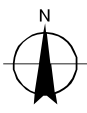


LEGEND

- Relevé
- Local Road
- Survey Area
- Vegetation Type**
- Flooded gum woodland over Blackberry (VT05)
- Jarrah-Marri woodland over Blackberry (VT04)
- Cleared



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



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**Vegetation Type
South Alignment (West)**

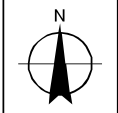
Figure 3. 4



LEGEND

- Quadrat
- Survey Area
- Vegetation Type**
- Marri-Jarra woodland over Taxandria shrubland (VT02)
- Cleared

Paper Size A4
 0 5 10 20
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



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**Vegetation Type
 Mullalyup Tank**

Figure 3. 2



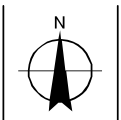
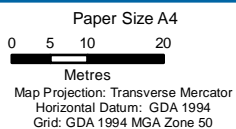
LEGEND

Survey Area

Vegetation Condition

Good - Degraded

Cleared

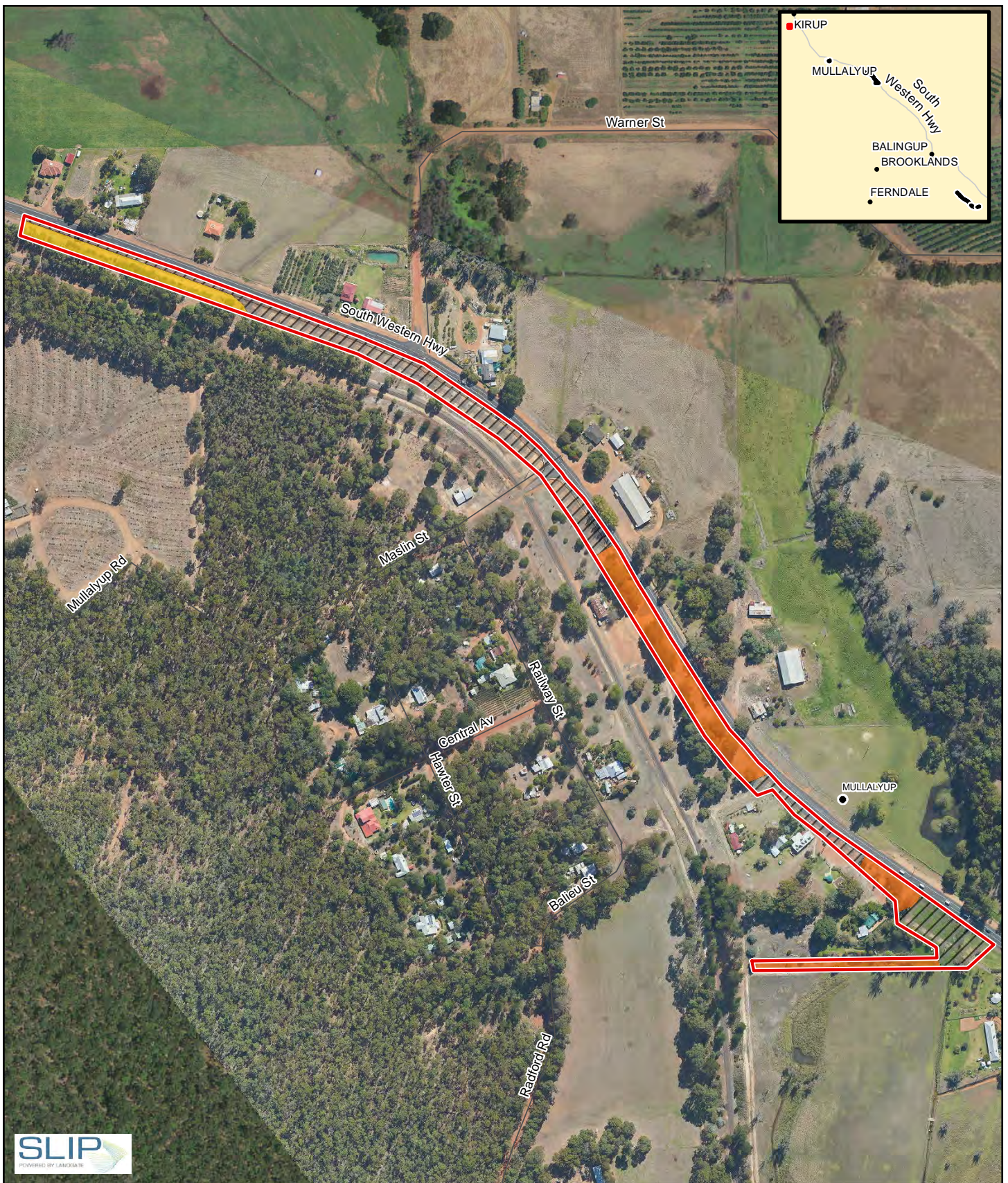


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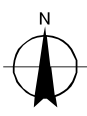
**Vegetation Condition
Kirup Dam Bypass**

Figure 4. 1



- LEGEND**
- Survey Area
 - Local Road
 - Degraded
 - Degraded - Completely degraded
 - Cleared
- Vegetation Condition**

Paper Size A4
 0 35 70 140
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50

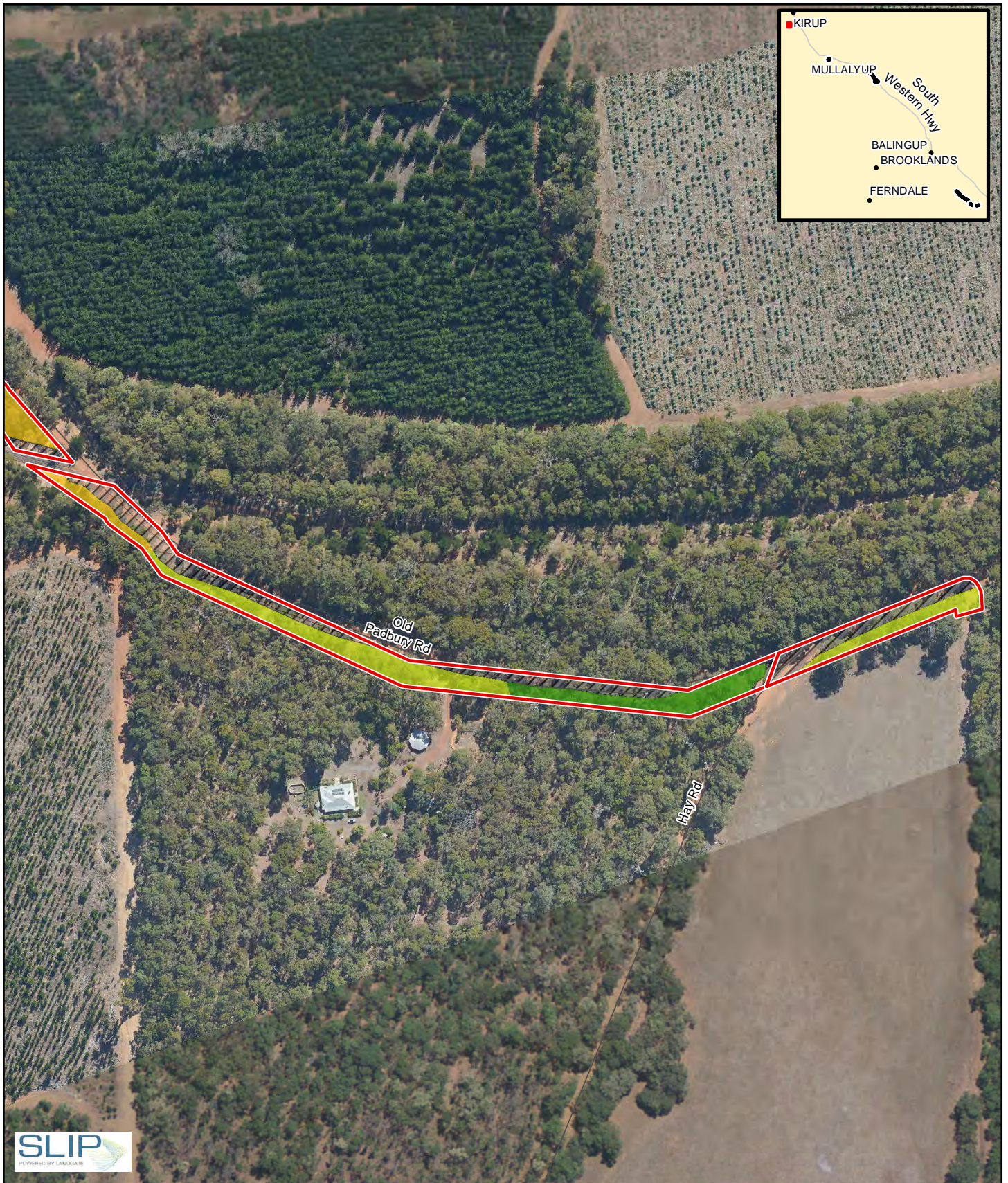


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Vegetation Condition
 New Cirillo Road Option

Figure 4. 3



LEGEND

- Survey Area
- Local Road
- Good - Degraded
- Degraded
- Very good - Good
- Cleared

Paper Size A4
 0 20 40 80
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



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**Vegetation Condition
 South Alignment (East)**

Figure 4. 5



LEGEND

- Survey Area
- Local Road

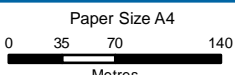
Significant Weeds

- ★ *Asparagus asparagoides* (Bridal Creeper)

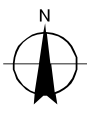
- /// *Asparagus asparagoides* (Bridal Creeper) 30% < 70% cover

Vegetation Condition

- Degraded
- Cleared



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



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**Vegetation Condition
South Alignment (West)**

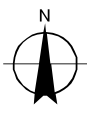
Figure 4. 4



LEGEND

- Survey Area
- Degraded
- Vegetation Condition**
- Very good
- Good - Degraded
- Cleared

Paper Size A4
 0 5 10 20
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



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**Vegetation Condition
 Mullalyup Tank**

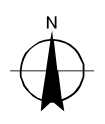
Figure 4. 2



LEGEND

- | | | | | |
|-------------------------------|---|---------------------------|--|---------------------------------|
| Black Cockatoo Habitat | | Fauna Observations | Sample Locations | Survey Area |
| | Jarrah (<i>Eucalyptus marginata</i>) – no hollows | | Forest Red-tailed Black Cockatoo feeding evidence on Marri | |
| | Marri (<i>Corymbia calophylla</i>) – no hollows | | | Habitat assessment |
| | | | | Black Cockatoo Foraging Habitat |

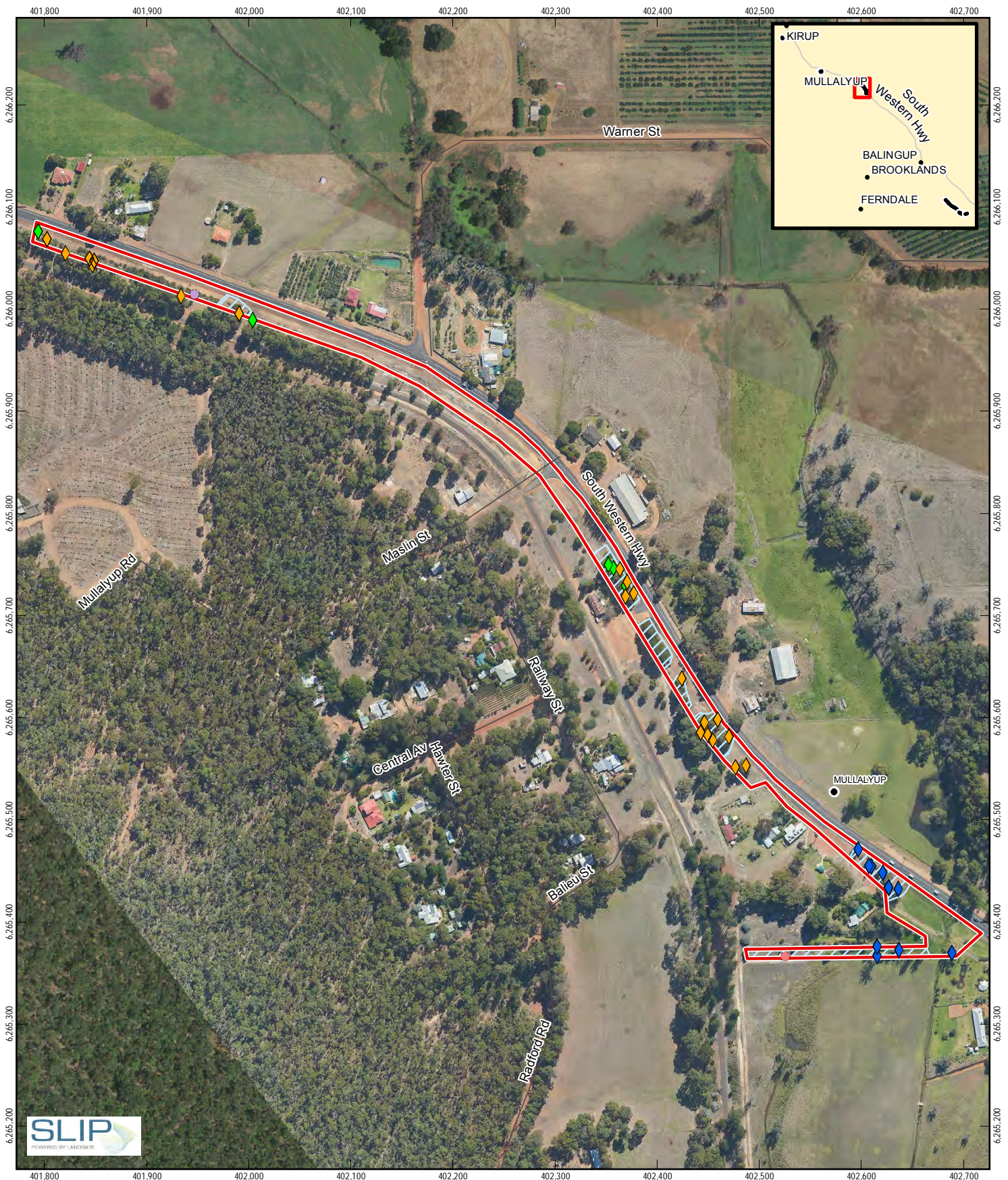
Paper Size A4
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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



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 Greenbushes to Kirup Link EIA and Approvals
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Fauna Habitat Types, Observations
 and Black Cockatoo Habitat
 Kirup Dam Bypass

Figure 5. 1

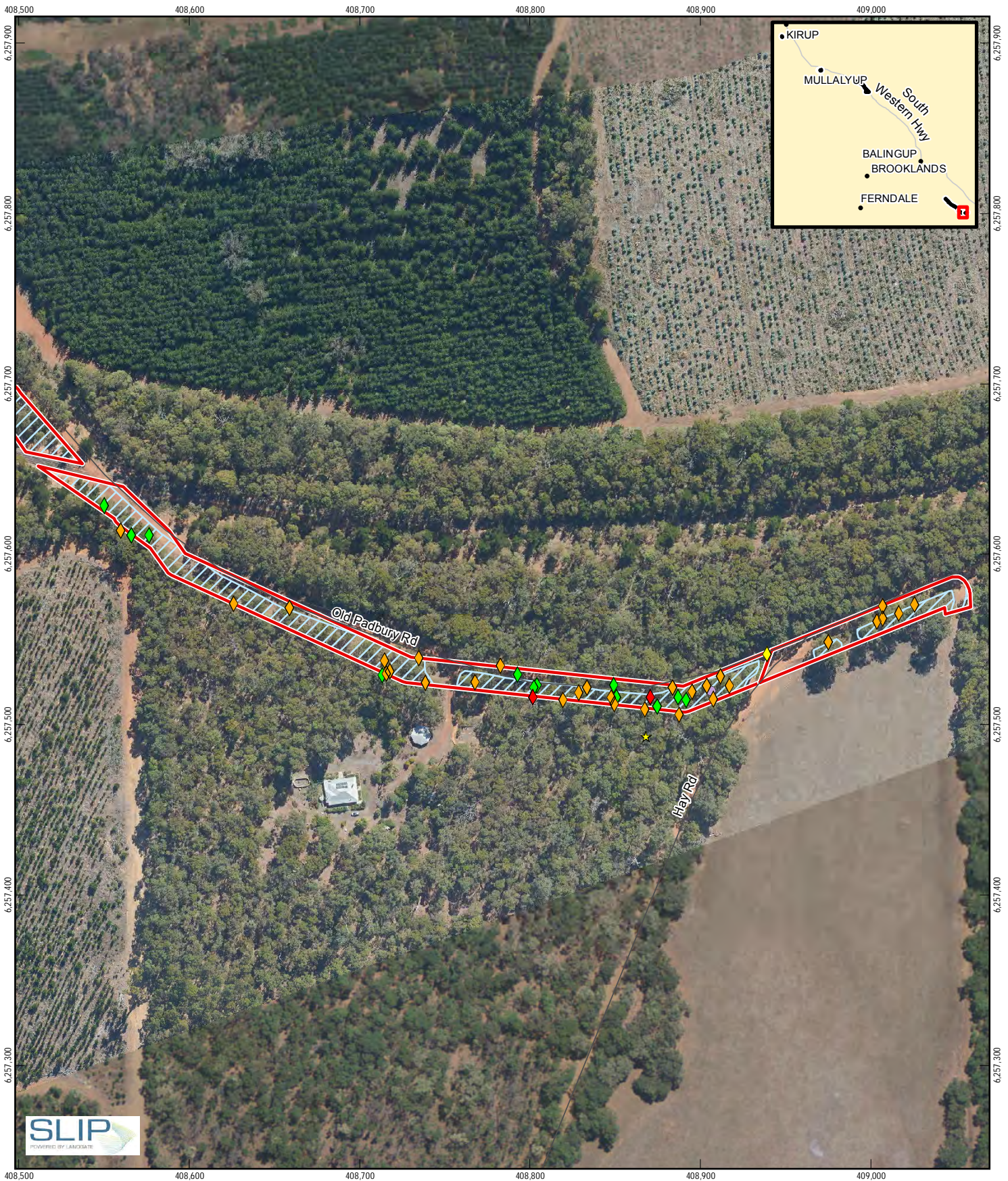


LEGEND

Jarrah (<i>Eucalyptus marginata</i>) – no hollows	Flooded Gum (<i>Eucalyptus rudis</i>) – no hollows	Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>	Local Road
Marri (<i>Corymbia calophylla</i>) – no hollows	Carnaby's Black Cockatoo <i>Calyptorhynchus latirostris</i>	Black Cockatoo Foraging Habitat	
		Survey Area	

<p>Paper Size A4</p> <p>0 35 70 140</p> <p>Metres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>				<p>Water Corporation Greenbushes to Kirup Link EIA and Approvals</p> <p>Job Number 61-35763-01 Revision 0 Date 16 Aug 2017</p> <p>Fauna Habitat Types, Observations and Black Cockatoo Habitat New Cirillo Road Option</p>
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Figure 5. 2

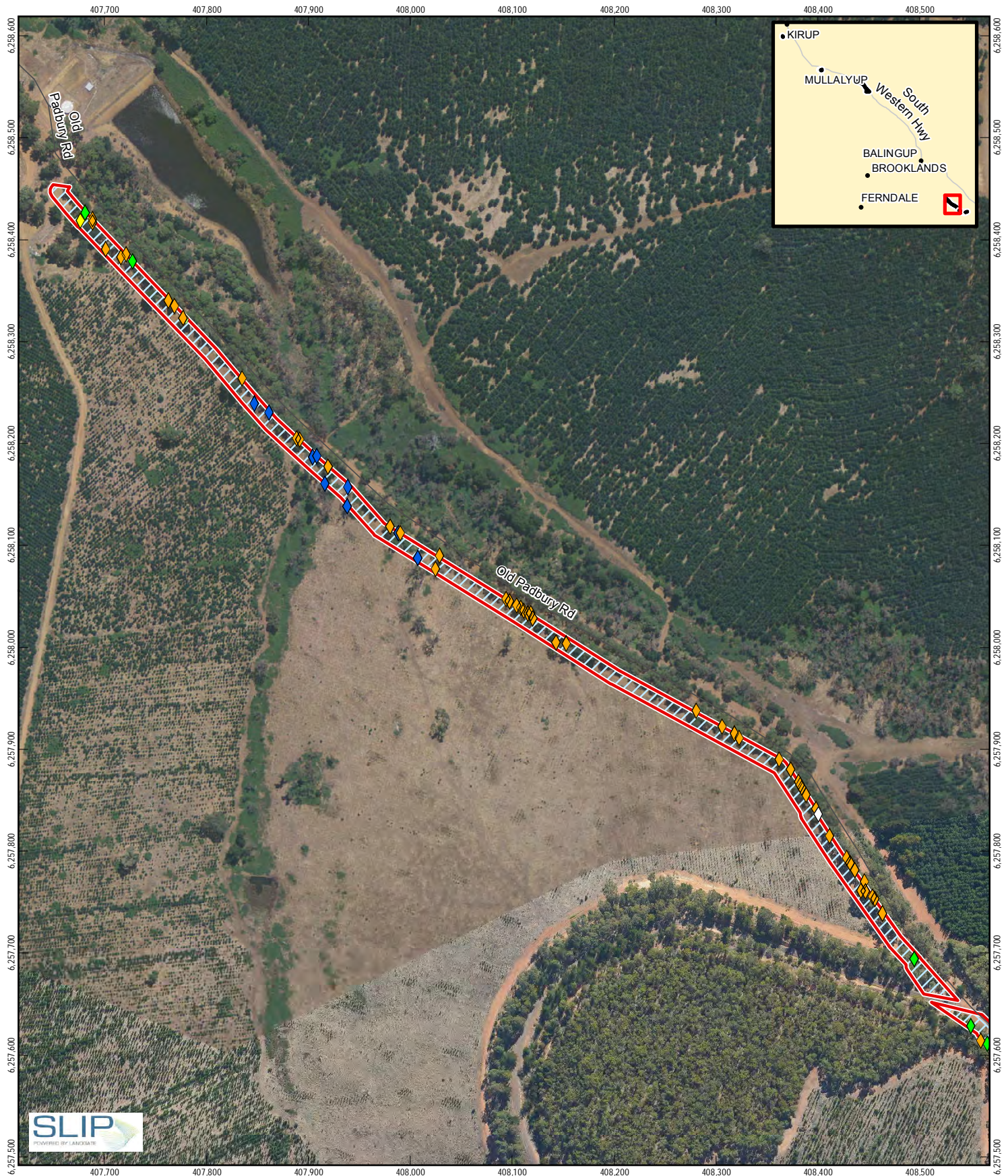


LEGEND

Jarrah (<i>Eucalyptus marginata</i>) – no hollows	Marri (<i>Corymbia calophylla</i>) – no hollows	Fauna Observations	Black Cockatoo Foraging Habitat
Jarrah (<i>Eucalyptus marginata</i>) – hollows	Marri (<i>Corymbia calophylla</i>) – hollows	Carnaby's Black Cockatoo <i>Calyptorhynchus latirostris</i>	Survey Area
		Sample Locations	Local Road
		Camera trap	

<p>Paper Size A4</p> <p>0 20 40 80</p> <p>Metres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>				<p>Water Corporation Greenbushes to Kirup Link EIA and Approvals</p> <p>Fauna Habitat Types, Observations and Black Cockatoo Habitat South Alignment (East)</p>	<p>Job Number 61-35763-01 Revision 0 Date 16 Aug 2017</p>
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Figure 5. 3



LEGEND

Black Cockatoo Habitat

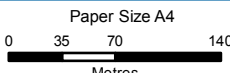
- Jarrah (*Eucalyptus marginata*) – no hollows
- Jarrah (*Eucalyptus marginata*) – hollows

- Marri (*Corymbia calophylla*) – no hollows
- Flooded Gum (*Eucalyptus rudis*) – no hollows
- Stag

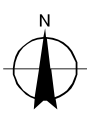
Fauna Observations

- Forest Red-tailed Black Cockatoo feeding evidence on Marri
- Black Cockatoo Foraging Habitat

- Survey Area
- Local Road



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Water Corporation
Greenbushes to Kirup Link EIA and Approvals
Fauna Habitat Types, Observations
and Black Cockatoo Habitat
South Alignment (West)

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Figure 5. 4



6,246,800

6,246,800

6,246,700

6,246,700



LEGEND

Black Cockatoo Habitat

- ◆ Jarrah (*Eucalyptus marginata*) – no hollows
- ◆ Jarrah (*Eucalyptus marginata*) – hollows

- ◆ Marri (*Corymbia calophylla*) – no hollows
- ◆ Marri (*Corymbia calophylla*) – hollows

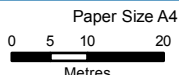
Fauna Observations

- Carnaby's Black Cockatoo *Calyptorhynchus latirostris*
- Forest Red-tailed Black Cockatoo feeding evidence on Marri

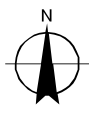
Sample Locations

- ★ Camera trap
- Habitat assessment
- Black Cockatoo Foraging Habitat

 Survey Area



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



Water Corporation
 Greenbushes to Kirup Link EIA and Approvals
 Fauna Habitat Types, Observations
 and Black Cockatoo Habitat
 Mullalyup Tank

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Figure 5.5

Appendix B – Relevant legislation, conservation codes and background information

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of the Environment and Energy (DotEE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Environment Regulation (DER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

- a) Native vegetation should not be cleared if it comprises a high level of biodiversity.
- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
- c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
- d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.
- e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
- f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
- g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
- h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

- i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.
- j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State Biodiversity and Conservation Act 2016

The Biodiversity Conservation Bill 2015 was introduced to State Parliament in November 2015, and passed in September 2016. The Bill became the *Biodiversity Conservation Act 2016* (BC Act) upon receiving Assent on 21 September 2016. The BC Act will eventually fully replace both the *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act).

Several parts of the BC Act were proclaimed by the State Governor in the Government Gazette and came into effect on 3 December 2016. However, provisions that replace those existing under the WC Act and Sandalwood Act (including threatened species listings and controls over the taking and keeping of native species) and their associated Regulations cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been made. It is hoped the new Regulations will be completed and ready to commence by late 2017.

State Wildlife Conservation Act 1950

The WC Act provides for the conservation and protection of wildlife. It is administered by the Department of Parks and Wildlife (DPaW) and applies to both flora and fauna. Any person wanting to capture, collect, disturb or study fauna requires a permit to do so. A permit is required under the WC Act if removal of threatened species is required.

State Biosecurity and Agriculture Management Act 2007

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Agriculture and Food Western Australia (DAFWA) and replace the repealed *Agriculture and Related Resources Protection Act 1976*. The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DAFWA Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Background information

Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the <i>Australian Heritage Commission Act 1975</i> of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the <i>Environmental Protection (Gnangara Mound Crown Land) Policy 1992</i> .
The areas covered by the <i>Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002</i> .
The areas covered by the lakes to which the <i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i> (EPP Lakes) applies.
Protected wetlands as defined in the <i>Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998</i> .

Reserves and conservation areas

Department of Parks and Wildlife managed lands and waters

DPaW manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DPaW managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. DPaW managed conservation estate, is vested with the Conservation Commission of Western Australia. Access to, or through, some areas of DPaW managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DPaW managed lands will generally be referred to DPaW throughout the assessment process.

Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil.

Ramsar Listed Wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity ... because of their ecological, botanical, zoological, limnological or hydrological importance” (DotEE 2017b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DotEE 2017b).

Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DotEE 2017a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
- The wetland supports one percent or more of the national populations of any native plant or animal taxa
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- The wetland is of outstanding historical or cultural significance

Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia’s biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia’s Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2016), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated at least every two years.

Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of 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 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.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State WC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The DPaW also maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable.

Possible TECs that do not meet survey criteria are added to the DPaW Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Conservation codes and definitions for TECs listed under the EPBC Act or endorsed by the WA Minister for the Environment

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: A) is not critically endangered; and B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Vulnerable (VU)	An ecological community if, at that time: A) is not critically endangered or endangered; and B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Western Australia Conservation Categories	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

Categories	Definition
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

Conservation categories and definitions for PECS as listed by the DPaW

Category	Description
Priority 1	<p>Poorly known ecological communities.</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority 2	<p>Poorly known ecological communities.</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority 3	<p>Poorly known ecological communities.</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Description
Priority 4	<p>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. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority 5	<p>Conservation Dependent ecological communities.</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in 'pristine' condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Conservation significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DotEE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for Conservation of Nature (IUCN).

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of Threatened flora and fauna has been published as Specially Protected under the WC Act, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2015 for Threatened Fauna and under Schedules 1 to 4 of the Wildlife Conservation (Rare Flora) Notice 2015 for Threatened (Declared Rare) Flora. The schedules align with the categories of the EPBC Act Threatened Fauna and Threatened Flora Lists. Threatened species are those species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such.

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

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

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DPaW Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act listed flora and fauna species

Conservation category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A) A species known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or B) A species that 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.
Critically Endangered	A species facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered	A) A species not critically endangered; and B) A species facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Conservation category	Definition
Vulnerable	A) A species not critically endangered or endangered; and B) A species facing a high risk of extinction in the wild in the medium-term, as determined in accordance with the prescribed criteria.
Conservation Dependent	A) 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; or B) The following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that Section 180 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; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Conservation codes and descriptions for WC Act listed flora and fauna species

Conservation category	Schedule and definition
Threatened species (T)	Published as Specially Protected under the WC Act, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora. Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the WC Act. Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the WC Act.
Critically Endangered (CR)	Schedule 1: Threatened species considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Schedule 2: Threatened species considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Schedule 3: Threatened species considered to be facing a high risk of extinction in the wild.
Presumed Extinct (EX)	Schedule 4: Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
International Agreement (IA)	Schedule 5: Migratory birds protected under an international agreement
Conservation Dependent (CD)	Schedule 6: Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other Specially Protected (OS)	Schedule 7: Fauna otherwise in need of special protection to ensure their conservation.

Conservation codes for DPaW listed Priority flora and fauna

Priority category	Definition
Priority 1	<p>Poorly-known taxa</p> <p>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.</p>
Priority 2	<p>Poorly-known taxa</p> <p>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.</p>
Priority 3	<p>Poorly-known taxa</p> <p>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.</p>
Priority 4	<p>Rare, Near Threatened and other taxa in need of monitoring</p> <p>A. Rare: Taxa 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 taxa are usually represented on conservation lands.</p> <p>B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.</p>

Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- 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)

- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007*.

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

References

- ANZECC 2000, *Core Environmental Indicators for Reporting on the State of Environment*, ANZECC State of the Environment Reporting Task Force.
- Commonwealth of Australia 2001, *National Targets and Objectives for Biodiversity Conservation 2001–2005*, Canberra, AGPS.
- DotEE 2017a, *Criteria for determining nationally important wetlands*, retrieved 2017, from <http://www.environment.gov.au/topics/water/water-our-environment/wetlands/australian-wetlands-database/directory-important>.
- DotEE 2017b, *The Ramsar Convention on Wetlands*, retrieved 2017, from <http://www.environment.gov.au/topics/water/water-our-environment/wetlands/ramsar-convention-wetlands>.
- English, V and Blyth, J 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Perth, Department of Conservation and Land Management.
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- Shepherd, DP, Beeston, GR & Hopkins, AJM 2002, *Native Vegetation in Western Australia – Extent, Type and Status, Resource Management Technical Report 249*, Perth, Department of Agriculture.

Appendix C – Desktop searches

EPBC Act PMST Report (5 km buffer)

NatureMap Flora Report (5 km buffer)

NatureMap Fauna Report (5 km buffer)



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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/05/17 13:31:06

[Summary](#)

[Details](#)

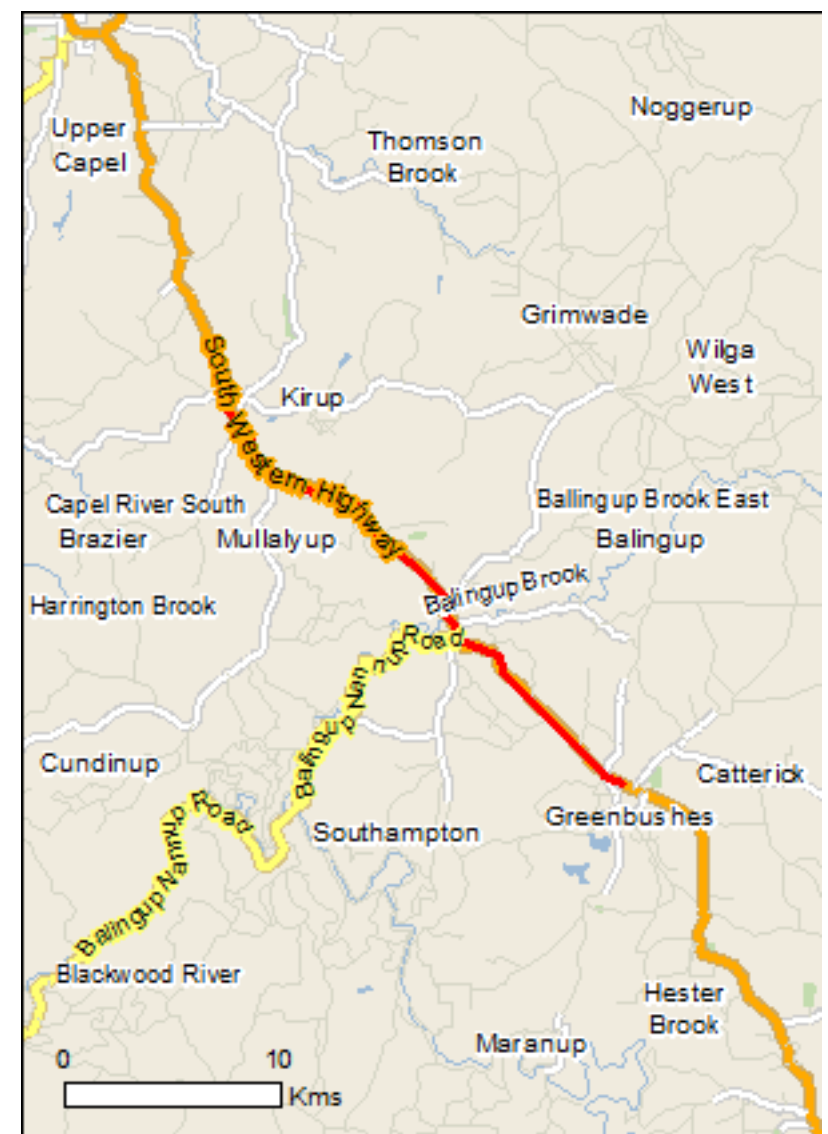
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

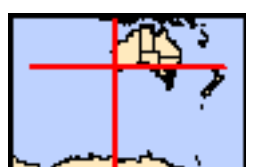
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 5.0Km](#)



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	14
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 <http://www.environment.gov.au/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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	20
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Myrmecobius fasciatus Numbat [294]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

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.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Unnamed WA20751	WA
Regional Forest Agreements	[Resource Information]
Note that all areas with completed RFAs have been included.	
Name	State
South West WA RFA	Western Australia
Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

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

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-33.696605 115.889434,-33.703461 115.891838,-33.709458 115.891838,-33.719454 115.901107,-33.727164 115.903511,-33.732018
115.907974,-33.743438 115.946769,-33.754 115.955009,-33.766273 115.973549,-33.773979 115.981102,-33.780257 115.982818,-33.783396
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116.055603

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.

NatureMap Flora Species Report

Created By Guest user on 12/05/2017

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Vertices 33° 42' 46" S,115° 53' 39" E 33° 43' 20" S,115° 54' 04" E 33° 43' 34" S,115° 54' 10" E 33° 43' 43" S,115° 54' 20" E 33° 43' 55" S,115° 54' 33" E 33° 43' 58" S,115° 55' 01" E 33° 44' 35" S,115° 56' 45" E 33° 45' 17" S,115° 57' 25" E 33° 45' 25" S,115° 57' 43" E 33° 46' 00" S,115° 58' 33" E 33° 46' 33" S,115° 58' 53" E 33° 46' 48" S,115° 58' 56" E 33° 47' 18" S,115° 59' 06" E 33° 47' 27" S,115° 59' 28" E 33° 47' 28" S,115° 59' 53" E 33° 47' 38" S,116° 00' 14" E 33° 47' 50" S,116° 00' 13" E 33° 48' 22" S,116° 00' 59" E 33° 48' 27" S,116° 01' 00" E 33° 49' 26" S,116° 02' 12" E 33° 50' 14" S,116° 03' 08" E
Group By Family

Family	Species	Records
Alliaceae	1	1
Apiaceae	7	12
Araceae	1	1
Asparagaceae	13	15
Asteraceae	13	24
Boraginaceae	1	1
Boryaceae	2	2
Brassicaceae	2	2
Bryaceae	2	2
Campanulaceae	2	2
Caprifoliaceae	1	1
Centrolepidaceae	1	2
Cephalozellaceae	2	3
Colchicaceae	2	2
Convolvulaceae	1	1
Cupressaceae	1	1
Cyperaceae	8	9
Dasypogonaceae	2	2
Dennstaedtiaceae	1	1
Dicranaceae	1	12
Dilleniaceae	5	10
Ditrichaceae	1	2
Droseraceae	2	3
Elaeocarpaceae	5	12
Ericaceae	9	17
Euphorbiaceae	1	2
Fabaceae	43	64
Frullaniaceae	1	2
Gentianaceae	2	2
Geraniaceae	1	2
Goodeniaceae	5	7
Haemodoraceae	6	10
Hemerocallidaceae	2	3
Hypericaceae	1	1
Iridaceae	9	17
Juncaceae	4	4
Juncaginaceae	1	1
Lamiaceae	2	6
Lentibulariaceae	1	1
Lindsaeaceae	1	1
Loganiaceae	2	2
Lophocoleaceae	1	1
Malvaceae	1	3
Myrtaceae	17	23
Olaceae	1	2
Onagraceae	2	2
Orchidaceae	19	25
Oxalidaceae	2	2
Phyllanthaceae	2	2
Pinaceae	1	1
Pittosporaceae	3	4
Plantaginaceae	3	5
Poaceae	12	17
Podocarpaceae	1	11
Polygonaceae	2	2
Pottiaceae	2	6
Primulaceae	1	1
Proteaceae	14	21
Racopilaceae	1	1
Ranunculaceae	3	4
Restionaceae	6	9
Ricciaceae	1	1
Rosaceae	4	6
Rubiaceae	2	3
Rutaceae	2	2
Santalaceae	2	7
Sapindaceae	1	2

Scrophulariaceae	1	1
Sematophyllaceae	1	5
Solanaceae	2	2
Stylidiaceae	11	14
Thymelaeaceae	3	3
Xanthorrhoeaceae	2	2
Zamiaceae	1	2
TOTAL	295	457

Name ID	Species Name	Naturalised	Conservation Code	1 Endemic To Query Area
Alliaceae				
1.	1378 <i>Allium triquetrum</i> (Three-cornered Garlic)	Y		
Apiaceae				
2.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
3.	6246 <i>Pentapeltis silvatica</i> (Southern Pentapeltis)			
4.	6253 <i>Platysace filliformis</i>			
5.	6283 <i>Xanthosia atkinsoniana</i>			
6.	6284 <i>Xanthosia candida</i>			
7.	6285 <i>Xanthosia ciliata</i>			
8.	6289 <i>Xanthosia huegelii</i>			
Araceae				
9.	1049 <i>Zantedeschia aethiopica</i> (Arum Lily)	Y		
Asparagaceae				
10.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
11.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
12.	1309 <i>Laxmannia squarrosa</i>			
13.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
14.	1225 <i>Lomandra drummondii</i>			
15.	1228 <i>Lomandra hermaphrodita</i>			
16.	1229 <i>Lomandra integra</i>			
17.	1234 <i>Lomandra nigricans</i>			
18.	1236 <i>Lomandra odora</i> (Tiered Matrush)			
19.	1239 <i>Lomandra preissii</i>			
20.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
21.	<i>Lomandra</i> sp.			
22.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
Asteraceae				
23.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
24.	20074 <i>Coryza sumatrensis</i>	Y		
25.	12741 <i>Hyalosperma cotula</i>			
26.	8086 <i>Hypochoeris glabra</i> (Smooth Catsear)	Y		
27.	18585 <i>Lagenophora huegelii</i>			
28.	8106 <i>Millotia tenuifolia</i> (Soft Millotia)			
29.	8203 <i>Senecio diaschides</i>			
30.	20663 <i>Senecio multicaulis</i> subsp. <i>multicaulis</i>			
31.	8223 <i>Sigesbeckia orientalis</i> (Indian Weed)	Y		
32.	14583 <i>Siloxerus multiflorus</i>			
33.	8227 <i>Silybum marianum</i> (Variegated Thistle)	Y		
34.	8248 <i>Tolpis barbata</i> (Yellow Hawkweed)	Y		
35.	29048 <i>Tolpis virgata</i>	Y		
Boraginaceae				
36.	6674 <i>Borago officinalis</i> (Borage)	Y		
Boryaceae				
37.	1272 <i>Borya scirpoidea</i>			
38.	1273 <i>Borya sphaerocephala</i> (Pincushions)			
Brassicaceae				
39.	3061 <i>Raphanus raphanistrum</i> (Wild Radish)	Y		
40.	3066 <i>Rorippa nasturtium-aquaticum</i> (Watercress)	Y		
Bryaceae				
41.	32426 <i>Rosulabryum campylothecium</i>			
42.	32427 <i>Rosulabryum capillare</i>			
Campanulaceae				
43.	9289 <i>Lobelia anceps</i> (Angled Lobelia)			
44.	<i>Wahlenbergia</i> sp.			
Caprifoliaceae				
45.	7365 <i>Lonicera japonica</i> (Japanese Honeysuckle)	Y		
Centrolepidaceae				
46.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
Cephaloziellaceae				
47.	<i>Cephaloziella exiliflora</i>			
48.	<i>Cephaloziella hirta</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Colchicaceae				
49.	12770 <i>Burchardia congesta</i>			
50.	1385 <i>Burchardia multiflora</i> (Dwarf Burchardia)			
Convolvulaceae				
51.	6663 <i>Cuscuta epithymum</i> (Lesser Dodder, Greater Dodder)	Y		
Cupressaceae				
52.	93 <i>Callitris drummondii</i> (Drummond's Cypress Pine)			
Cyperaceae				
53.	747 <i>Baumea rubiginosa</i>			
54.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
55.	902 <i>Gahnia decomposita</i>			
56.	933 <i>Lepidosperma gladiatum</i> (Coast Sword-sedge, Kerbin)			
57.	944 <i>Lepidosperma scabrum</i>			
58.	976 <i>Schoenus breviculmis</i>			
59.	985 <i>Schoenus discifer</i>			
60.	35578 <i>Tetragia</i> sp. Blackwood River (A.R. Annels 3043)		P3	
Dasygongonaceae				
61.	1218 <i>Dasygongon bromeliifolius</i> (Pineapple Bush)			
62.	1219 <i>Dasygongon hookeri</i> (Pineapple Bush)			
Dennstaedtiaceae				
63.	41651 <i>Pteridium esculentum</i> subsp. <i>esculentum</i>			
Dicranaceae				
64.	32338 <i>Campylopus introflexus</i>	Y		
Dilleniaceae				
65.	5109 <i>Hibbertia amplexicaulis</i>			
66.	5114 <i>Hibbertia commutata</i>			
67.	5125 <i>Hibbertia ferruginea</i>			
68.	45534 <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
69.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
Ditrichaceae				
70.	32462 <i>Ceratodon purpureus</i> subsp. <i>convolutus</i>			
Droseraceae				
71.	13217 <i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>			
72.	3118 <i>Drosera pallida</i> (Pale Rainbow)			
Elaeocarpaceae				
73.	4526 <i>Tetradlea affinis</i>			
74.	4535 <i>Tetradlea hirsuta</i> (Black Eyed Susan)			
75.	4538 <i>Tetradlea parvifolia</i>		P3	
76.	4544 <i>Tetradlea setigera</i>			
77.	4548 <i>Tremandra stelligera</i>			
Ericaceae				
78.	6360 <i>Leucopogon australis</i> (Spiked Beard-heath)			
79.	6367 <i>Leucopogon capitellatus</i>			
80.	6396 <i>Leucopogon glabellus</i>			
81.	41260 <i>Leucopogon microcarpus</i>			
82.	40941 <i>Leucopogon obovatus</i> subsp. <i>revolutus</i>			
83.	6428 <i>Leucopogon pendulus</i>			
84.	6436 <i>Leucopogon propinquus</i>			
85.	6454 <i>Leucopogon verticillatus</i> (Tassel Flower)			
86.	31952 <i>Sphenotoma gracilis</i> (Swamp Paper-heath)			
Euphorbiaceae				
87.	4666 <i>Monotaxis occidentalis</i>			
Fabaceae				
88.	11377 <i>Acacia browniana</i> var. <i>obscura</i>			
89.	3331 <i>Acacia extensa</i> (Wiry Wattle)			
90.	3410 <i>Acacia lateriticola</i>			
91.	17958 <i>Acacia mearnsii</i>	Y		
92.	10955 <i>Acacia melanoxylon</i>	Y		
93.	3448 <i>Acacia mooreana</i>			
94.	15483 <i>Acacia pulchella</i> var. <i>pulchella</i>			
95.	3504 <i>Acacia pycnantha</i> (Golden Wattle)	Y		
96.	30034 <i>Acacia saligna</i> subsp. <i>pruinescens</i>			
97.	30032 <i>Acacia saligna</i> subsp. <i>saligna</i>			
98.	30036 <i>Acacia saligna</i> subsp. <i>stolonifera</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
99.	15487 <i>Acacia varia</i> var. <i>varia</i>			
100.	3713 <i>Bossiaea linophylla</i>			
101.	3714 <i>Bossiaea ornata</i> (Broad Leaved Brown Pea)			
102.	10861 <i>Callistachys lanceolata</i> (Wonnich)			
103.	18156 <i>Chamaecytisus palmensis</i> (Tagasaste)	Y		
104.	8971 <i>Chorizema cordatum</i>			
105.	3761 <i>Chorizema rhombeum</i>			
106.	3799 <i>Daviesia cordata</i> (Bookleaf)			
107.	15505 <i>Daviesia incrassata</i> subsp. <i>incrassata</i>			
108.	3891 <i>Gastrolobium bilobum</i> (Heart Leaf Poison)			
109.	3924 <i>Gastrolobium spinosum</i> (Prickly Poison)			
110.	18143 <i>Genista monspessulana</i>	Y		
111.	3948 <i>Gompholobium capitatum</i>			
112.	3954 <i>Gompholobium polymorphum</i>			
113.	3955 <i>Gompholobium preissii</i>			
114.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
115.	3964 <i>Hovea chorizemifolia</i> (Holly-leaved Hovea)			
116.	3968 <i>Hovea trisperma</i> (Common Hovea)			
117.	4036 <i>Kennedia carinata</i>			
118.	4037 <i>Kennedia coccinea</i> (Coral Vine)			
119.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
120.	3669 <i>Labichea punctata</i> (Lance-leaved Cassia)			
121.	8564 <i>Lotus subbiflorus</i>	Y		
122.	4065 <i>Lupinus angustifolius</i> (Narrowleaf Lupin)	Y		
123.	4067 <i>Lupinus luteus</i> (Yellow Lupin)	Y		
124.	4090 <i>Mirbelia dilatata</i> (Holly-leaved Mirbelia)			
125.	3618 <i>Paraserianthes lophantha</i> (Albizia)			
126.	4177 <i>Pultenaea ochreatea</i>			
127.	4207 <i>Sphaerolobium medium</i>			
128.	4208 <i>Sphaerolobium nudiflorum</i>			
129.	<i>Trifolium</i> sp.			
130.	4313 <i>Trifolium subterraneum</i> (Subterranean Clover)	Y		
Frullaniaceae				
131.	<i>Frullania probosciphora</i>			
Gentianaceae				
132.	6539 <i>Centaurium erythraea</i> (Common Centaury)	Y		
133.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
Geraniaceae				
134.	4341 <i>Geranium solanderi</i> (Native Geranium)			
Goodeniaceae				
135.	7420 <i>Dampiera alata</i> (Winged-stem Dampiera)			
136.	29362 <i>Goodenia coerulea</i>			
137.	7505 <i>Goodenia eatoniana</i>			
138.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
139.	7602 <i>Scaevola calliptera</i>			
Haemodoraceae				
140.	11931 <i>Anigozanthos bicolor</i> subsp. <i>decrescens</i>			
141.	1447 <i>Conostylis pusilla</i>			
142.	1453 <i>Conostylis serrulata</i>			
143.	1465 <i>Haemodorum discolor</i>			
144.	1468 <i>Haemodorum laxum</i>			
145.	1478 <i>Phlebocarya ciliata</i>			
Hemerocallidaceae				
146.	1296 <i>Johnsonia inconspicua</i>		P3	
147.	1297 <i>Johnsonia lupulina</i> (Hooded Lily)			
Hypericaceae				
148.	5182 <i>Hypericum perforatum</i> (St John's Wort)	Y		
Iridaceae				
149.	18279 <i>Babiana angustifolia</i>	Y		
150.	18392 <i>Freesia alba</i> x <i>leichtlinii</i>	Y		
151.	1534 <i>Ixia polystachya</i> (Variable Ixia)	Y		
152.	19179 <i>Moraea flaccida</i> (One-leaf Cape Tulip)	Y		
153.	1542 <i>Patersonia babianoides</i>			
154.	11550 <i>Patersonia umbrosa</i> var. <i>xanthina</i> (Yellow Flags)			
155.	1558 <i>Sparaxis bulbifera</i>	Y		
156.	1561 <i>Tritonia crocata</i>	Y		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
157.	38401 <i>Tritonia gladiolaris</i> (Lined Tritonia)	Y		
Juncaceae				
158.	8328 <i>Juncus amabilis</i>			
159.	1184 <i>Juncus holoschoenus</i> (Jointleaf Rush)			
160.	1195 <i>Juncus subsecundus</i> (Finger Rush)			
161.	1198 <i>Luzula meridionalis</i> (Field Woodrush)			
Juncaginaceae				
162.	40660 <i>Cynogeton huegelii</i>			
Lamiaceae				
163.	38323 <i>Lavandula stoechas</i> subsp. <i>stoechas</i>	Y		
164.	6881 <i>Marrubium vulgare</i> (Horehound)	Y		
Lentibulariaceae				
165.	7157 <i>Utricularia violacea</i> (Violet Bladderwort)			
Lindsaeaceae				
166.	59 <i>Lindsaea linearis</i> (Screw Fern)			
Loganiaceae				
167.	46255 <i>Orianthera campanulata</i>			
168.	46316 <i>Orianthera serpyllifolia</i> subsp. <i>angustifolia</i>			
Lophocoleaceae				
169.	<i>Chiloscyphus semiteres</i> var. <i>semiteres</i>			
Malvaceae				
170.	5092 <i>Thomasia pauciflora</i> (Few Flowered Thomasia)			
Myrtaceae				
171.	17104 <i>Corymbia calophylla</i> (Marri)			
172.	5615 <i>Eucalyptus decipiens</i> (Limestone Marlock, Moit)			
173.	5628 <i>Eucalyptus drummondii</i> (Drummond's Gum)			
174.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
175.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
176.	18085 <i>Eucalyptus utilis</i>			
177.	5797 <i>Eucalyptus wandoo</i> (Wandoo, Wondoo)			
178.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
179.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
180.	40780 <i>Melaleuca citrina</i>	Y		
181.	13273 <i>Melaleuca incana</i> subsp. <i>incana</i>			
182.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
183.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
184.	37683 <i>Melaleuca viminalis</i>		P2	
185.	13280 <i>Melaleuca viminea</i> subsp. <i>viminea</i>			
186.	20133 <i>Taxandria parviceps</i>			
187.	15618 <i>Verticordia plumosa</i> var. <i>plumosa</i>			
Olacaceae				
188.	2365 <i>Olex benthamiana</i>			
Onagraceae				
189.	6132 <i>Epilobium ciliatum</i>	Y		
190.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
Orchidaceae				
191.	15335 <i>Caladenia brownii</i>			
192.	1580 <i>Caladenia cairnsiana</i> (Zebra Orchid)			
193.	1590 <i>Caladenia ferruginea</i> (Rusty Spider Orchid)			
194.	1597 <i>Caladenia infundibularis</i>			
195.	1603 <i>Caladenia longiclavata</i> (Clubbed Spider Orchid)			
196.	15377 <i>Caladenia reptans</i> subsp. <i>reptans</i>			
197.	<i>Caladenia</i> sp.			
198.	15380 <i>Caladenia splendens</i>			
199.	12945 <i>Corybas recurvus</i>			
200.	1627 <i>Cryptostylis ovata</i> (Slipper Orchid)			
201.	12944 <i>Diuris amplissima</i>			
202.	11156 <i>Drakaea livida</i>			
203.	15411 <i>Eriochilus dilatatus</i> subsp. <i>magnus</i>			
204.	1656 <i>Lyperanthus serratus</i> (Rattle Beak Orchid)			
205.	1668 <i>Prasophyllum brownii</i>			
206.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
207.	16367 <i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
208.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
209.	11053 <i>Thelymitra macrophylla</i>			
Oxalidaceae				
210.	30375 <i>Oxalis exilis</i>			
211.	4351 <i>Oxalis flava</i> (Pinkbulb Soursob)	Y		
Phyllanthaceae				
212.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
213.	4690 <i>Poranthera huegelii</i>			
Pinaceae				
214.	88 <i>Pinus radiata</i> (Radiata Pine)	Y		
Pittosporaceae				
215.	3157 <i>Billardiera floribunda</i> (White-flowered Billardiera)			
216.	25798 <i>Billardiera fusiformis</i> (Australian Bluebell)			
217.	28290 <i>Cheiranthra parviflora</i>			
Plantaginaceae				
218.	7068 <i>Kickxia spuria</i> (Roundleaf Toadflax)	Y		
219.	34759 <i>Plantago bellardii</i>	Y		
220.	7109 <i>Veronica calycina</i> (Cup Speedwell)			
Poaceae				
221.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
222.	194 <i>Amphipogon amphipogonoides</i>			
223.	250 <i>Bromus hordeaceus</i> (Soft Brome)	Y		
224.	277 <i>Cortaderia selloana</i> (Pampas Grass)	Y		
225.	299 <i>Deyeuxia quadriseta</i> (Reed Bentgrass)			
226.	444 <i>Holcus lanatus</i> (Yorkshire Fog)	Y		
227.	528 <i>Paspalum distichum</i> (Water Couch)	Y		
228.	557 <i>Piptatherum miliaceum</i> (Rice Millet)	Y		
229.	40430 <i>Rytidosperma pilosum</i>			
230.	40427 <i>Rytidosperma setaceum</i>			
231.	667 <i>Tetrarrhena laevis</i> (Forrest Ricegrass)			
232.	<i>Vulpia</i> sp.			
Podocarpaceae				
233.	86 <i>Podocarpus drouynianus</i> (Wild Plum, Kula)			
Polygonaceae				
234.	13911 <i>Persicaria decipiens</i>			
235.	2429 <i>Rumex acetosella</i> (Sorrel)	Y		
Pottiaceae				
236.	32315 <i>Barbula calycina</i>			
237.	32445 <i>Tortula muralis</i>			
Primulaceae				
238.	6483 <i>Samolus junceus</i>			
Proteaceae				
239.	32580 <i>Banksia dallanneyi</i> var. <i>dallanneyi</i>			
240.	32577 <i>Banksia dallanneyi</i> var. <i>melliculca</i>			
241.	1819 <i>Banksia grandis</i> (Bull Banksia, Pulgarla)			
242.	32046 <i>Banksia squarrosa</i> subsp. <i>argillacea</i>		T	
243.	13085 <i>Grevillea centristigma</i>			
244.	2080 <i>Grevillea quercifolia</i> (Oak-leaf Grevillea)			
245.	2082 <i>Grevillea ripicola</i> (Collie Grevillea)		P4	
246.	2112 <i>Grevillea trifida</i>			
247.	2128 <i>Hakea amplexicaulis</i> (Prickly Hakea)			
248.	2175 <i>Hakea lissocarpha</i> (Honey Bush)			
249.	2191 <i>Hakea oleifolia</i> (Dungyn)			
250.	2203 <i>Hakea ruscifolia</i> (Candle Hakea)			
251.	2237 <i>Isopogon sphaerocephalus</i> (Drumstick Isopogon)			
252.	2267 <i>Persoonia longifolia</i> (Snottygobble)			
Racopilaceae				
253.	32480 <i>Racopilum cuspidigerum</i> var. <i>convolutaceum</i>			
Ranunculaceae				
254.	2929 <i>Clematis pubescens</i> (Common Clematis)			
255.	10911 <i>Ranunculus amphitrichus</i>			
256.	2932 <i>Ranunculus colonorum</i> (Common Buttercup)			
Restionaceae				
257.	17691 <i>Desmocladius fasciculatus</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
258.	1070 <i>Hypolaena exsulca</i>			
259.	1071 <i>Hypolaena fastigiata</i>			
260.	1078 <i>Leptocarpus coangustatus</i>			
261.	1090 <i>Lepyrodia muirii</i>			
262.	1092 <i>Loxocarya cinerea</i>			
Ricciaceae				
263.	<i>Riccia</i> sp.			
Rosaceae				
264.	10764 <i>Rosa chinensis x multiflora</i>	Y		
265.	3187 <i>Rosa rubiginosa</i> (Sweet Briar)	Y		
266.	20506 <i>Rubus anglocandicans</i>	Y		
267.	23990 <i>Rubus ulmifolius</i> var. <i>ulmifolius</i>	Y		
Rubiaceae				
268.	7348 <i>Opercularia hispidula</i> (Hispid Stinkweed)			
269.	7350 <i>Opercularia rubioides</i>		P3	
Rutaceae				
270.	4420 <i>Boronia fastigiata</i> (Bushy Boronia)			
271.	18529 <i>Philothea spicata</i> (Pepper and Salt)			
Santalaceae				
272.	2342 <i>Leptomeria cunninghamii</i>			
273.	2355 <i>Leptomeria squarrolosa</i>			
Sapindaceae				
274.	4757 <i>Dodonaea ceratocarpa</i>			
Scrophulariaceae				
275.	7107 <i>Verbascum virgatum</i> (Twiggy Mullein)	Y		
Sematophyllaceae				
276.	32433 <i>Sematophyllum homomallum</i>			
Solanaceae				
277.	6964 <i>Datura stramonium</i> (Common Thornapple)	Y		
278.	<i>Solanum torvum</i>			
Stylidiaceae				
279.	7674 <i>Levenhookia preissii</i> (Preiss's Stylewort)			
280.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
281.	7678 <i>Stylidium adnatum</i> (Common Beaked Triggerplant)			
282.	7684 <i>Stylidium amoenum</i> (Lovely Triggerplant)			
283.	30278 <i>Stylidium androsaceum</i>			
284.	7702 <i>Stylidium ciliatum</i> (Golden Triggerplant)			
285.	7708 <i>Stylidium crassifolium</i> (Thick-leaved Triggerplant)			
286.	7745 <i>Stylidium junceum</i> (Reed Triggerplant)			
287.	7796 <i>Stylidium scandens</i> (Climbing Triggerplant)			
288.	<i>Stylidium</i> sp.			
289.	7799 <i>Stylidium spathulatum</i> (Creamy Triggerplant)			
Thymelaeaceae				
290.	5231 <i>Pimelea angustifolia</i> (Narrow-leaved Pimelea)			
291.	11533 <i>Pimelea imbricata</i> var. <i>imbricata</i>			
292.	11182 <i>Pimelea lehmanniana</i> subsp. <i>nervosa</i>			
Xanthorrhoeaceae				
293.	1253 <i>Xanthorrhoea gracilis</i> (Graceful Grass Tree, Mimidi)			
294.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
Zamiaceae				
295.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
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1 - Priority 1
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3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap Fauna Species Report

Created By Guest user on 12/05/2017

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Vertices 33° 42' 46" S,115° 53' 45" E 33° 43' 20" S,115° 54' 04" E 33° 43' 32" S,115° 54' 11" E 33° 43' 57" S,115° 54' 33" E 33° 43' 57" S,115° 54' 55" E 33° 44' 32" S,115° 56' 41" E 33° 45' 17" S,115° 57' 25" E 33° 45' 22" S,115° 57' 45" E 33° 46' 11" S,115° 58' 42" E 33° 46' 52" S,115° 58' 59" E 33° 47' 17" S,115° 59' 04" E 33° 47' 28" S,115° 59' 48" E 33° 47' 34" S,116° 00' 04" E 33° 47' 40" S,116° 00' 12" E 33° 47' 52" S,116° 00' 12" E 33° 48' 28" S,116° 01' 02" E 33° 49' 59" S,116° 02' 38" E 33° 50' 18" S,116° 03' 19" E
Group By Species Group

Species Group	Species	Records
Amphibian	6	22
Bird	107	1696
Fish	3	7
Invertebrate	15	15
Mammal	17	114
Reptile	9	34
TOTAL	157	1888

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Amphibian				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
4.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
5.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
6.	25421 <i>Neobatrachus albigipes</i> (White-footed Trilling Frog)			
Bird				
7.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
8.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
9.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
10.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
11.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
12.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
13.	24301 <i>Aegotheles cristatus</i> subsp. <i>cristatus</i> (Australian Owlet-nightjar)			
14.	24312 <i>Anas gracilis</i> (Grey Teal)			
15.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
16.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
17.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
18.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
19.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
20.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
21.	41324 <i>Ardea modesta</i> (Eastern Great Egret)		IA	
22.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
23.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
24.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
25.	24318 <i>Aythya australis</i> (Hardhead)			
26.	<i>Barnardius zonarius</i>			
27.	24319 <i>Biziura lobata</i> (Musk Duck)			
28.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
29.	24427 <i>Cacomantis flabelliformis</i> subsp. <i>flabelliformis</i> (Fan-tailed Cuckoo)			
30.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
31.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
32.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black-Cockatoo)		T	
33.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)		T	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
34.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)		T	
35.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
36.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
37.	24288 <i>Circus approximans</i> (Swamp Harrier)			
38.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
39.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
40.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
41.	25592 <i>Corvus coronoides</i> (Australian Raven)			
42.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
43.	24322 <i>Cygnus atratus</i> (Black Swan)			
44.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
45.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
46.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
47.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
48.	<i>Egretta novaehollandiae</i>			
49.	<i>Elanus axillaris</i>			
50.	47937 <i>Eileynornis melanops</i> (Black-fronted Dotterel)			
51.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
52.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
53.	25621 <i>Falco berigora</i> (Brown Falcon)			
54.	24471 <i>Falco berigora</i> subsp. <i>berigora</i> (Brown Falcon)			
55.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
56.	25623 <i>Falco longipennis</i> (Australian Hobby)			
57.	24474 <i>Falco longipennis</i> subsp. <i>longipennis</i> (Australian Hobby)			
58.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
59.	25727 <i>Fulica atra</i> (Eurasian Coot)			
60.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
61.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
62.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
63.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
64.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
65.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
66.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
67.	<i>Lophoictinia isura</i>			
68.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
69.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
70.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
71.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
72.	<i>Microcarbo melanoleucos</i>			
73.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
74.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
75.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
76.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
77.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
78.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
79.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
80.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
81.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
82.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
83.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
84.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
85.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
86.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
87.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
88.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
89.	24745 <i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
90.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
91.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
92.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
93.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
94.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
95.	30854 <i>Polytelis anthopeplus</i> subsp. <i>westralis</i> (Regent Parrot)			
96.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
97.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
98.	<i>Purpureicephalus spurius</i>			
99.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
100.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
101.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
102.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
103.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
104.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
105.	25752 <i>Sturnus vulgaris</i> (Common Starling)	Y		
106.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
107.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
108.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
109.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
110.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
111.	25764 <i>Tyto novaehollandiae</i> (Masked Owl)			
112.	24855 <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i> (Masked Owl (southern subsp))		P3	
113.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

Fish

114.	<i>Edelia vittata</i>			
115.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
116.	<i>Nannoperca vittata</i>			

Invertebrate

117.	<i>Aganippe raphiduca</i>			
118.	<i>Araneus cyphoxis</i>			
119.	<i>Araneus senicaudatus</i>			
120.	<i>Argiope protensa</i>			
121.	<i>Austracantha minax</i>			
122.	<i>Celaenia excavata</i>			
123.	33939 <i>Cherax cainii</i> (Marron)			
124.	<i>Cherax preissii</i>			
125.	<i>Cyclosa trilobata</i>			
126.	<i>Heurodes turritus</i>			
127.	<i>Latrodectus hasseltii</i>			
128.	<i>Longepi woodman</i>			
129.	<i>Missulena granulosa</i>			
130.	<i>Tasmanicosa leuckartii</i>			
131.	<i>Tetragnatha nitens</i>			

Mammal

132.	24187 <i>Chalinolobus morio</i> (Chocolate Wattled Bat)			
133.	24092 <i>Dasyurus geoffroi</i> (Chuditch, Western Quoll)		T	
134.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
135.	25478 <i>Isoodon obesulus</i> (Southern Brown Bandicoot)		P4	
136.	24153 <i>Isoodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P4	
137.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
138.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
139.	24223 <i>Mus musculus</i> (House Mouse)	Y		
140.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
141.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
142.	25508 <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)			
143.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum)		T	
144.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
145.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
146.	24111 <i>Sminthopsis gilberti</i> (Gilbert's Dunnart)			
147.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
148.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			

Reptile

149.	24990 <i>Aprasia pulchella</i> (Granite Worm-lizard)			
150.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
151.	25096 <i>Egernia kingii</i> (King's Skink)			
152.	25117 <i>Hemiergis peronii</i> subsp. <i>peronii</i>			
153.	25118 <i>Hemiergis peronii</i> subsp. <i>tridactyla</i>			
154.	25192 <i>Morethia obscura</i>			
155.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
156.	25225 <i>Varanus rosenbergi</i> (Heath Monitor)			
157.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			

Conservation Codes

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¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix D – Flora Data

Flora species list

Quadrat and relevé data

Flora likelihood of occurrence assessment guidelines

Flora likelihood of occurrence assessment

Flora Species List – Greenbushes to Kirup Link

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Apiaceae								
	<i>Platysace compressa</i>		✓					
Asparagaceae								
	* W & DP <i>Asparagus asparagoides</i>				✓	✓		
	<i>Lomandra hermaphrodita</i>		✓					
	<i>Lomandra micrantha</i>	✓		✓				
	<i>Lomandra nigricans</i>		✓					
	<i>Lomandra preissii</i>		✓					
	<i>Lomandra purpurea</i>	✓						
	<i>Lomandra sericea</i>		✓					
	<i>Thysanotus manglesianus/patersonii</i>			✓				
Asteraceae								
	* <i>Conyza bonariensis</i>						✓	
	* <i>Crepis capillaris</i>				✓	✓		
	* <i>Hypochaeris glabra</i>	✓	✓	✓			✓	
	<i>Lagenophora huegelii</i>	✓						
	* <i>Sonchus oleraceus</i>				✓		✓	
Boraginaceae								
	<i>Burchardia congesta</i>	✓						
Brassicaceae								
	* <i>Brassica tournefortii</i>						✓	
Cyperaceae								
	* <i>Cyprus congestus</i>						✓	
	<i>Lepidosperma leptostachyum</i>	✓						

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
	<i>Lepidosperma</i> sp.		✓					
	<i>Tetraria octandra</i>		✓					
Dasygongonaceae								
	<i>Dasygogon bromeliifolius</i>		✓					
Dennstaedtiaceae								
	<i>Pteridium esculentum</i>	✓	✓	✓			✓	✓
Dilleniaceae								
	<i>Hibbertia amplexicaulis</i>		✓	✓				
	<i>Hibbertia hypericoides</i>	✓	✓					
Droseraceae								
	<i>Drosera</i> sp.		✓					
Elaeocarpaceae								
	<i>Platytheca galioides</i>	✓						
Ericaceae								
	<i>Leucopogon ?capitellatus</i>			✓				
	<i>Leucopogon propinquus</i>		✓					
	<i>Leucopogon verticillaris</i>	✓		✓				
	<i>Sphenotoma capitata</i>	✓						
Fabaceae								
	<i>Acacia alata</i>	✓						
	* <i>Acacia baileyana</i>				✓		✓	
	<i>Acacia divergens</i>		✓					
	<i>Acacia extensa</i>	✓	✓		✓			
	* <i>Acacia longifolia</i>		✓					
	<i>Acacia obovata</i>							

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
	<i>Acacia pulchella</i>		✓		✓			
	* <i>Acacia pycnantha</i>						✓	
	<i>Acacia saligna</i>						✓	
	<i>Acacia stenoptera</i>							
	<i>Bossiaea linophylla</i>			✓				
	<i>Bossiaea ornata</i>	✓	✓	✓				
	<i>Hardenbergia comptoniana</i>			✓				
	<i>Hovea chorizemifolia</i>	✓	✓					
	<i>Jacksonia furcellata</i>				✓			
	<i>Kennedia prostrata</i>			✓				✓
	<i>Mirbelia dilatata</i>	✓	✓					✓
Goodeniaceae								
	<i>Dampiera linearis</i>	✓						
	<i>Scaevola calliptera</i>		✓	✓				
Haemodoraceae								
	<i>Haemodorum simplex</i>			✓				✓
Hemerocallidaceae								
	<i>Johnsonia lupulina</i>	✓	✓					
Iridaceae								
	* <i>Gladiolus caryophyllaceus</i>		✓					
	<i>Patersonia occidentalis</i>	✓	✓					
	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	✓						✓
Juncaceae								
	* <i>Juncus microcephalus</i>							
	<i>Juncus pallidus</i>				✓	✓		

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Lamiaceae								
	* <i>Mentha pulegium</i>					✓		
Malvaceae								
	<i>Lasiopetalum floribunda</i>	✓						
Myrtaceae								
	<i>Agonis flexuosa</i>						✓	
	<i>Callistemon</i> sp.						✓	
	<i>Calothamnus</i> sp.							✓
	<i>Corymbia calophylla</i>	✓	✓	✓	✓		✓	✓
	<i>Eucalyptus marginata</i>	✓	✓	✓	✓		✓	✓
	<i>Eucalyptus rudis</i>					✓	✓	
	* <i>Eucalyptus</i> spp. (planted)						✓	
	<i>Melaleuca</i> sp. (sterile)		✓					
	<i>Taxandria linearifolia</i>						✓	
	<i>Taxandria parviceps</i>		✓					
Orchidaceae								
	<i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>			✓				
Orobanchaceae								
	* <i>Orobanche minor</i>				✓			
Oxalidaceae								
	* <i>Oxalis glabra</i>	✓		✓			✓	✓
Plantaginaceae								
	* <i>Plantago lanceolata</i>				✓	✓		
Pinaceae								
	* <i>Pinus pinaster</i>		✓				✓	✓

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
	* <i>Pinus radiata</i>				✓			
Pittosporaceae								
	<i>Billardiera heterophylla</i>	✓			✓		✓	
Poaceae								
	* <i>Avena</i> sp.				✓			
	* <i>Bambusa textilis gracilis</i>						✓	
	* <i>Briza maxima</i>	✓	✓	✓			✓	✓
	* <i>Briza minor</i>	✓						
	* <i>Cynodon dactylon</i>						✓	
	* <i>Eragrostis curvula</i>						✓	✓
	* <i>Poaceae</i> sp. (sterile)	✓	✓				✓	
Podocarpaceae								
	<i>Podocarpus drouynianus</i>	✓	✓					
Primulaceae								
	* <i>Lysimachia arvensis</i>				✓	✓		
Proteaceae								
	<i>Banksia dallanneyi</i>		✓					✓
	<i>Banksia grandis</i>		✓	✓				
	<i>Banksia nivea</i>	✓						
	<i>Hakea amplexicaulis</i>	✓	✓					✓
	<i>Hakea lissocarpa</i>	✓						
	<i>Hakea petiolaris</i>						✓	
	<i>Persoonia longifolia</i>	✓		✓				✓
Ranunculaceae								
	<i>Clematis linearifolia</i>							✓

Family	Taxon	VT01	VT02	VT03	VT04	VT05	VT06	VT07
	<i>Clematis pubescens</i>			✓				
Restionaceae								
	<i>Desmocladius fasciculatus</i>		✓					✓
	<i>Desmocladius flexuosus</i>		✓					
	<i>Hypolaena exsulca</i>		✓					
	<i>Leptocarpus scariosus</i>	✓	✓					
Rhamnaceae								
	<i>Trymalium odoratissimum</i> subsp. <i>trifidum</i>							
Rubiaceae								
	<i>Opercularia hispidula</i>			✓				
	<i>Opercularia vaginata</i>			✓				
	*W & DP <i>Rubus ulmifolius</i>				✓	✓		
Solanaceae								
	* <i>Solanum nigrum</i>				✓		✓	
Thymelaeaceae								
	<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>	✓						
Violaceae								
	<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>							
Xanthorrhoeaceae								
	<i>Xanthorrhoea gracilis</i>	✓	✓				✓	
	<i>Xanthorrhoea preissii</i>	✓	✓		✓		✓	✓
Zamiaceae								
	<i>Macrozamia riedlei</i>	✓	✓	✓			✓	✓

* - Denotes an introduced species

W - Weeds of National Significance (WONS)

DP - Declared Pests (BAM Act)

VEGETATION DATA SHEET:		Date:	16/05/2017	Site :	Mullalyup Tank
Location:	Tank site, south of Cundinup Road				
MGA zone:	50	Easting:	399 580	Northing:	626 6755
Site type:	Quadrat 1	Dimensions:	10 m x 10 m		
Vegetation type:	VT02			Observer:	AB
<i>Corymbia calophylla</i> <i>Eucalyptus marginata</i> open forest <i>Banksia grandis</i> isolated trees <i>Taxandria parviceps</i> <i>Hibbertia hypericoides</i> <i>Podocarpus drouynianus</i> shrubland <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open herbland				Drainage:	Good
				Landform:	Plain
				Slope:	Negligible
				Leaf litter:	Plentiful
				Wood Litter:	Plentiful
Condition:	Very Good			Rocks:	Laterite 6-20mm
Disturbance:	Weeds			Soil surface:	Humus/litter 80%
Fire:	Old (> 5 yr)		Soil:	Loamy sand (orange/ brown)	
Fire intensity:	Minor, scars on some trees				



Quadrat 1 Species List

Taxon	70-30%	30-10%	<10%	<2% N	<2% T <10	Ht (m)
<i>Corymbia calophylla</i>	✓					25
<i>Eucalyptus marginata</i>		✓				2
<i>Banksia grandis</i>			✓			3
<i>Taxandria parviceps</i>			✓			2
<i>Acacia extensa</i>				✓		1.5
<i>Desmocladius flexuosus</i>				✓		0.3

Taxon	70-30%	30-10%	<10%	<2% N	<2% T <10	Ht (m)
<i>Hibbertia hypericoides</i>				✓		1
<i>Lomandra sericea</i>				✓		0.5
<i>Patersonia</i> sp.				✓		1
<i>Podocarpus drouynianus</i>				✓		1
<i>Xanthorrhoea gracilis</i>				✓		1.5
<i>Bossiaea ornata</i>					✓	0.2
<i>Desmocladius fasciculatus</i>					✓	0.3
<i>Drosera</i> sp.					✓	cr
* <i>Gladiolus caryophyllaceus</i>					✓	0.2
<i>Hakea amplexicaulis</i>					✓	1
<i>Hovea chorizemifolia</i>					✓	0.2
* <i>Hypochaeris glabra</i>					✓	0.2
<i>Johnsonia lupulina</i>					✓	0.5
<i>Lepidosperma</i> sp.					✓	0.3
<i>Leptocarpus scariosus</i>					✓	0.5
<i>Leucopogon propinquus</i>					✓	0.4
<i>Lomandra hermaphrodita</i>					✓	0.3
<i>Lomandra nigricans</i>					✓	0.5
<i>Macrozamia riedlei</i>					✓	1
<i>Myrtaceae</i> sp. (sterile)					✓	1
<i>Platysace compressa</i>					✓	0.2
* <i>Poaceae</i> sp. (sterile)					✓	0.2
<i>Scaevola calliptera</i>					✓	0.2
<i>Tetraria/ Schoenus</i>					✓	0.3
<i>Acacia divergens</i>						opp
* <i>Acacia longifolia</i>						opp
<i>Acacia pulchella</i>						opp
<i>Banksia dallanneyi</i>						opp
* <i>Briza maxima</i>						opp
<i>Dasypogon bromeliifolius</i>						opp
<i>Hibbertia amplexicaulis</i>						opp
<i>Hypolaena exsulca</i>						opp
<i>Lomandra preissii</i>						opp
<i>Lomandra sericea</i>						opp
<i>Mirbelia dilatata</i>						opp
* <i>Pinus pinaster</i>						opp
<i>Pteridium esculentum</i>						opp
<i>Xanthorrhoea preissii</i>						opp

* denotes an introduced species
opp – opportunistic species

VEGETATION DATA SHEET:		Date: 17/05/2017	Site : South Alignment East	
Location:	Cnr of Hay & Old Padbury Rd, North Greenbushes			
MGA zone:	50	Easting: 408 861	Northing: 625 7511	
Site type:	Quadrat 2	Dimensions:	10 m x 10 m	
Vegetation type:	VT03	Observer:	AB	
<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> <i>Banksia grandis</i> open forest <i>Bossiaea linophylla</i> shrubland <i>Pteridium</i> <i>esculentum</i> <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open fernland/herbland.	Drainage:	Good		
	Landform:	Plain		
	Slope:	Negligible		
	Leaf litter:	Plentiful		
Condition:	Very Good - Good		Wood Litter:	Plentiful
Disturbance:	Weeds and gravel road nearby		Rocks:	Negligible
Fire:	Old (> 5 yr)	Soil surface:	Humus/litter 80%	
Fire intensity:	Minor, scars on some trees	Soil:	Loamy sand (orange/ brown)	



Quadrat 2 Species List

Taxon	70-30%	30-10%	<10%	<2% N	<2% T <10	Ht (m)
<i>Corymbia calophylla</i>	✓					25
<i>Eucalyptus marginata</i>		✓				2
<i>Banksia grandis</i>			✓			3
<i>Taxandria parviceps</i>			✓			2
<i>Acacia extensa</i>				✓		1.5
<i>Desmocladius flexuosus</i>				✓		0.3
<i>Hibbertia hypericoides</i>				✓		1

Taxon	70-30%	30-10%	<10%	<2% N	<2% T <10	Ht (m)
<i>Lomandra sericea</i>				✓		0.5
<i>Patersonia</i> sp.				✓		1
<i>Podocarpus drouynianus</i>				✓		1
<i>Xanthorrhoea gracilis</i>				✓		1.5
<i>Bossiaea ornata</i>					✓	0.2
<i>Desmocladius fasciculatus</i>					✓	0.3
<i>Drosera</i> sp.					✓	cr
* <i>Gladiolus caryophyllaceus</i>					✓	0.2
<i>Hakea amplexicaulis</i>					✓	1
<i>Hovea chorizemifolia</i>					✓	0.2
* <i>Hypochaeris glabra</i>					✓	0.2
<i>Johnsonia lupulina</i>					✓	0.5
<i>Lepidosperma</i> sp.					✓	0.3
<i>Leptocarpus scariosus</i>					✓	0.5
<i>Leucopogon propinquus</i>					✓	0.4
<i>Lomandra hermaphrodita</i>					✓	0.3
<i>Lomandra nigricans</i>					✓	0.5
<i>Macrozamia riedlei</i>					✓	1
<i>Myrtaceae</i> sp. (sterile)					✓	1
<i>Platysace compressa</i>					✓	0.2
* <i>Poaceae</i> sp. (sterile)					✓	0.2
<i>Scaevola calliptera</i>					✓	0.2
<i>Tetraria/ Schoenus</i>					✓	0.3
<i>Acacia divergens</i>						opp
<i>Acacia longifolia</i>						opp
<i>Acacia pulchella</i>						opp
<i>Banksia dallanneyi</i>						opp
* <i>Briza maxima</i>						opp
<i>Dasypogon bromeliifolius</i>						opp
<i>Hibbertia amplexicaulis</i>						opp
<i>Hypolaena exsulca</i>						opp
<i>Lomandra preissii</i>						opp
<i>Lomandra sericea</i>						opp
<i>Mirbelia dilatata</i>						opp
* <i>Pinus pinaster</i>						opp
<i>Pteridium esculentum</i>						opp
<i>Xanthorrhoea preissii</i>						opp

* denotes an introduced species
opp – opportunistic species

VEGETATION DATA SHEET:		Date:	16/05/2017	Site :	Kirup Dam Bypass
Location:	Near Castle Street towards Kirup Dam				
MGA zone:	50	Easting:	397 059	Northing:	626 8979
Site type:	Relevé 1	Dimensions:	NA		
Vegetation type:	VT01			Observer:	AB
<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> open forest <i>Hibbertia hypericoides</i> <i>Hakea lissocarpha</i> shrubland <i>Patersonia occidentalis</i> <i>Lepidosperma leptostachyum</i> open herbland				Drainage:	Good
				Landform:	Mid-slope
				Slope:	Moderate
				Leaf litter:	Plentiful
				Wood Litter:	Plentiful
Condition:	Good - Degraded			Rocks:	Coarse gravel
Disturbance:	Weeds and a gravel road occupies most of the site (80 %)				
Fire:	Old (> 5 yr)	Soil surface:	Lateritic gravel		
Fire intensity:	Minor, scars on some trees	Soil:	Loamy sand (orange/ brown)		



Relevé 1 Species List

Taxon
<i>Corymbia calophylla</i>
<i>Eucalyptus marginata</i>
* <i>Briza maxima</i>
* <i>Briza minor</i>
<i>Hakea lissocarpha</i>
<i>Hibbertia hypericoides</i>

Taxon
<i>*Hypochaeris glabra</i>
<i>Lepidosperma leptostachyum</i>
<i>Leptocarpus scariosus</i>
<i>Mirbelia dilatata</i>
<i>Patersonia occidentalis</i>
<i>*Poaceae</i> sp. (sterile)
<i>Pteridium esculentum</i>
<i>Xanthorrhoea gracilis</i>
<i>Acacia alata</i>
<i>Dampiera linearis</i>
<i>Hakea amplexicaulis</i>
<i>Hovea chorizemifolia</i>
<i>Johnsonia lupulina</i>
<i>Macrozamia riedlei</i>
<i>Persoonia longifolia</i>
<i>Platytheca galioides</i>
<i>Podocarpus drouynianus</i>
<i>Acacia extensa</i>
<i>Banksia nivea</i>
<i>Billardiera heterophylla</i>
<i>Bossiaea ornata</i>
<i>Burchardia congesta</i>
<i>Lagenophora huegelii</i>
<i>Lasiopetalum floribunda</i>
<i>Leucopogon verticillaris</i>
<i>Lomandra micrantha</i>
<i>Lomandra purpurea</i>
<i>*Oxalis glabra</i>
<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>
<i>Sphenotoma capitata</i>
<i>*Watsonia meriana</i> var. <i>bulbillifera</i>
<i>Xanthorrhoea preissii</i>

* denotes an introduced species
opp – opportunistic species

VEGETATION DATA SHEET:		Date: 17/05/2017	Site : South Alignment West	
Location:	Old Padbury Road			
MGA zone:	50	Easting: 408 132	Northing: 625 8021	
Site type:	Relevé 2	Dimensions: NA		
Vegetation type:	VT04	Observer:	AB	
<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> * <i>Pinus radiata</i> open forest <i>Xanthorrhoea preissii</i> isolated shrubs * <i>Rubus ulmifolius</i> shrubland		Drainage:	Good	
		Landform:	Mid-slope	
		Slope:	Undulating	
		Leaf litter:	Plentiful	
Condition:	Degraded	Wood Litter:	Plentiful	
Disturbance:	Dominated by Declared Weeds and WONS		Rocks:	Coarse gravel
Fire:	Old (> 5 yr)	Soil surface:	Lateritic gravel	
Fire intensity:	Minor, scars on some trees	Soil:	Loamy sand (orange/ brown)	



Relevé 2 Species List

Taxon
* <i>Acacia baileyana</i>
<i>Acacia extensa</i>
<i>Acacia pulchella</i>
* <i>Asparagus asparagoides</i> (WON & DP)
* <i>Avena</i> sp.
<i>Billardiera heterophylla</i>
* <i>Briza maxima</i>

Taxon
<i>Corymbia calophylla</i>
* <i>Crepis capillaris</i>
<i>Eucalyptus marginata</i>
<i>Eucalyptus rudis</i>
<i>Jacksonia furcellata</i>
<i>Juncus pallidus</i>
* <i>Lysimachia arvensis</i>
* <i>Mentha pulegium</i>
* <i>Orobanche minor</i>
* <i>Oxalis glabra</i>
* <i>Pinus radiata</i>
* <i>Plantago lanceolata</i>
* <i>Rubus ulmifolius</i> (WONS & DP)
* <i>Solanum nigrum</i>
<i>Xanthorrhoea preissii</i>

* denotes an introduced species
opp – opportunistic species

VEGETATION DATA SHEET:		Date:	17/05/2017	Site :	South Alignment West
Location:	Old Padbury Road				
MGA zone:	50	Easting:	407 895	Northing:	625 8191
Site type:	Relevé 3	Dimensions:	NA		
Vegetation type:	VT05			Observer:	AB
<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> <i>Banksia grandis</i> open forest <i>Bossiaea linophylla</i> shrubland <i>Pteridium</i> <i>esculentum</i> <i>Lomandra sericea</i> <i>Desmocladius fasciculatus</i> open fernland/herbland.				Drainage:	Good
				Landform:	Drainage depression
				Slope:	NA
				Leaf litter:	Plentiful
				Wood Litter:	Plentiful
Condition:	Degraded			Rocks:	Coarse gravel
Disturbance:	Dominated by Declared Weeds and WONS				
Fire:	Old (> 5 yr)	Soil surface:	Lateritic gravel		
Fire intensity:	Minor, scars on some trees	Soil:	Loamy sand (orange/ brown)		



Relevé 3 Species List

Taxon
* <i>Asparagus asparagoides</i> (WONS & DP)
<i>Corymbia calophylla</i>
* <i>Crepis capillaris</i>
<i>Eucalyptus rudis</i>
<i>Juncus pallidus</i>
* <i>Lysimachia arvensis</i>
* <i>Mentha pulegium</i>
* <i>Orobanche minor</i>

Taxon
* <i>Oxalis glabra</i>
* <i>Plantago lanceolata</i>
* <i>Rubus ulmifolius</i> (WONS & DP)
* <i>Solanum nigrum</i>
<i>Xanthorrhoea preissii</i>

* denotes an introduced species

VEGETATION DATA SHEET:		Date:	17/05/2017	Site :	New Cirilo Road Option
Location:	South West Highway, Mullalyup				
MGA zone:	50	Easting:	401 946	Northing:	626 6014
Site type:	Relevé 4	Dimensions:	NA		
Vegetation type:	VT06	Observer:	AB		
<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i> * <i>Pinus radiata</i> open forest <i>Xanthorrhoea preissii</i> isolated shrubs * <i>Rubus ulmifolius</i> shrubland	Drainage:	Good			
	Landform:	Plain			
	Slope:	Negligible			
	Leaf litter:	Plentiful			
	Wood Litter:	Plentiful			
Condition:	Degraded		Rocks:	Coarse gravel	
Disturbance:	Weeds, Fire and gravel tracks				
Fire:	Recent (<1 yr)	Soil surface:	Lateritic gravel		
Fire intensity:	Minor, scars on most trees	Soil:	Loamy sand (orange/ brown)		



Relevé 4 Species List

Taxon
<i>Banksia dallaneyi</i>
* <i>Brassica tournefortii</i>
* <i>Briza maxima</i>
* <i>Calothamnus</i> sp.
<i>Clematis linearifolia</i>
<i>Conyza bonariensis</i>
<i>Corymbia calophylla</i>

Taxon
* <i>Eragrostis curvula</i>
<i>Eucalyptus marginata</i>
<i>Haemodorum simplex</i>
<i>Hakea amplexicaulis</i>
* <i>Hypochaeris glabra</i>
<i>Kennedia prostrata</i>
<i>Macrozamia riedlei</i>
<i>Mirbelia dilatata</i>
* <i>Oxalis glabra</i>
<i>Persoonia longifolia</i>
* <i>Pinus pinaster</i>
* <i>Poaceae</i> sp. (sterile)
<i>Pteridium esculentum</i>
* <i>Solanum nigrum</i>
* <i>Sonchus oleraceus</i>
* <i>Watsonia meriana</i> var. <i>bulbillifera</i>
<i>Xanthorrhoea gracilis</i>
<i>Xanthorrhoea preissii</i>

* denotes an introduced species

VEGETATION DATA SHEET:		Date:	17/05/2017	Site :	New Cirilo Road Option
Location:	South West Highway, Mullalyup				
MGA zone:	50	Easting:	402 622	Northing:	626 5444
Site type:	Relevé 5	Dimensions:	NA		
Vegetation type:	VT07			Observer:	AB
<i>Eucalyptus rudis</i> open woodland <i>Xanthorrhoea preissii</i> isolated shrubs * <i>Rubus ulmifolius</i> shrubland.				Drainage:	Good
				Landform:	Plain
				Slope:	Negligible
				Leaf litter:	Plentiful
Condition:	Degraded to Completely Degraded/Cleared			Wood Litter:	Plentiful
Disturbance:	Weeds, gravel tracks, infrastructure			Rocks:	Coarse gravel
Fire:	Old (>5 yr)	Soil surface:	Lateritic gravel		
Fire intensity:	No damage	Soil:	Loamy sand (orange/ brown)		



Relevé 5 Species List

Taxon
* <i>Acacia baileyana</i>
* <i>Acacia pycnantha</i>
<i>Acacia saligna</i>
<i>Agonis flexuosa</i>
* <i>Bambusa textilis gracilis</i>
<i>Billardiera heterophylla</i>
* <i>Brassica tournefortii</i>
* <i>Briza maxima</i>

Taxon
* <i>Callistemon</i> sp.
* <i>Conyza bonariensis</i>
<i>Corymbia calophylla</i>
* <i>Cynodon dactylon</i>
* <i>Cyprus congestus</i>
<i>Desmocladius fasciculatus</i>
* <i>Eragrostis curvula</i>
<i>Eucalyptus marginata</i>
<i>Eucalyptus rudis</i>
* <i>Eucalyptus</i> spp.(unidentified)
<i>Hakea amplexicaulis</i>
<i>Hakea petiolaris</i>
* <i>Hypochaeris glabra</i>
<i>Kennedia prostrata</i>
<i>Macrozamia riedlei</i>
<i>Mirbelia dilatata</i>
* <i>Oxalis glabra</i>
<i>Persoonia longifolia</i>
* <i>Pinus pinaster</i>
* <i>Poaceae</i> sp. (sterile)
<i>Pteridium esculentum</i>
* <i>Solanum nigrum</i>
* <i>Sonchus oleraceus</i>
<i>Taxandria linearifolia</i>
<i>Xanthorrhoea gracilis</i>
<i>Xanthorrhoea preissii</i>

* denotes an introduced species

Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within study area from field survey results.
Likely	Species previously recorded within 2 km and large areas of suitable habitat occur in the study area.
Possible	Species previously recorded within 2 km and areas of suitable habitat occur/may occur in the study area.
Unlikely	Species previously recorded within 2 km, but suitable habitat does not occur in the study area.
Highly unlikely	Species not previously recorded within 2 km, suitable habitat does not occur in the study area and/or the study area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

PMST – DotE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area

NM – DBCA NatureMap (accessed May 2017)

Flora likelihood of occurrence assessment for conservation significant flora

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DotE 2017)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
Proteaceae	<i>Banksia squarrosa</i> subsp. <i>argillacea</i>	T		Erect, open, non-lignotuberous shrub, 1.2-4 m high. Flowers yellow, Jun to Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 3.5 km away.	NM
Orchidaceae	<i>Caladenia harringtoniae</i>	T	Vu	Tuberous, perennial, herb, 0.2-0.4 m high. Flowers pink, Oct to Nov. Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 5 km away	PMST
Orchidaceae	<i>Caladenia hoffmanii</i>	T	En	Tuberous, perennial, herb, 0.13-0.3 m high. Flowers green & yellow & red, Aug to Oct. Clay, loam, laterite, granite. Rocky outcrops and	Highly Unlikely – there is no suitable habitat present in the survey area and the closest known record is >100 km away.	PMST

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DotE 2017)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
				hillsides, ridges, swamps and gullies		
Orchidaceae	<i>Caladenia huegelii</i>	T	En	Tuberous, perennial, herb, 0.25-0.6 m high. Flowers green & cream & red, Sep to Oct. Grey or brown sand, clay loam	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 30 km away.	PMST
Orchidaceae	<i>Diuris micrantha</i>	T	Vu	Tuberous, perennial, herb, 0.3-0.6 m high. Flowers yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water	Highly Unlikely – there is no suitable habitat present in the survey area and the closest known record is > 60 km away.	PMST
Orchidaceae	<i>Eleocharis keigheryi</i>	T	Vu	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flowers green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans	Highly Unlikely – there is no suitable habitat present in the survey area and the closest known record is > 30 km away.	PMST
Myrtaceae	<i>Melaleuca viminialis</i>	P2		Slender erect shrub, with weeping branches. 1-4 m high Flowers red, Nov-May. Sandy clay	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 3.5 km away.	NM
Hemerocallidaceae	<i>Johnsonia inconspicua</i>	P3		Rhizomatous, tufted perennial, grass-like or herb, 0.1-0.3 m high, to 0.2 m wide. Flowers green-white/pink, Oct to Nov. White-grey or black sand. Low dunes, winter-wet flats	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 2.5 km away.	NM
Rubiaceae	<i>Opercularia rubioides</i>	P3		Perennial, herb or shrub, 0.04-0.45 m high. Flowers green-cream-white, Sep to Nov. White/grey sand, gravelly sandy clay, sandy loam. Floodplains, stony hills, flat plains	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 4 km away.	NM
Cyperaceae	<i>Tetraria</i> sp. Blackwood River (A.R. Annels 3043)	P3		Sedge up to 40 cm high which grows in wetlands and on the edges of creeklines.	Likely – limited habitat is available but the species is cryptic and the closest known record is ~ 50 m away.	NM

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DotE 2017)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
Elaeocarpaceae	<i>Tetradlea parvifolia</i>	P3		Small shrub, 0.2-0.3 m high. Flowers pink, Oct. Gravelly soil	Possibly – suitable habitat was found within the survey area. The closest known record is ~ 5 km away.	NM
Proteaceae	<i>Grevillea ripicola</i>	P4		Spreading, much-branched, non-lignotuberous shrub, 0.6-2(-3) m high, to 4 m wide. Flowers red/red-orange, Jan or Mar to Apr or Nov to Dec. Sandy clay, clay or gravelly loam. Swampy flats, granite outcrops, along watercourses	Unlikely – there is no suitable habitat present in the survey area and the closest known record is ~ 3.5 km away.	NM

Appendix E - Fauna data

Fauna species list

Fauna likelihood of occurrence assessment guidelines

Fauna likelihood of occurrence assessment

Fauna species list

Scientific Name	Common Name	Status (State/Federal)
Amphibians		
<i>Crinia georgiana</i>	Quacking frog	
<i>Crinia signifera</i>	Clicking froglet	
<i>Geocrinia leai</i>	Ticking frog	
<i>Heleioporus eyrei</i>	Moaning frog	
Birds		
<i>Acanthiza inornata</i>	Western Thornbill	
<i>Anthochaera carunculata</i>	Red Wattlebird	
<i>Barnardius zonarius</i>	Twenty-eight Parrot	
<i>Cacomantis pallidus</i>	Pallid Cuckoo	
<i>Calyptorhynchus banksii</i> subsp. <i>naso</i>	Forest Red-tailed Black-Cockatoo	Vu, Vu
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	En, Vu
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	En, En
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	
<i>Corvus coronoides</i>	Australian Raven	
<i>Cracticus tibicen</i>	Australian Magpie	
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	*
<i>Daphoenositta chrysoptera</i>	Varied Sittella	
<i>Dromaius novaehollandiae</i>	Emu	
<i>Eolophus roseicapillus</i>	Galah	
<i>Gerygone fusca</i>	Western Gerygone	
<i>Grallina cyanoleuca</i>	Magpie-lark	
<i>Lichenostomus virescens</i>	Singing Honeyeater	
<i>Lichmera indistincta</i>	Brown Honeyeater	
<i>Malurus splendens</i>	Splendid Fairy-wren	
<i>Myiagra inquieta</i>	Restless Flycatcher	
<i>Pachycephala rufiventris</i>	Rufous Whistler	
<i>Pardalotus striatus</i>	Striated Pardalote	
<i>Petroica boodang</i>	Scarlet Robin	
<i>Phylidonyris niger</i>	White-cheeked Honeyeater	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
<i>Platycercus icterotis</i> subsp. <i>icterotis</i>	Western Rosella	
<i>Polytelis anthopeplus</i>	Regent Parrot	
<i>Purpureicephalus spurius</i>	Red-capped Parrot	
<i>Rhipidura albiscapa</i>	Grey Fantail	
<i>Rhipidura leucophrys</i>	Willie Wagtail	
<i>Smicronis brevirostris</i>	Weebill	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	*
Mammals		

Scientific Name	Common Name	Status (State/Federal)
<i>Bos taurus</i>	European Cattle	*
<i>Canis lupus</i> subsp. <i>familiaris</i>	Domestic Dog	*
<i>Felis catus</i>	Cat	*
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	
<i>Mus musculus</i>	House Mouse	*
<i>Oryctolagus cuniculus</i>	Rabbit	*
<i>Rattus fuscipes</i>	Bush Rat	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	
<i>Vulpes vulpes</i>	Fox	*

*introduced species

See Appendix B for conservation codes

Parameters of fauna likelihood of occurrence assessment

Assessment outcome	Description
Likely	Species are likely to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the survey area.
Unlikely	Species assessed as unlikely include those species previously recorded within 5 km of the survey area however: <ul style="list-style-type: none"> • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area. • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area. OR Those species that have a known distribution overlapping with the survey area however: <ul style="list-style-type: none"> • There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.
Highly unlikely	Species that are considered highly unlikely to occur in the survey area include: <ul style="list-style-type: none"> • Those species that have no suitable habitat within the survey area. • Those species that have become locally extinct, or are not known to have ever been present in the region of the survey area.

Source information - desktop searches

PMST – DotEE Protected Matters Search Tool (PMST) to identify fauna listed under the EPBC Act potentially occurring within the survey area

DBCA – DBCA 2017. WA Government, Department of Parks and Wildlife Threatened and Priority fauna rankings (current as of 6 January 2017) - *Wildlife Conservation Act 1950*

NM – DBCA NatureMap (accessed May2017)

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Fauna likelihood of occurrence assessment

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
Birds							
<i>Calyptorhynchus latirostris</i> (Carnaby's Black Cockatoo)	En	En	X	X	X	This species mainly occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by <i>Hakea</i> , <i>Banksia</i> and <i>Grevillea</i> species. The species also occurs in forests containing Marri (<i>Corymbia calophylla</i>), Jarrah (<i>Eucalyptus marginata</i>) or Karri (<i>E. diversicolor</i>). Breeding usually occurs in the western Wheatbelt region of WA, with flocks moving to the higher rainfall coastal area to forage after the breeding season. Feeds on the seeds of a variety of native plants, including <i>Allocasuarina</i> , <i>Banksia</i> , <i>Eucalyptus</i> , <i>Grevillea</i> and <i>Hakea</i> , and some introduced plants (DSEWPac, 2012).	<p>Known</p> <p>Several flocks were observed feeding in and flying over the survey area.</p> <p>The habitat within the survey area is suitable for foraging and contains potential breeding trees.</p>
<i>Calyptorhynchus banksii subsp. naso</i> (Forest Red-tailed Black Cockatoo)	Vu	Vu	X	X	X	Forest Red-tailed Black Cockatoo typically occurs in dense Jarrah (<i>Eucalyptus marginata</i>), Karri (<i>E. diversicolor</i>) and Marri (<i>Corymbia calophylla</i>) forests, however the species also occurs in a range of other forest and woodland types, including Blackbutt (<i>E. patens</i>), Wandoo (<i>E. wandoo</i>), Tuart (<i>E. gomphocephala</i>), Albany Blackbutt, Yate (<i>E. cornuta</i>), and Flooded Gum (<i>E. rudis</i>) (DSEWPac, 2012). Habitats also tend to have an understorey of <i>Banksia spp.</i> , <i>Persoonia spp.</i> , <i>Allocasuarina spp.</i> The Forest red-tailed Black Cockatoo generally nests in hollows in live or dead trees of Marri, Karri, Wandoo, Bullich, Blackbutt, Tuart and Jarrah (DSEWPac 2012).	<p>Known</p> <p>One flock was observed loafing in the survey area and there was numerous evidence of fresh and old foraging on Marri nuts.</p> <p>The habitat within the survey area is suitable for foraging and contains potential breeding trees.</p>

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
<i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo)	Vu	En	X	X	X	Baudin's Black Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri (<i>Corymbia calophylla</i>) and Eucalyptus species, especially Karri (<i>E. diversicolor</i>) and Jarrah (<i>E. marginata</i>). The species also occurs in woodlands of Wandoo (<i>E. wandoo</i>), Blackbutt (<i>E. patens</i>), Flooded Gum (<i>E. rudis</i>), and Yate (<i>E. cornuta</i>). Baudin's Black Cockatoo breeds in the Jarrah, Marri and Karri forests of the deep south-west in areas averaging more than 750 mm of rainfall annually. The range of the species extends from Albany to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Boyup Brook. Preferred roosts are in areas with a dense canopy close to permanent water sources that provide the birds with protection from weather conditions (DSEWPaC, 2012).	<p>Known</p> <p>Several individuals were observed in the survey area.</p> <p>The habitat within the survey area is suitable for foraging and contains potential breeding trees.</p>
<i>Falco peregrinus</i> (Peregrine Falcon)		S	X			The Peregrine Falcon is seen occasionally anywhere in the south-west of WA. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities (Morcombe, 2004).	<p>Likely – irregular visitor</p> <p>The woodland within the survey area is suitable for foraging for the Peregrine Falcon.</p>
<i>Merops ornatus</i> (Rainbow Bee-eater)		IA	X		X	The Rainbow Bee-eater is found throughout the state except in desert regions, particularly in open forests and woodlands, with sandy, loamy soil, but also sandridges, sandpits, riverbanks, mangroves, rainforest shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. They also inhabit sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe 2004; Pizzey and Knight 2012). They dig out nests	<p>Likely – seasonal visitor</p> <p>There is suitable habitat and recent records located within the survey area. The species is a seasonal spring breeding migrant in south-western Australia.</p>

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
						in open areas where there is relatively soft but firm sands, either on flat ground or in the side of a sandy bank (Nevill 2013).	
<i>Ninox connivens</i> subsp. <i>connivens</i> (Barking Owl Southern subsp.)		P2	X		X	The southwest subspecies of the Barking Owl is found in the deep south-west region and is very scarce (Nevill 2013). Barking Owls are found in open woodlands and the edges of forests, often adjacent to farmland. They are less likely to use the interior of forested habitat. They are usually found in habitats that are dominated by eucalyptus species, particularly Marri. They prefer woodlands and forests with a high density of large trees and particularly sites with hollows that are used by the owls as well as their prey. Habitat preference is strongly biased towards areas that provide a high density of large trees greater than 60 cm diameter and a high density of hollow trees of a range of sizes, including large hollows greater than 15 cm diameter which are suitable nesting places. Roost sites are often located near waterways or wetlands.	Likely – occasional visitor The woodland habitat in the survey area is considered to be moderate value to the barking owl due to the low density of large hollow-bearing trees. The nearest record is located approximately 31 km from the survey area.
<i>Oxyura australis</i> (Blue-billed Duck)		P4			X	The blue-billed Duck is a small Australian almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright-blue during the breeding season. The Blue-billed Duck is endemic to Australia's temperate regions, ranging from the south west of WA, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).	Unlikely There is no suitable habitat within the survey area for the Blue-billed Duck, although there are nearby areas where the species may occur. The nearest record is located within 1 km of the survey area.
<i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i>		P3	X		X	The Masked Owl is found across a range of habitats from wet sclerophyll forest, dry sclerophyll forest, non-eucalypt dominated forest, scrub and	Likely

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
(Masked Owl southern subsp.)						cleared land with remnant old growth trees. There are however several aspects of habitat preference which appear to be common: the Masked Owl requires large hollows in old growth eucalypts for nesting; it often favours areas with dense understorey or ecotones comprising dense and sparse ground cover, they are often recorded foraging within 100-300 m of the boundary of two vegetation types (Bell & Mooney, 2002).	The woodland habitat in the survey area is considered to be moderate value to the barking owl due to the low density of large hollow-bearing trees (limited nesting habitat). There is a recent NatureMap record located within the survey area.
Mammals							
<i>Falsistrellus mackenziei</i> (Western False Pipistrelle)		P4			X	The Western False Pipistrelle occurs in wet sclerophyll forest dominated by Karri (<i>Eucalyptus diversicolor</i>), and in the high rainfall zones of the Jarrah (<i>E. marginata</i>) and Tuart (<i>E. gomphocephala</i>) dry sclerophyll forests. The species is restricted to areas in or adjacent to stands of old growth forest. It has also been recorded in mixed Tuart-Jarrah tall woodlands on the adjacent coastal plain. Marri (<i>Corymbia calophylla</i>), Sheoak (<i>Casuarina huegeliana</i>) and Peppermint (<i>Agonis flexuosa</i>) trees are often co-dominant at its collection localities (Churchill 2008; McKenzie and Start 1999).	Likely There is suitable woodland habitat for this species in the survey area and the nearest record is located approximately 12 km away.
<i>Dasyurus geoffroii</i> (Western Quoll, Chuditch)	Vu	Vu	X	X	X	The Chuditch inhabits eucalypt forest (especially Jarrah, <i>Eucalyptus marginata</i>), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke & Strahan, 2008). The species can travel large distances, has a large home range	Likely There is suitable woodland habitat for this species in the survey area and there is a recent NatureMap record located within the survey area.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
						and is sparsely populated through a large portion of its range.	
<i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i> (Southern Brush-tailed Phascogale)		Vu				Found in dry, open sclerophyll forests and woodlands with a generally sparse ground-storey, which contain suitable nesting resources such as tree hollows, rotted stumps and tree cavities. Records are less common in high rainfall areas in both the north and south of WA (DEC 2012). This species is one of the most arboreal dasyurids and seldom feed on the ground. Foraging success is greatest on mature trees, large logs and dead standing trees with rough bark. An individual can use more than 40 nests in a single year, including hollow trees, rotted stumps, house ceilings and bird nests (Van Dyck and Strahan 2008).	Likely There is suitable woodland habitat for this species in the survey area and the nearest record is located approximately 5 km away.
<i>Pseudocheirus occidentalis</i> (Western Ringtail Possum)	Vu	Cr	X	X	X	Ideal habitat for the Western Ringtail Possum comprises long unburnt mature remnants of peppermint (<i>Agonis flexuosa</i>) woodlands with high canopy continuity; others comprise of jarrah (<i>Eucalyptus marginata</i>)/marri (<i>Corymbia calophylla</i>) forests and woodlands with adequate hollows, coastal heath, myrtaceous heaths and shrublands, Bullich (<i>E. megacarpa</i>) dominated riparian zones and karri forests. Populations are associated with swamps, water courses or floodplains, and at topographic low points which provide cooler, often more fertile conditions. Their current distribution is patchy and largely restricted to the moister south-western corner of WA, especially in the Australind/Eaton area to Waychinicup National Park. The Upper Warren area east of Manjimup is the only place the possum survives in the absence of coastal peppermint. Persistence in translocation sites has only been at Karakamia Sanctuary, Perup	Unlikely There is some suitable woodland habitat (e.g. hollow-bearing trees) for this species in the survey area and the nearest records are located within 5 km (1997 and 2014). The survey area was thoroughly searched for dreys (nests) and scats however no evidence of Western Ringtail Possum was observed during the survey. Previous records of Western Ringtail Possums are sparsely scattered in the local region. The Western Ringtail Possum may potentially occur in native vegetation surrounding the survey area however the population density is likely to be very low.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
						Sanctuary and Yalgorup National Park (DBCA 2014; TSSC 2013; Van Dyck and Strahan 2008).	
<i>Setonix brachyurus</i> (Quokka)	Vu	Vu		X	X	The Quokka prefer dense forests and thickets, streamside vegetation, heaths and shrublands of <i>Agonis linearifolia</i> -dominated swamps in the Jarrah (<i>Eucalyptus marginata</i>) forest. The northern extent of the current distribution on the mainland is in the Jarrah forest immediately south-east of the Perth metropolitan area, to southward through the southern Jarrah, Marri and Karri forests to the south coast, but largely confined throughout to areas receiving an annual rainfall of 1,000 millimetres or more (Van Dyck and Strahan, 2008).	Unlikely There is no suitable habitat within the survey area for the Quokka, due to the absence of areas with dense understorey vegetation. The nearest record is located approximately 6 km away.
<i>Myrmecobius fasciatus</i> (Numbat)	Vu	En	X	X	X	Current Numbat populations occupy several different habitat types: upland Jarrah forest, open eucalypt woodland, banksia woodland and tall closed shrubland. The only remaining original subpopulations are at Dryandra Woodland and the Upper Warren area (including Tone Perup Nature Reserve, Greater Kingston National Park and adjoining State Forest). In WA there are nine translocation sites, including Boyagin Nature Reserve, Tutanning Nature Reserve, Batalling block and Karroun Hill Nature Reserve (see DBCA 2015 for complete list and details). At Dryandra, numbats inhabit brown mallet (<i>Eucalyptus astringens</i>) plantations. Habitats usually have an abundance of termites in the soil, and hollow logs, tree hollows, burrows and branches for shelter (DotEE 2017; Van Dyck and Strahan 2008).	Unlikely There are no remaining populations of the Numbat in the Donnybrook to Bridgetown region.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
<i>Hydromys chrysogaster</i> (Water Rat)		P4	X		X	The Water Rat lives in the vicinity of permanent bodies of fresh, brackish, or marine water, lakes and farm dams, and on sheltered coastal beaches, mangroves and offshore islands. In the south-west of WA they have been shown to prefer areas with riparian vegetation, better water quality and a degree of habitat complexity. Woody debris, rock ledges and wetland islands are likely to be important areas for feeding and refuge (DEC 2012). It is an occasional vagrant to temporary waters. Water Rat's dens are made at the end of tunnels in banks and occasionally in logs (Van Dyck and Strahan 2008).	Unlikely There is no suitable habitat within the survey area.
<i>Isodon obesulus subsp. fusciventer</i> (Quenda, Southern Brown Bandicoot)		P4	X		X	The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Van Dyck and Strahan, 2008).	Likely There is suitable woodland habitat within the survey area and the species was previously recorded (Astron Environmental Services 2013). The Quenda would typically prefer areas with a dense understorey, such as the riparian vegetation in the Southern Alignment.
<i>Macropus irma</i> (Western Brush Wallaby)		P4	X		X	The Western Brush Wallaby is a grazer found primarily in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest. This species was once very common in the south-west of WA but has undergone a reduction in range and a significant decline in abundance in its current habitat. (Van Dyke & Strahan, 2008).	Likely There is suitable woodland habitat for this species in the survey area and there is a recent NatureMap record located within the survey area.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act Status	WA Status	NM	PMST	DBCA – South West		
Reptiles							
<i>Ctenotus delli</i> (Dell's Skink)		P4			X	The Perth Slider is locally restricted to the Swan Coastal Plain south of the Swan River, including Rottnest and Garden Islands, where it inhabits coastal dunes, <i>Banksia</i> /eucalypt woodlands and suburban gardens. There are also isolated populations on the mid-west coast at Woodleigh Station and in Busselton (Wilson and Swan 2013).	Unlikely The survey area is outside the known distribution of the Dell's Skink. The nearest NatureMap record to the survey area is an error in the database.

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GHD

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Benkovic L Zimmermann	A Napier E Lynch		D Farrar		16/08/17

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Memorandum

15 August 2017

To Water Corporation

Copy to

From Erin Lynch

Tel +61 8 6222 8316

Subject Additional Survey Area - Black Cockatoo Trees

Job no. 6135763

1 Introduction

1.1 Project background

The Water Corporation proposes to construct new infrastructure to improve the supply of water to the towns of Balingup, Mullalyup and Kirup, as a component of the broader Warren Blackwood Water Supply Scheme. This will potentially involve clearing of vegetation and fauna habitat for the construction and installation of this infrastructure.

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The survey areas are located within the Shires of Donnybrook – Balingup and Bridgetown – Greenbushes, between the towns of Mullalyup and Greenbushes (Figure 1). The combined length of the survey areas is approximately 4.6 km with a width of approximately 12 m.

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Memorandum

baudinii, and Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso*, (Department of Sustainability, Environment, Water, Populations, and Communities (DSEWPaC 2012).

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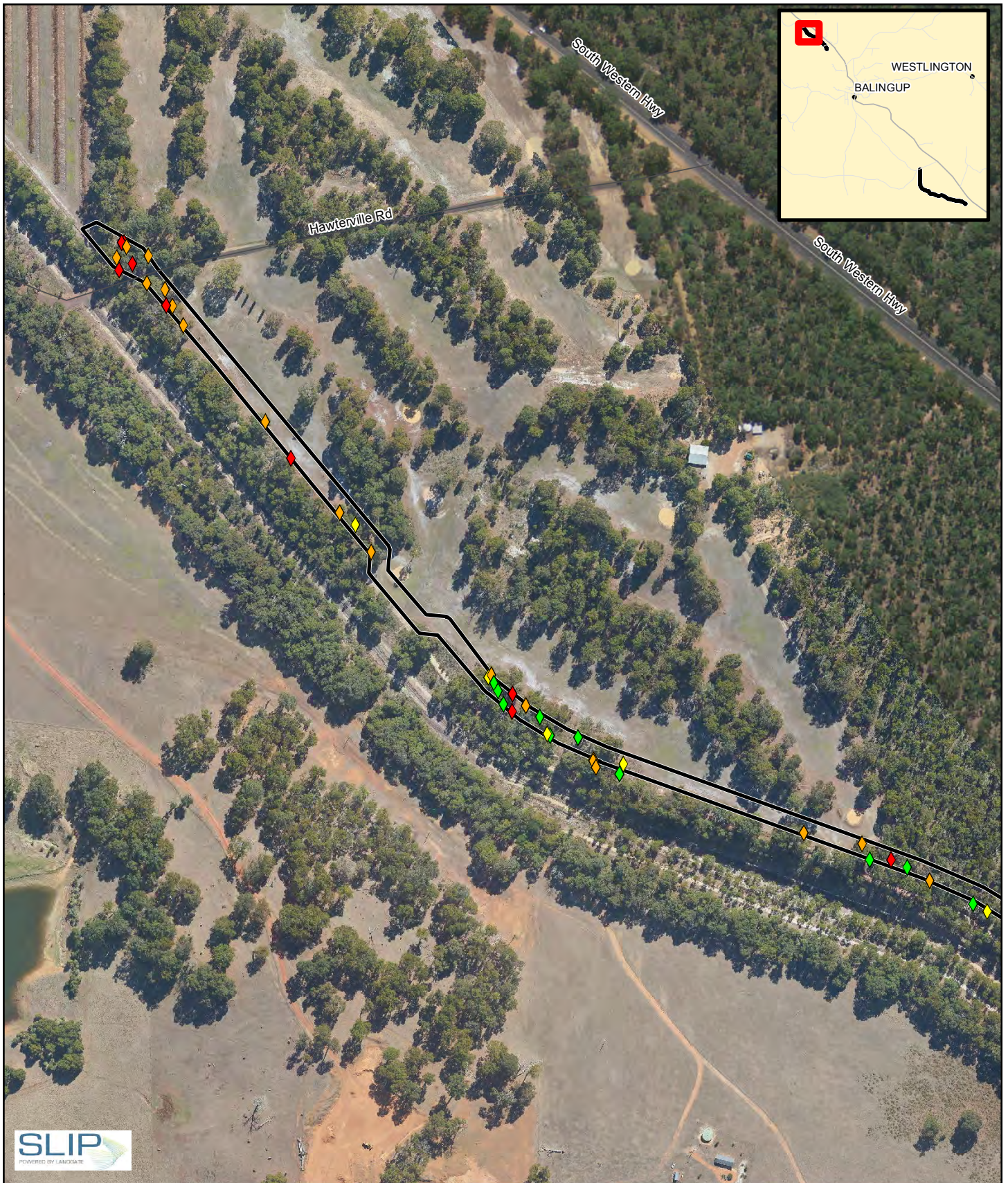
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Regards

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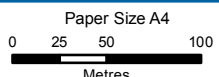
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Ecologist



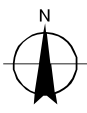
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Black Cockatoo Habitat

- ◆ Jarrah (*Eucalyptus marginata*) – hollows
- ◆ Marri (*Corymbia calophylla*) – no hollows
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- Additional Survey Area
- ◆ Marri (*Corymbia calophylla*) – hollows
- Local Road



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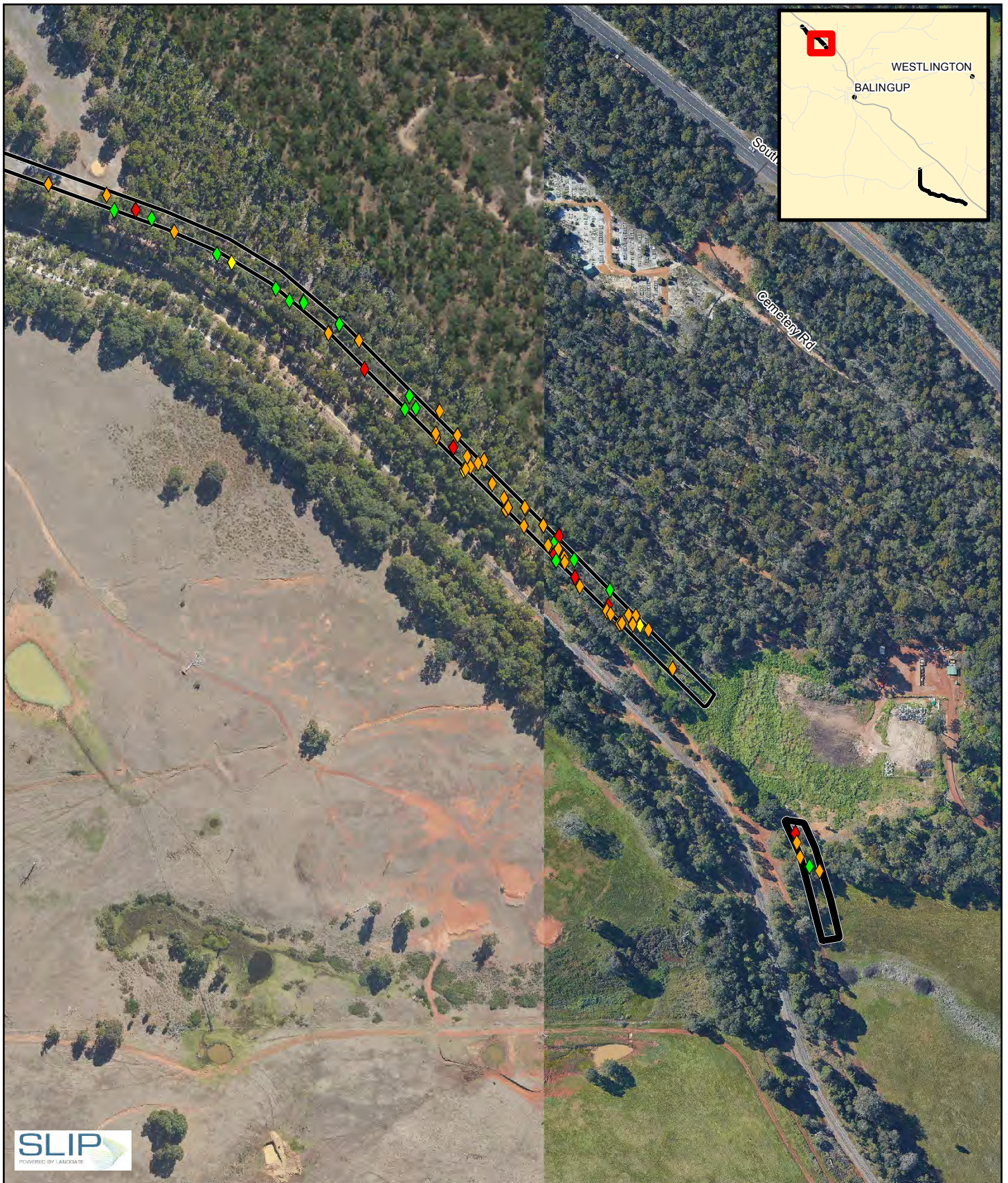


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Job Number | 61-35763-01
Revision | A
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Black Cockatoo Observations

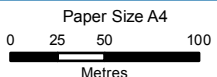
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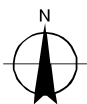
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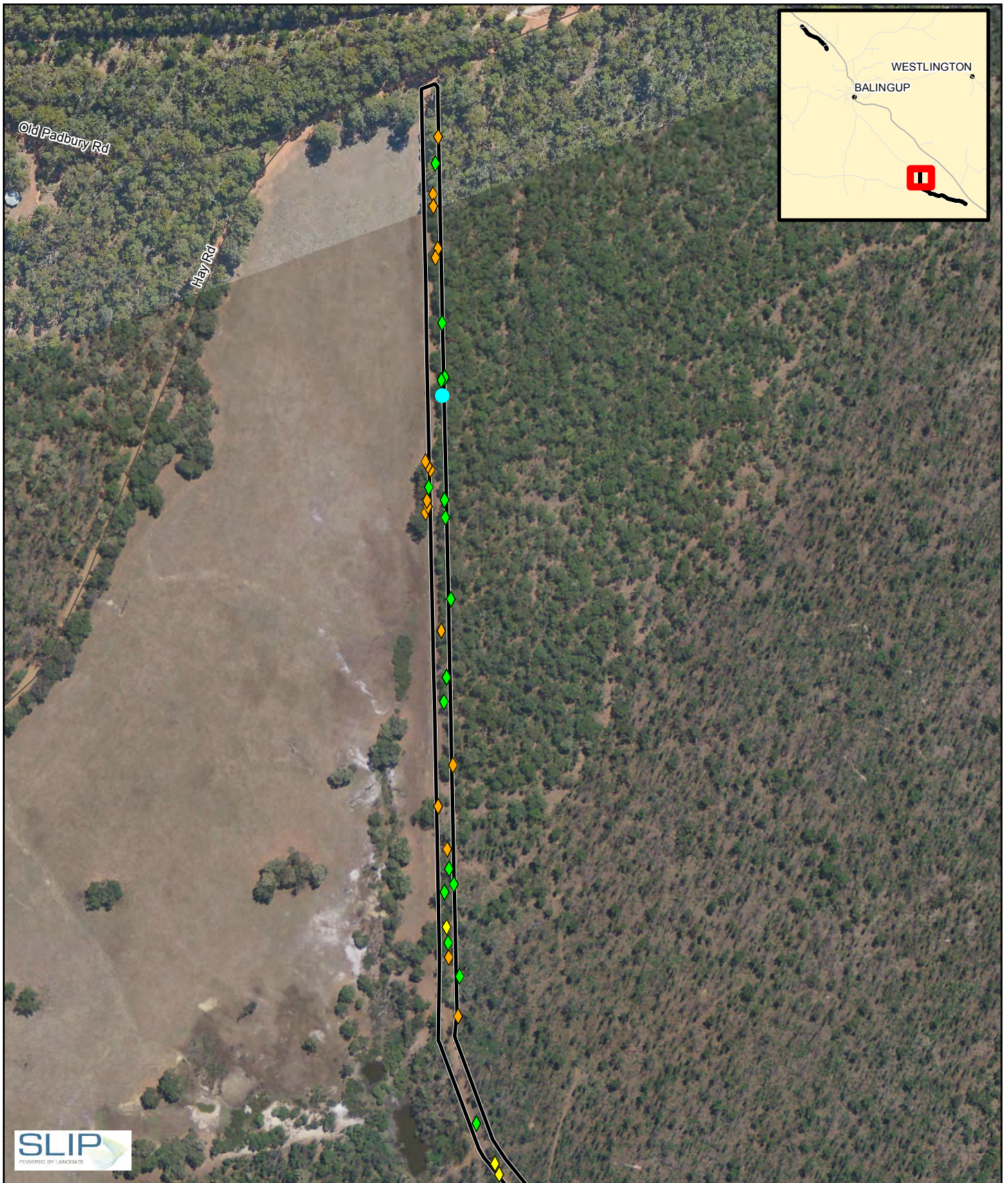


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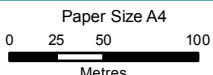
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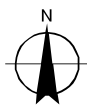
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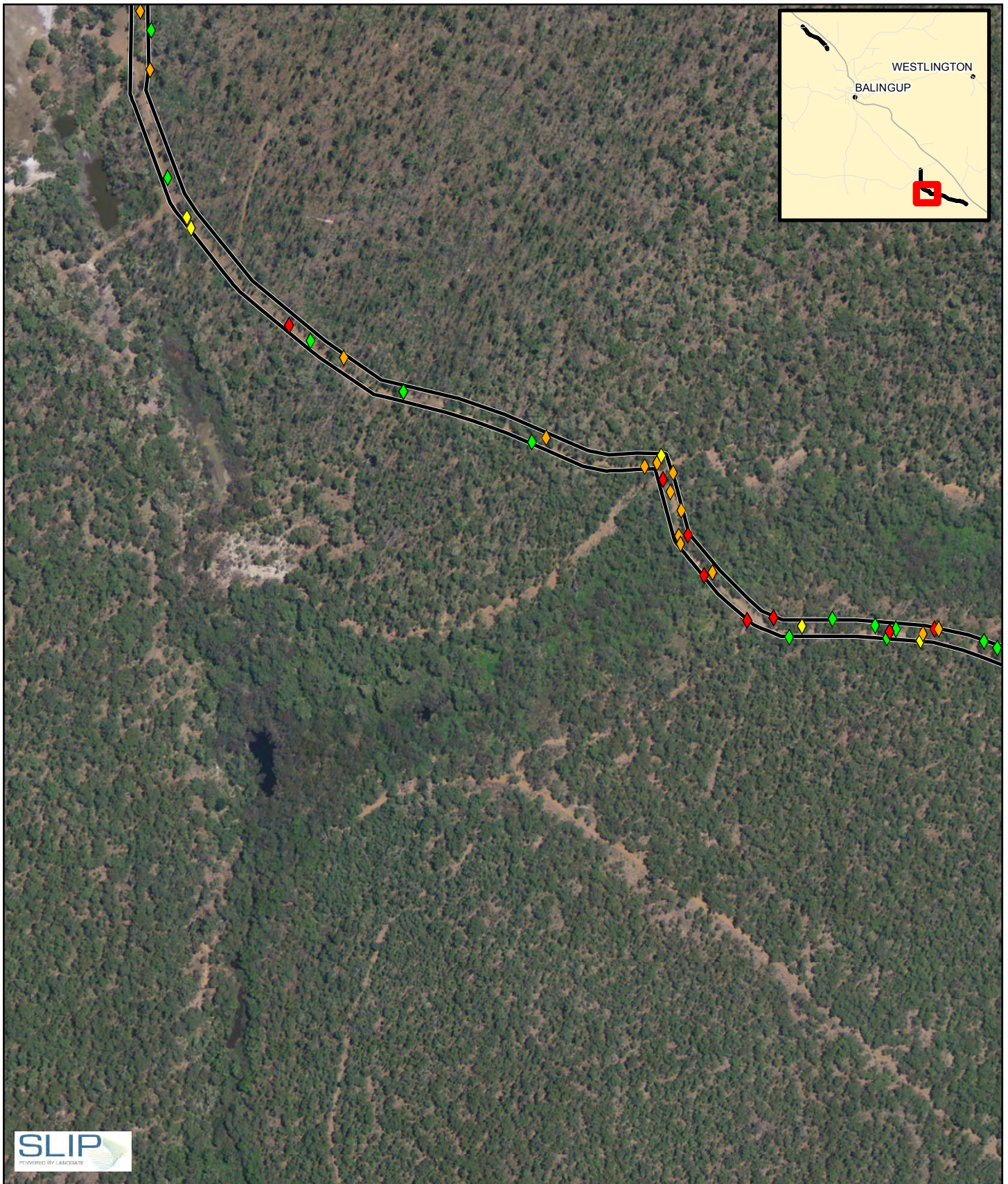


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Black Cockatoo Observations **Figure 1**

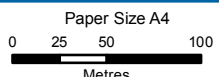
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Data source: Landgate: Virtual Mosaic, Roads - 20170525; Water Corporation: Survey Area - 20170511; GHD: Black Cockatoo Habitat, Fauna Observations, Sample Locations - 20170525, Created by:krawinson



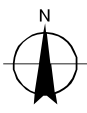
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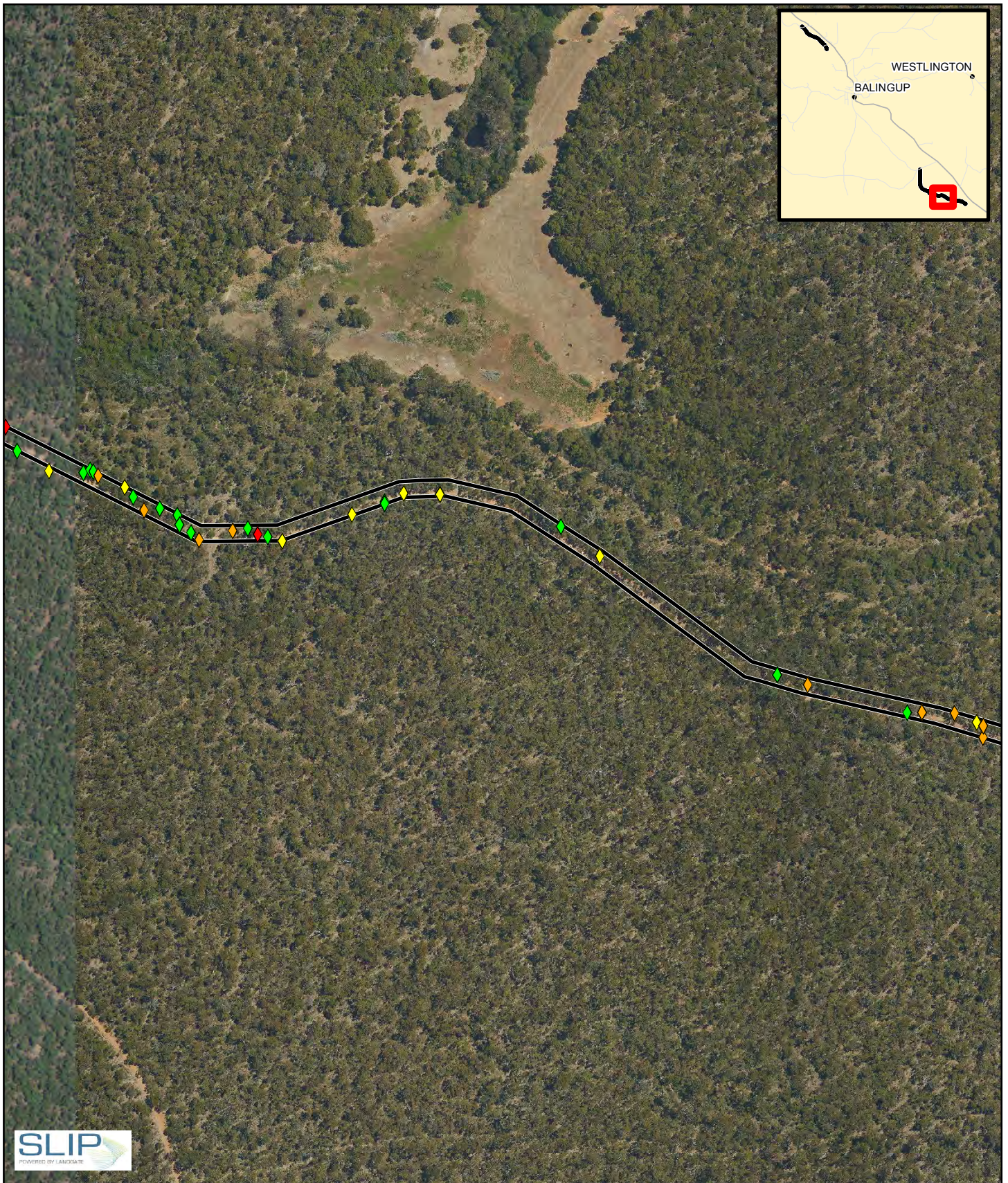


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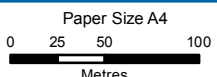
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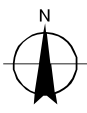
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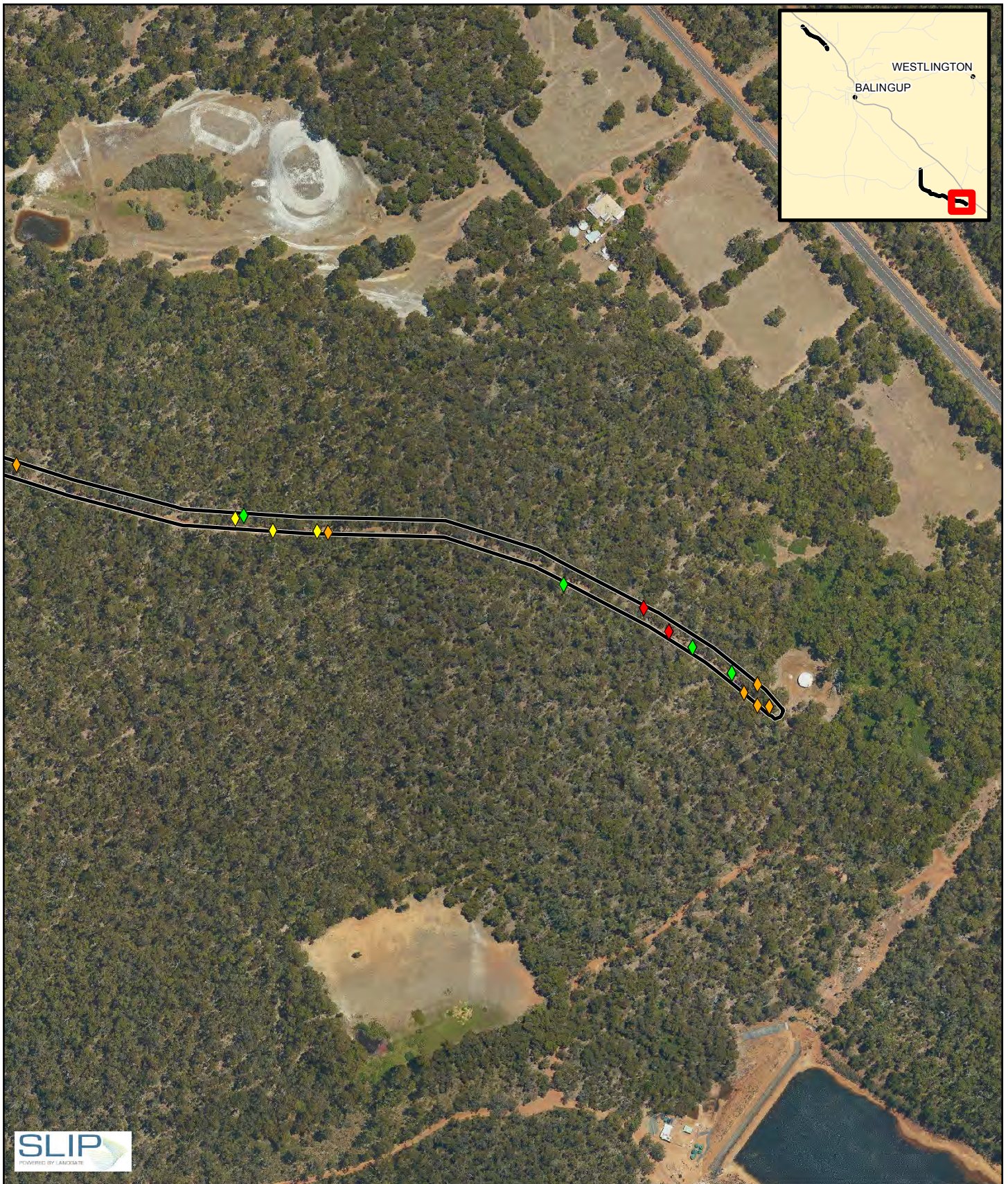


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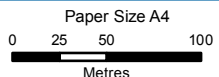
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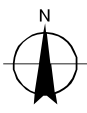
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Black Cockatoo Observations

Figure 1



Memorandum

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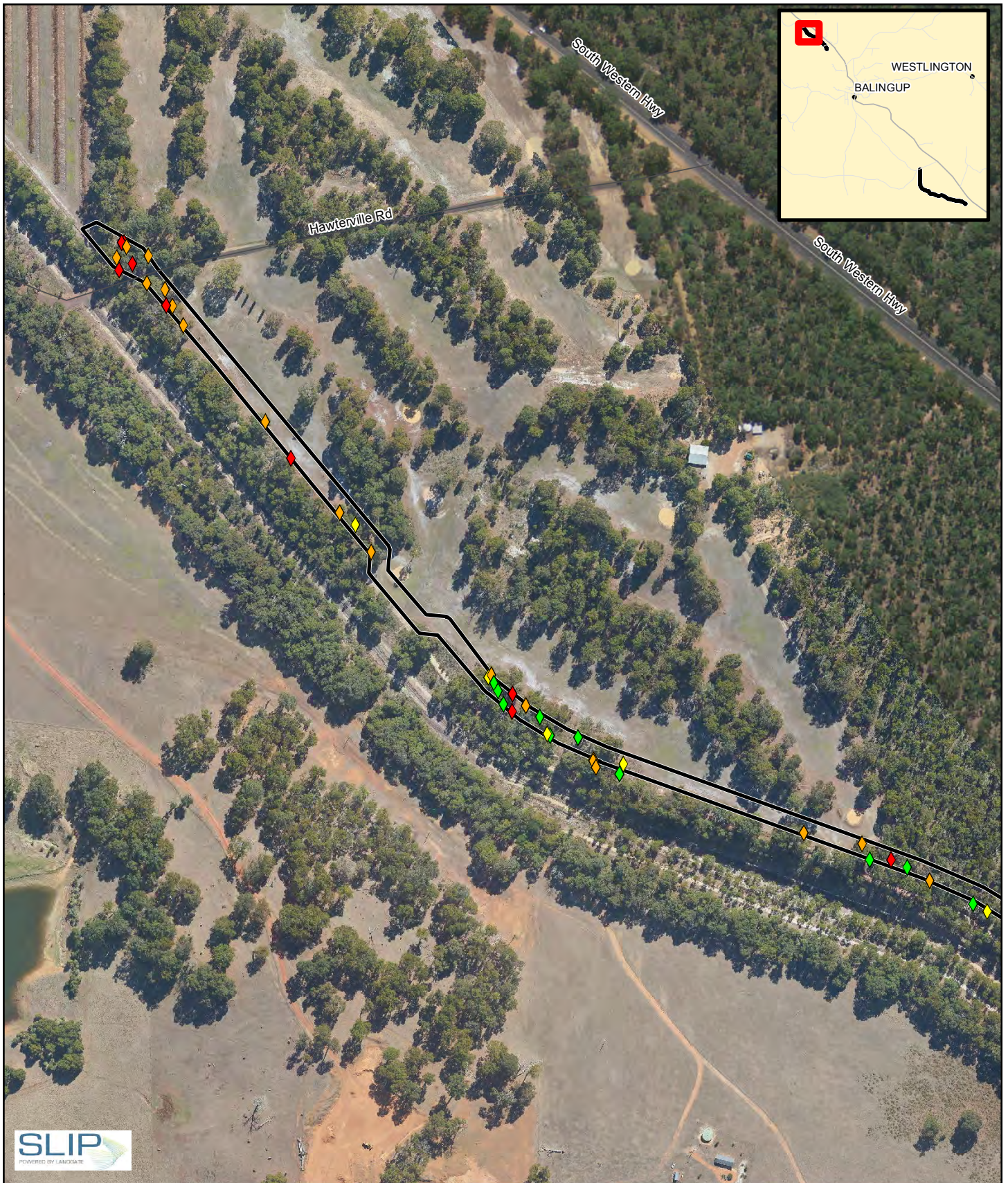
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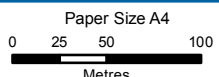
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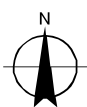
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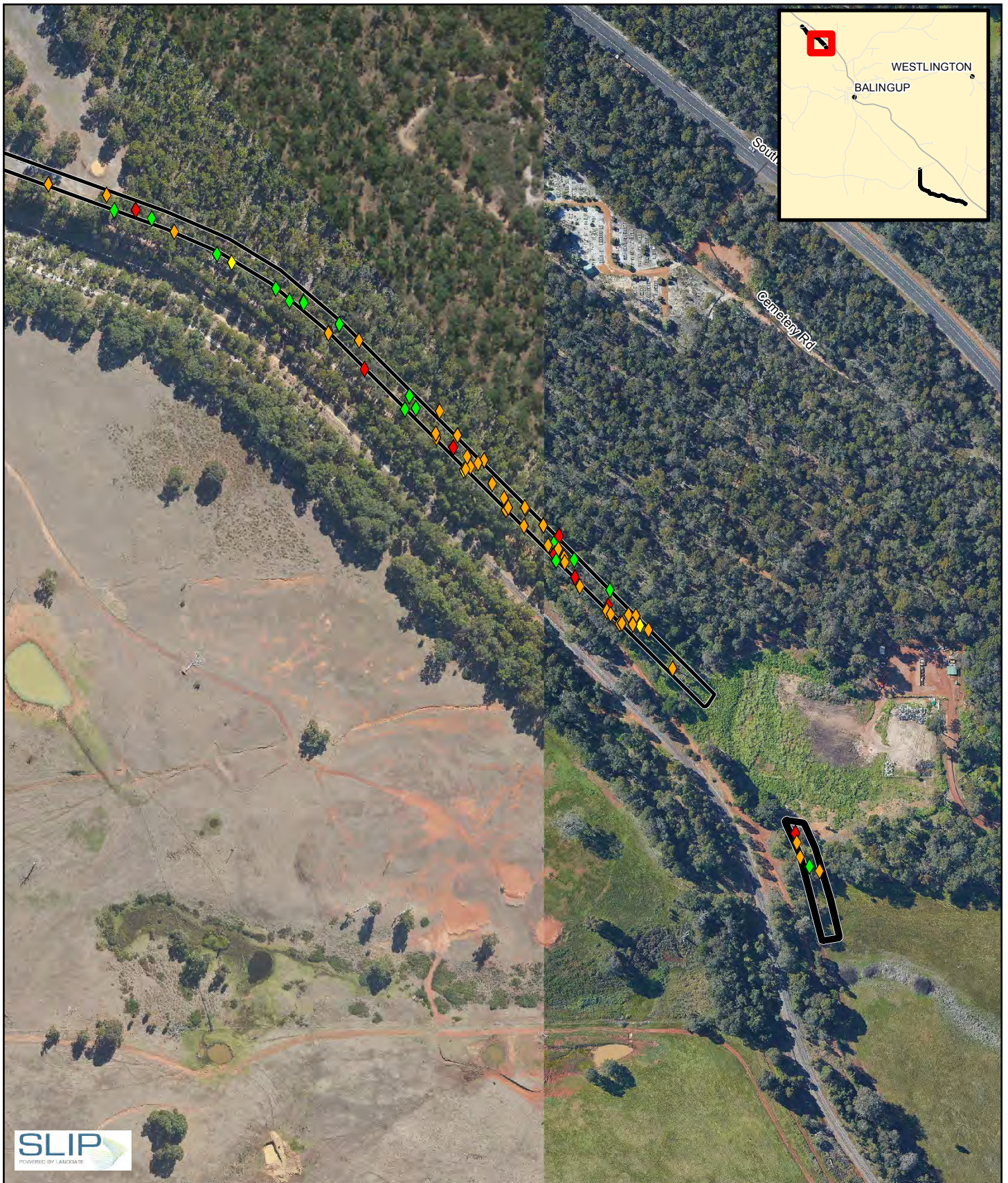


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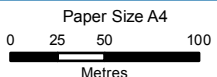
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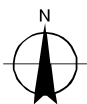
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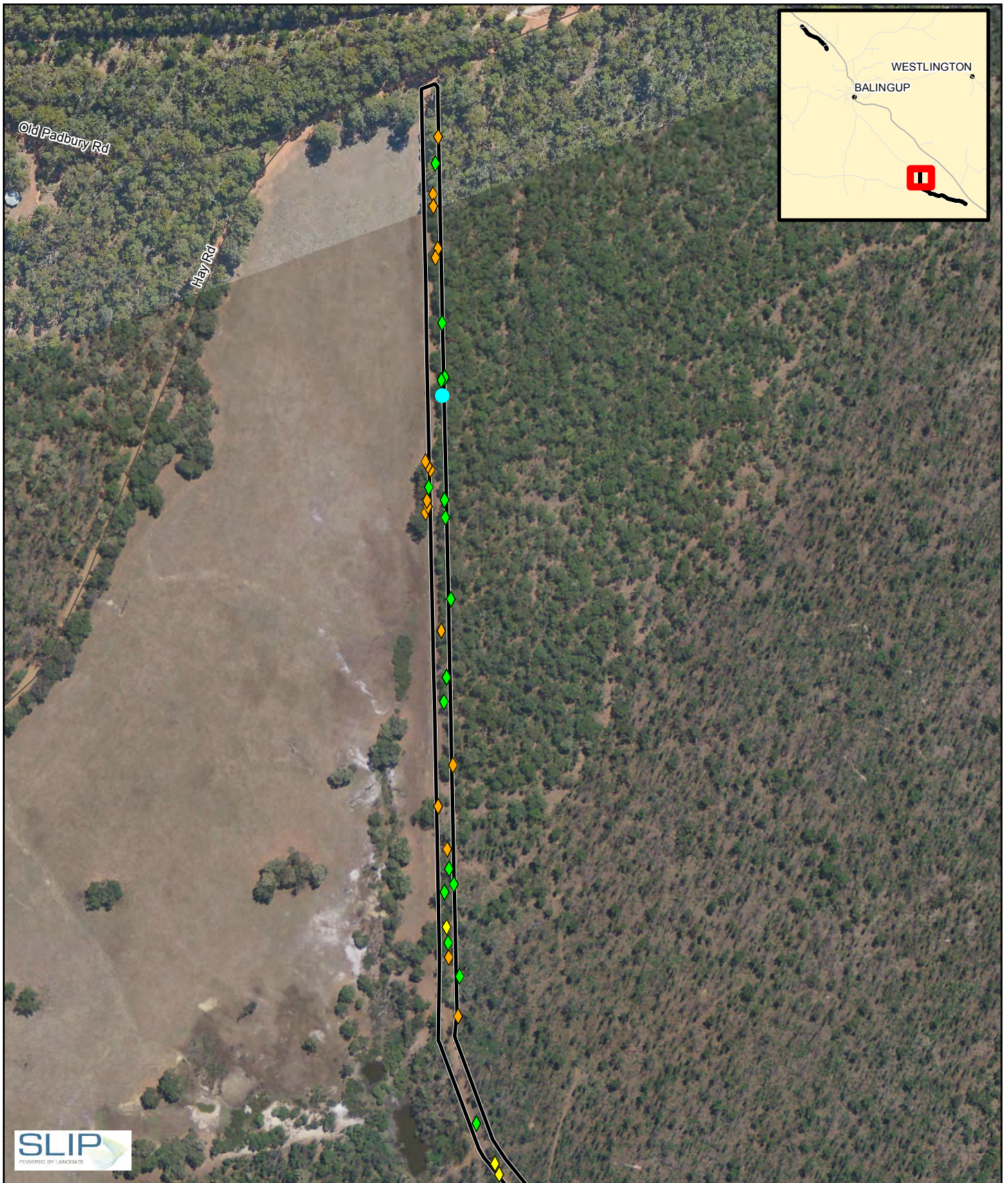


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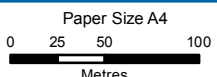
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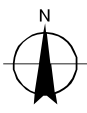
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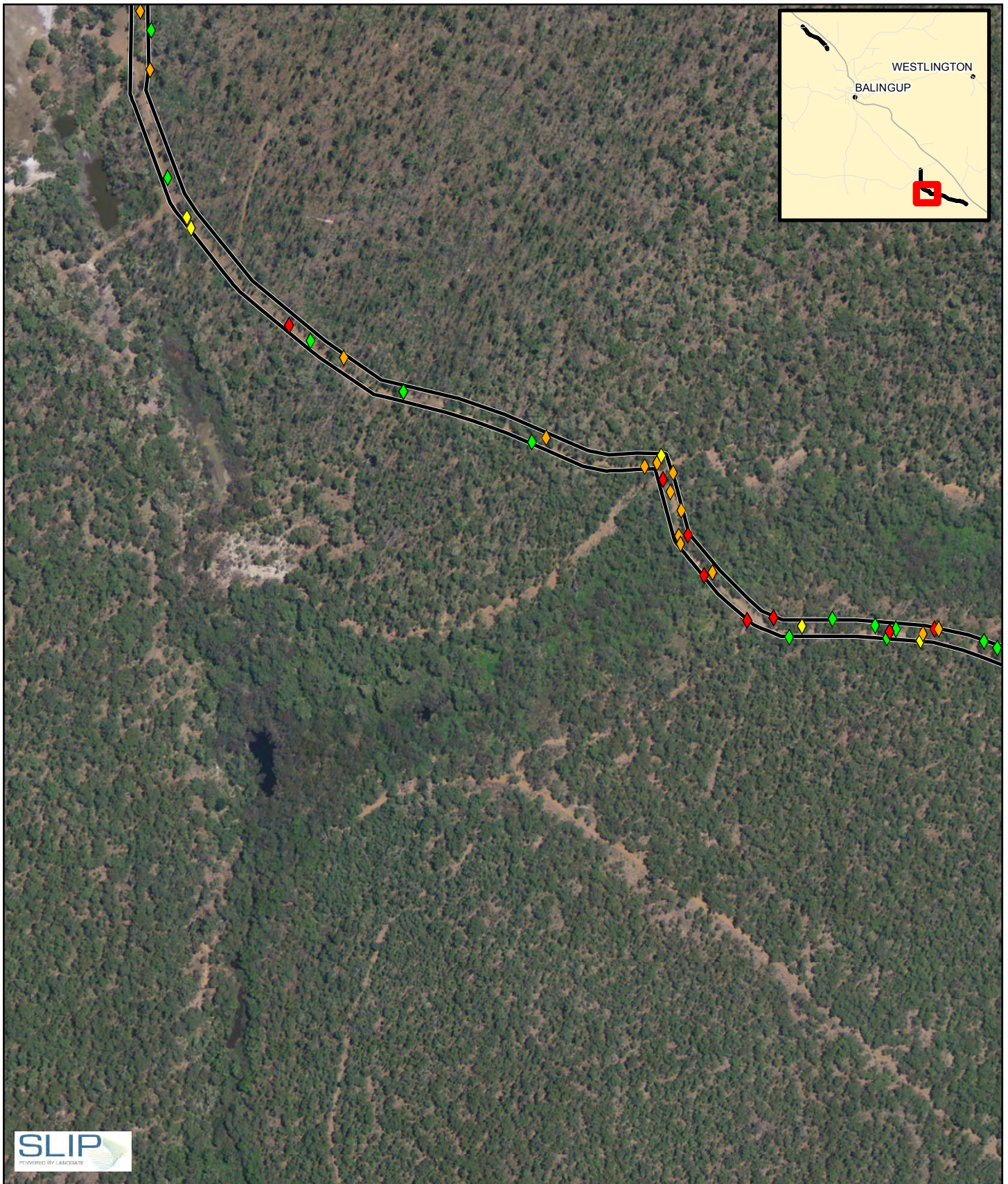


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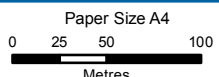
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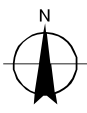
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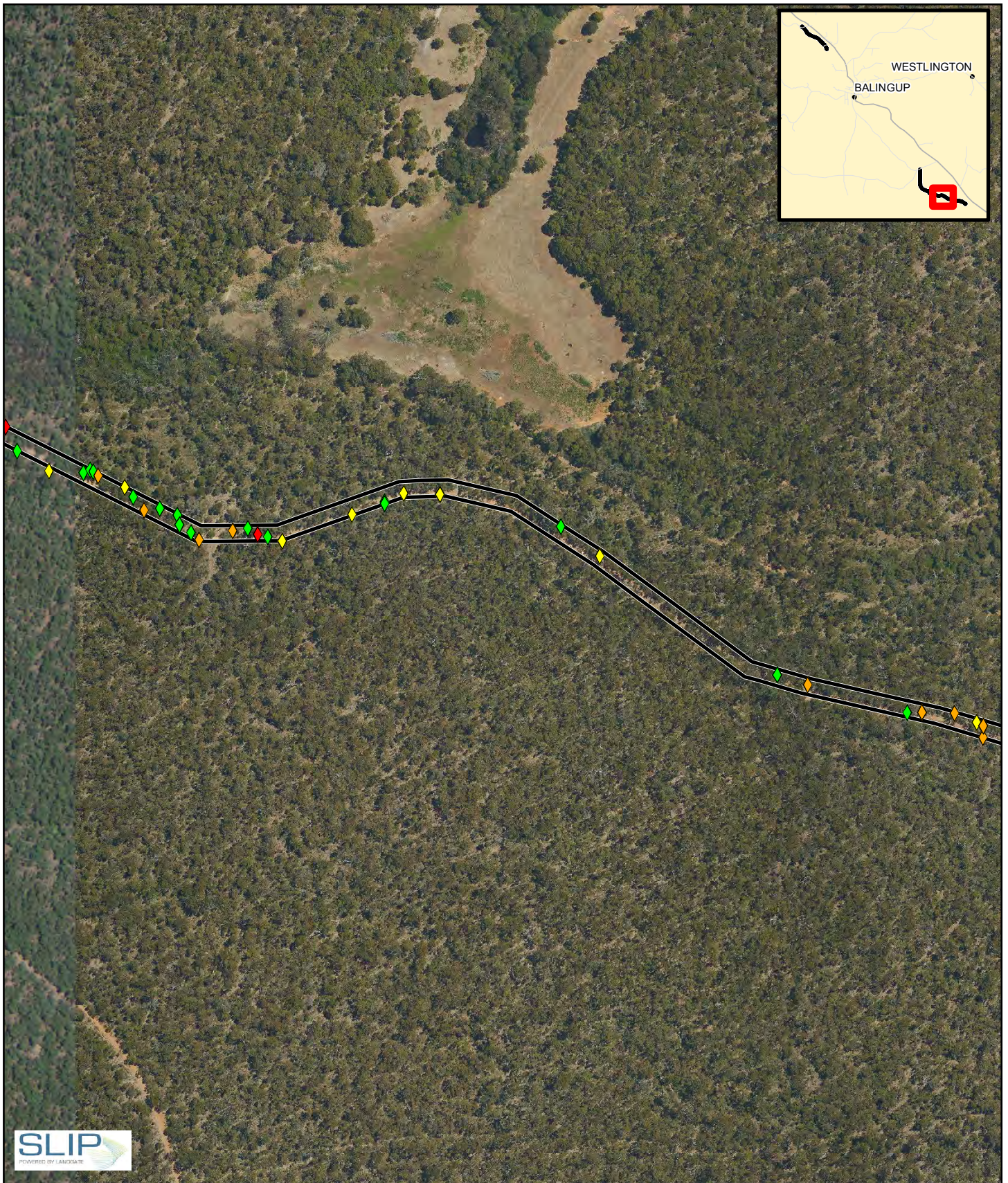


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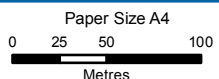
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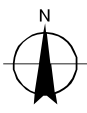
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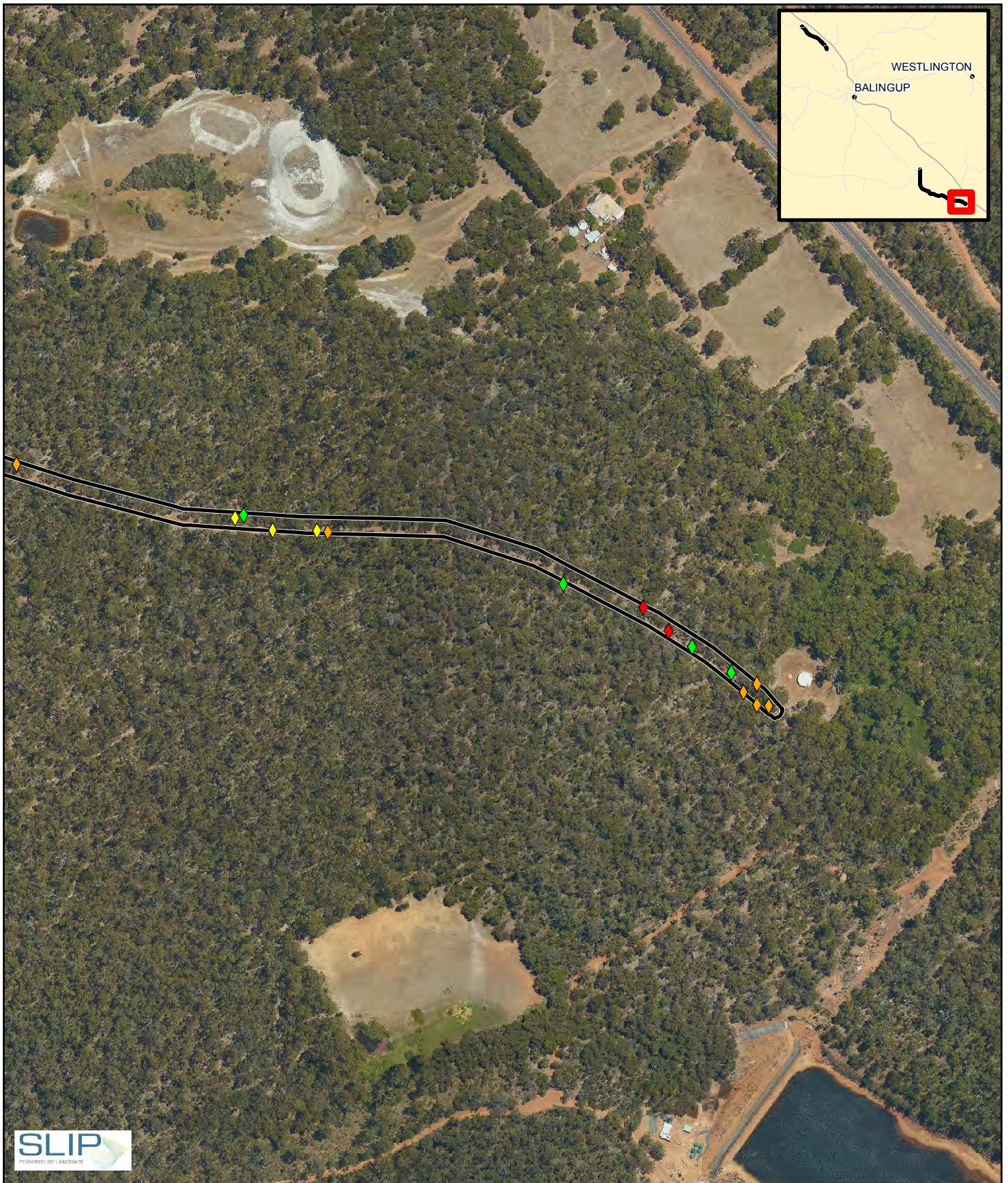


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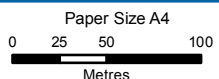
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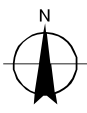
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Black Cockatoo Observations

Figure 1

GHD

Water Corporation - Greenbushes to Kirup Link

Phytophthora Dieback occurrence assessment – Version 0.4



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This report has been prepared in accordance with the scope of work agreed between the Client and Glevan Consulting and contains results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

Procedures and guidelines stipulated in various Department of Environment and Conservation and Dieback Working Group manuals are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work. These guidelines, along with overarching peer review and quality standards ensure that all results are presented to the highest standard.

Glevan Consulting has assessed areas based on existing evidence presented at the time of assessment. The Phytophthora pathogen may exist in the soil as incipient disease. Methods have been devised and utilised that compensate for this phenomenon; however, very new centres of infestation, that do not present any visible evidence, may remain undetected during the assessment.

Author Evan Brown

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1 Summary

The Water Corporation's Warren–Blackwood Regional Water Supply Scheme is undergoing significant upgrades to meet the long-term supply needs of Boyup Brook, Hester, Greenbushes, Balingup, Mullalyup, Kirup, Bridgetown, Nannup and Manjimup.

The Warren–Blackwood area is dominated by surface water sources, with limited groundwater available. Nine local surface water sources contribute to the scheme, as well as one groundwater bore, which is licenced to take up to 1.09 billion litres per year, from the Yarragadee Aquifer (Water Corporation, n.d.).

One project as part of this program, is the Greenbushes to Kirup Link, a twenty-three kilometre link between Greenbushes and Kirup (Figure 1). Glevan Consulting assessed the vegetation within and adjacent to this corridor (the Project Area) for the presence of the disease caused by *Phytophthora Dieback*. The Project Area has six components, being:

Kirup Dam Bypass	Line Road, Kirup
Mullalyup Tank Site	3km west of Mullalyup
Balingup Tank Site	1.5km south of Balingup
Northern Alignment	Mullalyup to Balingup
Southern Alignment Part A	Old Padbury Road, Balingup
Southern Alignment Part B	Hay Road, Balingup to southern terminus.

The Project Area covered 16.49 hectares, of which 5.14 hectares was assessable.

The assessment was conducted by Evan Brown of Glevan Consulting in August 2017.

The Project Area generally receives greater than 1000mm of annual rainfall and contains nine vegetation structures (Table 3). All assessable vegetation was restricted to the Kirup, Dwellingup and Catterick vegetation structures which include (cumulatively) *Phytophthora Dieback* indicating species within the *Xylomelum*, *Banksia*, *Persoonia*, *Leucopogon*, *Macrozamia*, *Adenanthos* and *Xanthorrhoea* families.

The Kirup Dam Bypass and Mullalyup Tank site are both classified as Infested. One section of the Northern Alignment is Uninterpretable. The Southern Alignment Part B has two Infested

sections, two sections being Temporarily Uninterpretable (recently burnt), and one section of Uninfested and Uninterpretable.

The remaining areas are Excluded from the assessment (Table 2).

2 Introduction

2.1 Background

The Water Corporation's Warren–Blackwood Regional Water Supply Scheme is undergoing significant upgrades to meet the long-term supply needs of Boyup Brook, Hester, Greenbushes, Balingup, Mullalyup, Kirup, Bridgetown, Nannup and Manjimup.

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2.2 Location of Project Area.

The Project Area has six components, being:

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Southern Alignment Part A	Old Padbury Road, Balingup
Southern Alignment Part B	Hay Road, Balingup to southern terminus.

2.3 Study team

The assessment was conducted by Evan Brown of Glevan Consulting in August 2017. Mr Brown is registered with the Department of Biodiversity, Conservation and Attractions (DBCA) in the detection, diagnosis and mapping of Phytophthora Dieback. This registration recognises the skills and experience of Mr Brown.

3 Phytophthora Dieback

The pathogen *Phytophthora cinnamomi* is an agent of environmental disease found in vulnerable areas of Western Australia.

Phytophthora Dieback is the common name for the observable disease result of interaction between the pathogen (*P. cinnamomi*) and the vegetation hosts (susceptible plant species within vulnerable areas). The environment conditions of the site significantly affect the pathogens ability to survive or flourish and spread over time.

All land with an annual average rainfall of more than 400 millimetres and suitable soil composition is considered vulnerable to Phytophthora Dieback. This large area stretches approximately from Perth, Bunbury and Augusta in the west to Narrogin, Ravensthorpe and Esperance in the east, and as far north as Kalbarri.

This vulnerable area has many different bioregions, having specific characteristics of each having been formed by climate and geology. These two factors are highly significant in determining the pathogen's effectiveness and resulting disease impact levels.

3.1 The Pathogen

Phytophthora cinnamomi is a microscopic water mould. It belongs to the class Oomycetes and belongs in the Kingdom Stramenopila. It is more closely related to brown algae than to true fungi.

Oomycetes organisms occupy both saprophytic and pathogenic lifestyles however *P. cinnamomi* is considered parasitic. It behaves largely as a necrotrophic pathogen causing damage to the host plant's root tissues because of infection and invasion.

The life cycle of *Phytophthora cinnamomi* is a continuous circle of infection, sporulation and further infection and is readily vectored by animals and human activity allowing for rapid invasion into new areas.

3.2 Host

A population of hosts is made up of susceptible, infected and immune or resistant individuals. The infection of host plants is an unseen activity happening constantly beneath the soil at an infested site.

The environmental conditions favouring or disfavouring the pathogen may change at a critical point during disease development, temporarily changing the rates of infection and invasion. This can be observed symptomatically after soil temperature change through winter months.

The plant host is a highly variable component of the disease development. Sites may range from having no susceptible host. Within vulnerable areas, three main family groups are regarded as highly susceptible to *Phytophthora* Dieback disease, being:

- Proteaceae
- Ericaceae
- Xanthorrhoeaceae.

3.3 Environment

Two fundamental environmental characteristics influencing *Phytophthora* Dieback disease are rainfall and soil.

Areas vulnerable to *Phytophthora* Dieback are defined as native vegetation which occur west of the 400-millimetre rainfall isohyet. The correlation of increased *Phytophthora* Dieback impact with increased annual rainfall is generally applicable.

Certain soil properties influence *Phytophthora* Dieback disease development within the vulnerable areas:

1. Moisture is critical for *Phytophthora cinnamomi* to survive in the soil and for sporangia production.
2. Soil pH affects the growth and reproduction of the pathogen. The calcareous sands closest to the coast are alkaline and hostile to *Phytophthora cinnamomi*, but are favourable to *P. multivora*.
3. Fertile soils are less favourable to *Phytophthora* Dieback because the richness of nutrients aids strong host resistance, good soil structure allows water movement and drainage, and high organic matter provides antagonistic microflora.
4. Coarse-textured soils have larger pore spaces which favour dispersal of spores.
5. The optimum temperature for *Phytophthora cinnamomi* sporulation is 21 to 30°C, peaking at 25°C., but some sporangia can still be produced at temperatures as low as 12°C. The optimum growth range is 15 to 30°C and temperatures lower than 5°C or greater than 35°C are unfavourable for the persistence of survival of spores and the vegetative mycelia of *P. cinnamomi*. (Department of Parks and Wildlife, 2015)

4 Methods

4.1 Pre survey desktop study

Known databases of *Phytophthora* locations retained by Glevan Consulting and Vegetation Health Services (DBCA) were searched to determine previous recoveries of *Phytophthora* within the project area.

Previous Phytophthora Dieback Occurrence reports and maps pertaining to the study area were also studied prior to undertaking the field work.

4.2 Interpretation

Based on the considerations of Section 3 'Phytophthora Dieback', the personnel involved in the field work determined the presence of Phytophthora Dieback based on symptoms and disease signatures displayed in susceptible vegetation. These symptoms are supported through the strategic sampling and subsequent recovery of Phytophthora from soil and tissue samples taken during the assessment.

The detection of the plant pathogen Phytophthora Dieback involves the observation and interpretation of plant deaths (or reduction of biomass or perceived temporal change in vegetation structure) using a logical assessment of factors that imply pathogen presence above other possible causes of plant deaths or vegetation change. A combination of the following factors may indicate the presence of disease caused by *Phytophthora* Dieback or other *Phytophthora* species.

Deaths of disease indicating species:

An indicator species is a plant species, which is reliably susceptible to Phytophthora Dieback (i.e. will die). Common indicators include several species of *Banksia*, *Patersonia*, *Persoonia*, and *Xanthorrhoea*. The distribution and composition of indicator species will vary from place to place according to vegetation types.

Chronology of deaths:

As the pathogen spreads through an area, some or all susceptible plants become infected and die. Consequently, there will be an age range from more recent deaths with yellowing or brown leaves through to older leafless stags to remnant stumps in the ground.

Pattern of deaths:

The topography, soil type, vegetation type and drainage characteristics of an area together with the influence of climatic patterns and disturbances will influence the shape or pattern of an infested area over time. A typical recent infestation may show a small cluster of dead indicator species which, in time, will spread to become a small circular shape 'the ulcer effect' and then begin lengthening towards natural drainage channels. A fringe of recent deaths is often seen around the edge of the infested area. Patterns may be further highlighted by a paucity of ground cover within the infested area.

Other causes of indicator species death:

Phytophthora cinnamomi is not the only agent to cause death of native vegetation. Other agents include, but are not limited to:

- other *Phytophthora* spp, *Armillaria luteobubalina*, various cankers, insects;
- drought, wind scorch, frost, salinity, water logging, fire and lightning;
- senescence, competition, physical damage;
- herbicides, chemical spills (for example fuel).

Based on the field assessment, the Project Area can be distributed to the following occurrence categories (Department of Parks and Wildlife, 2015).

Table 1 - Phytophthora Dieback occurrence categories

Vegetated area	Infested	Areas that have plant disease symptoms consistent with the presence of Phytophthora Dieback
	Uninfested	Areas free of plant disease symptoms that indicate the presence of Phytophthora Dieback.
	Uninterpretable	Areas where indicator plants are absent or too few to determine the presence or absence of Phytophthora Dieback.

	Temporarily Uninterpretable	Areas that are sufficiently disturbed so that Phytophthora Dieback occurrence mapping is not possible at the time of inspection.
	Not yet resolved	Areas where the interpretation process has not confidently determined the status of the vegetation.
Non-vegetated area	Excluded	Areas devoid of vegetation are excluded from the assessment area.

4.3 Demarcation of hygiene boundaries

Phytophthora Dieback infestations were demarcated with day-glow orange flagging tape. A single band of tape was tied to a suitable tree with the knot facing towards the infestation. The Uninterpretable boundaries were denoted with black and pink tiger tape. The taped boundaries were positioned approximately 15m outside the infested or uninterpretable areas, to provide the required buffer zone, and placed approximately 10 -15m apart.

4.4 Mapping

Subsequent to hygiene boundary demarcation, the boundaries were again walked and recorded utilising a handheld GPS. The recorded data was then transferred to a desktop computer and used to produce the relevant maps.

4.5 Limitations of disease mapping

The assessment for the disease caused by Phytophthora Dieback is based on interpreting the vegetation for symptoms which can be ascribed to the disease presence. These observable factors must be present during the assessment period. Management recommendations may be included if it is considered that the disease may be cryptic, or the project area displays evidence of activities that are considered a high risk of introducing the disease.

The validity of the hygiene boundaries mapped for this project is twelve months from the completion of this project. All boundaries should be reassessed by August 2018 if activities are still occurring beyond this time.

5 Project area environmental data

5.1 Rainfall

The Project Area generally receives greater than 1000mm of annual rainfall.

5.2 Vegetation structure

The Project Area contains nine vegetation structures (Table 3), as mapped for the Regional Forest Agreement (Mattiske & Havel, 1998). These are:

- Balingup
- Bridgetown
- Kirup
- Mumballup
- Queenwood
- Dwellingup, and
- Catterick.

All assessable vegetation was restricted to the Kirup, Dwellingup and Catterick vegetation structures. Phytophthora Dieback indicating species within this vegetation include:

- *Xylomelum occidentale*,
- *Banksia grandis*
- *Persoonia longifolia*
- *Leucopogon propinquus*,
- *Leucopogon verticillatus*,
- *Macrozamia riedlei*,
- *Banksia littoralis*,
- *Adenanthos obovatus*, and
- *Leucopogon australis subsp. acutifolius*.

6 Results

The Kirup Dam Bypass and Mullalyup Tank site are both classified as Infested. One section of the Northern Alignment is Uninterpretable. The Southern Alignment Part B has two Infested sections, two sections being Temporarily Uninterpretable (recently burnt), and one section of Uninfested and Uninterpretable.

The remaining areas are Excluded from the assessment (Table 2).

Table 2 - Area Summary

Category	Area (ha)	% of total area
Infested (with <i>P. cinnamomi</i>)	2.32 ha	14.05 %
Uninfested	0.70 ha	4.23 %
Temporarily Uninterpretable	1.08 ha	6.57 %
Uninterpretable	1.04 ha	6.32 %
Excluded	11.35 ha	68.83 %
TOTAL AREA	16.49 ha	

7 Discussion

Balingup Tank Site

The Balingup Tank Site (Map 1) contains no assessable vegetation and has been classified as Excluded.

Mullalyup Tank Site

The Mullalyup Tank Site (Map 2) contains vegetation that is displaying the symptoms of Phytophthora Dieback and is classified as Infested.

Kirup Dam Bypass

The Kirup Dam Bypass (Map 3) contains vegetation that is displaying the symptoms of Phytophthora Dieback and is classified as Infested.

Northern Alignment

The Northern Alignment (Map 4) extends from just north of Mullalyup to the southern end of the Balingup townsite.

One section of the route is vegetated however this vegetation did not contain a sufficient density of species to allow the confident assessment for the presence of Phytophthora Dieback and has been classified as Uninterpretable. The remainder of this section is Excluded.

Southern Alignment Part A

The Southern Alignment Part A (Map 5) extends south from the Padbury Reservoir and follows Padbury Road to the rail reserve, just west of Hay Road.

The entire section is Excluded as there is no assessable vegetation along the route. The majority of the route has been given to plantations and cleared road reserve.

Southern Alignment Part B

The Southern Alignment Part B (Map 6) extends from just west of Hay Road, through Greenbushes forest block and terminates at Reserve R6890.

The section from the rail reserve to Hay Road has recently been burnt and has been classified as Temporarily Uninterpretable.

From Hay Road and south along the western edge of the Greenbushes forest block are numerous deaths of Phytophthora Dieback indicating species, particularly within the *Banksia* and *Xanthorrhoea* families. This section has been classified as Infested.

A section from just west of the Bibbulmun Track to the creek just west of Greenbushes Loop has been classified as Temporarily Uninterpretable as it had been recently burnt.

A small section of infested vegetation has been demarcated adjacent to the creek that flows in from the east, on the northern side of Greenbushes Loop.

The southern end has been classified as Uninterpretable. Although pockets of vegetation exist with Phytophthora Dieback indicating species present, their location is sporadic and discontinuous.

8 Recommendations

- Soil and plant material of infested or unknown dieback status should not be introduced to uninfested or unmappable sections of the study area.
- Soil and plant material should not be transported from the infested or unmappable sections of the study area for use at any other protectable area site.
- Soil movement within each category is permissible, but should not occur across category boundaries, except where the source is uninfested.
- Vehicles and machinery should be clean upon entry into any of the site categories (except infested), and when moving across category boundaries. Moving from uninfested areas into other categories does not require clean down measures.
- Restrict access, where possible, to dry soil conditions only. Where vehicles or machinery are required to access the area during, or shortly after rainfall, they must carry clean down equipment, and remove any soil or plant material at designated hygiene points.

9 Bibliography

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Mattiske, E., & Havel, J. (1998). *Regional Forest Agreement Vegetation Complexes*. Unpublished report for Department of Conservation and Land Management.

Water Corporation. (n.d.). *Warren-Blackwood regional water supply scheme*. Retrieved from <https://www.watercorporation.com.au/water-supply/ongoing-works/warren-blackwood-regional-water-supply-scheme>

10 Appendix – Phytophthora occurrence map



DB_Status Excluded (1)

Balingup Tank Site - Map 1

Map 1 - Balingup Tank Site



DB_Status ■ Infested (1)

Mullalyup Tank Site - Map 2

Map 2 - Mullalyup Tank Site



DB_Status ■ Infested (1)

Kirup Dam Bypass - Map 3

Map 3 - Kirup Dam Bypass



Northern Alignment - Map 4

Map 4 - Northern Alignment



DB_Status Excluded (1) Infested (1) TUI (1)

Southern Alignment Part A - Map 5

Map 5 - Southern Alignment Part A



DB_Status ■ Infested (2) ■ TUI (2) ■ Uninfested (1)
■ Uninterpretable (1)

Southern Alignment Part B - Map 6

Map 6 - Southern Alignment Part B

11 Appendix – Vegetation Structures

Table 3 - Vegetation structures in Project Area

Code	Vegetation structure	Description		
		Over-storey	Mid-storey	Herbs and shrubs
BL	Balingup	Open Forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i>	<i>Banksia grandis</i> and <i>Persoonia longifolia</i>	<i>Macrozamia riedlei</i> , <i>Bossiaea ornata</i> , <i>Pteridium esculentum</i> , <i>Hibbertia hypericoides</i> , <i>Leucopogon capitellatus</i> , <i>Leucopogon verticillatus</i> , <i>Hibbertia amplexicaulis</i> and <i>Opercularia hispidula</i> var. <i>pauciflora</i>
BLf	Balingup	Open Forest of <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> subsp. <i>marginata</i> with <i>Eucalyptus patens</i> on lower slope	<i>Mirbelia dilatata</i> approaching the size of a small tree, on lower slope	<i>Hibbertia hypericoides</i> , <i>Acacia lateriticola</i> , <i>Xanthorrhoea preissii</i> , <i>Hakea lissocarpha</i> , <i>Leucopogon capitellatus</i> , <i>Hypocalymma angustifolium</i> , <i>Macrozamia riedlei</i> , <i>Lepidosperma squamatum</i> and <i>Leucopogon propinquus</i>
BT	Bridgetown	Woodland of <i>Corymbia calophylla</i> on deeper soils to Heath on shallow soils	No second storey	<i>Xanthorrhoea preissii</i> , <i>Leucopogon capitellatus</i> , <i>Leucopogon propinquus</i> , <i>Leucopogon verticillatus</i> , <i>Hakea lissocarpha</i> and <i>Calothamnus quadrifidus</i>
KR	Kirup	Open Forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i>	Strong development of <i>Xylomelum occidentale</i> , less <i>Banksia grandis</i>	<i>Bossiaea linophylla</i> , <i>Acacia extensa</i> , <i>Pteridium esculentum</i> , <i>Hibbertia hypericoides</i> , <i>Phlebocarya ciliata</i> , <i>Philothea spicata</i> , <i>Gompholobium tomentosum</i> , <i>Hibbertia racemosa</i> , <i>Opercularia hispidula</i> var. <i>pauciflora</i> and <i>Conostylis serrulata</i>
ML	Mumballup	Open Forest of <i>Melaleuca raphiophylla</i> and <i>Eucalyptus rudis</i> on river banks/ flats, <i>Eucalyptus patens</i> and <i>Corymbia calophylla</i> on terraces	Minor development of <i>Banksia littoralis</i> and <i>Paraserianthes lophantha</i> subsp. <i>lophantha</i>	<i>Taxandria linearifolia</i> ms, <i>Trymalium floribundum</i> , <i>Astartea fascicularis</i> , <i>Gahnia trifida</i> , <i>Lepidosperma tetraquetrum</i> , <i>Pteridium esculentum</i> , <i>Viminaria juncea</i> and <i>Hypocalymma angustifolium</i>
QW	Queenwood	Open Forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i>	<i>Banksia grandis</i> and <i>Persoonia longifolia</i>	<i>Acacia extensa</i> , <i>Acacia lateriticola</i> , <i>Hibbertia hypericoides</i> , <i>Bossiaea eriocarpa</i> , <i>Bossiaea ornata</i> , <i>Lepidosperma squamatum</i> , <i>Leucopogon capitellatus</i> ,

				<i>Patersonia umbrosa</i> var. <i>xanthina</i> and <i>Styphelia tenuiflora</i>
D1	Dwellingup	Open Forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i>	<i>Allocasuarina fraseriana</i> , <i>Banksia grandis</i> and <i>Persoonia longifolia</i>	<i>Acacia browniana</i> , <i>Hovea chorizemifolia</i> , <i>Leucopogon propinquus</i> , <i>Lasiopetalum floribundum</i> , <i>Leucopogon verticillatus</i> and <i>Macrozamia riedlei</i>
CC1	Catterick	Open Forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i>	<i>Banksia grandis</i> and <i>Banksia littoralis</i>	<i>Acacia extensa</i> , <i>Adenanthos obovatus</i> , <i>Leucopogon australis</i> subsp. <i>acutifolius</i> , <i>Hypolaena exsulca</i> , <i>Pericalymma ellipticum</i> , <i>Johnsonia lupulina</i> , <i>Hibbertia hypericoides</i> and <i>Tetraria octandra</i>



Appendix C

Biological Assessment Report

– Rocky Gully

Flora, Vegetation and Fauna Survey, Rocky Gully



Flora, Vegetation and Fauna Survey, Rocky Gully

Rocky Gully Offsets Site

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Executive Summary

The Water Corporation proposes to use Rocky Gully Reserve (no. 24734) as an offset site for impacts on Black Cockatoo habitat and riparian vegetation for works conducted in other areas of the State. The proposed offset site (the Project Area) is approximately 671 ha of intact native vegetation containing a Jarrah and Marri Forest and a wetland system.

A Level 1 flora and vegetation assessment, Level 1 fauna assessment, targeted Black Cockatoo survey and riparian assessment were undertaken, which comprised a desktop review and field survey. This report presents the existing environment, methodology and the results of these assessments.

A detailed desktop assessment was undertaken incorporating results (where relevant) from the Department of Parks and Wildlife (DPaW) database, NatureMap and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST). The desktop assessment identified no Threatened or Priority communities present in the vicinity of the Project Area. Database records indicated that a high number of conservation significant flora species that may occur, including 14 that are known or likely to occur, and eight that may occur. Similarly, the desktop fauna assessment identified 48 conservation significant fauna species that could potentially occur within the Project Area. Of these, six species are likely to occur, 18 species may occur and 24 species are unlikely to occur. The species likely to occur in the Project Area include four bird and two mammal species. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the Project Area, and reviewing the recent records and distribution of the species.

The field surveys were undertaken by Botanist Floora de Wit and Ecologist Jared Leigh on 11-14 July 2016. The Project Area was traversed by vehicle via existing tracks and on foot to a certain extent. Data was captured at 18 sample point locations considered suitable for representing environmental values observed within the Project Area. Additional opportunistic observations were made whilst traversing the area. The Level 1 fauna survey primarily focused on recording observations of fauna (particularly conservation significant species) within the Project Area, which included evidence of fauna activity such as scats, tracks, burrows, foraging evidence and diggings. Seven microhabitat searches of leaf litter, bark, fallen logs and rocks were conducted opportunistically when appropriate areas were located, and motion activated cameras were installed at three locations to observe fauna, particularly nocturnal fauna. Ten detailed habitat assessments were also completed across the Project Area. For Black Cockatoos, a breeding habitat and foraging habitat assessment was conducted at eight sites within the Project Area. Opportunistic observations of Black Cockatoos and roosting were recorded.

As anticipated, no conservation significant vegetation communities were observed in the Project Area. It cannot be confidently determined whether Threatened or Priority flora species are present as this was not an objective of the field survey. One *Hibbertia* species was collected and may represent the Priority 4 species *Hibbertia helianthemoides*. Lacking suitable identifiable characteristics such as flowers due to the timing of the field survey, the identification could not be determined with confidence. This species was collected at one location and recorded at two other locations. One *Andersonia* species was collected, which may represent a Priority 3 *Andersonia* species. This species had old flowering material and was therefore submitted to the Western Australian Herbarium (WAH) for formal identification by a DPaW taxonomist. It is likely that further surveys would lead to the identification of more conservation significant flora species as the vegetation is in excellent condition with no weeds recorded.

Sixteen fauna species were recorded within the Project Area during the field survey. This comprised 10 bird, four mammal and one amphibian species. Of the 16 fauna species observed, one species was of conservation significance, Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), which is listed as Vulnerable under the EPBC Act and Endangered under the *Wildlife Conservation Act 1950* (WC Act). Baudin's Black Cockatoo were seen or heard four times within the Project Area. Four introduced fauna species were also recorded in the Project Area. The European Wild Rabbit (*Oryctolagus cuniculus*) and the Red Fox (*Vulpes vulpes*) were both recorded and are listed as Declared Pests under the *Biosecurity and Agricultural Management Act 2007* (BAM Act).

Three main fauna habitats (including Cleared Areas) have been defined and mapped within the Project Area. The most common fauna habitat was the Marri and Jarrah Forest at approximately 81% of the Project Area. This habitat varies in density of understorey but would generally support many of the common and conservation significant fauna species likely to occur in the Project Area, such as Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Muir's Corella (*Cacatua pastinator pastinator*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Chuditch (*Dasyurus geoffroii*) and Western Brush Wallaby (*Macropus irma*).

The Project Area contains a significant area of young and mature Marri and Jarrah trees with Black Cockatoo breeding potential (Diameter at Breast Height [DBH] >500cm). It also contains and is located adjacent to several freshwater sources, but does not contain habitats dominated by proteaceous species. The Black Cockatoo foraging assessments determined that the Project Area contains approximately 547 ha of High quality foraging habitat for all three Western Australian Black Cockatoo species. This aligns with the Jarrah and Marri Forest fauna habitat, which would also provide Quality breeding habitat due to the moderate density of eucalypts with a DBH >500 cm. Baudin's Black Cockatoo were observed foraging on Marri within the Project Area on two occasions, with recent evidence of Baudin's Black Cockatoo foraging within the Project Area recorded an additional three times during the field survey.

Riparian vegetation was mapped as vegetation community MpAsCa. This community incorporates all wetland vegetation in the Project Area, including narrow streams with running water and wide shallow troughs with inundated soils. All riparian vegetation was considered as A grade vegetation in the Pristine category according to the foreshore condition assessment developed by the Waters & Rivers Commission (1999). No weeds were observed in the wetland vegetation and there has been no obvious historical disturbance.

A summary of total area for the environmental values identified as requiring an offset are outlined in Table 1.

Table 1 Summary of environmental values assessed for the Rocky Gully proposed offset site

Environmental Values	Foraging	Breeding	Area
Carnaby's Black Cockatoo	X	X	547 ha
Forest Red-tailed Black Cockatoo	X	X	547 ha
Baudin's Black Cockatoo	X	X	547 ha
Riparian vegetation	NA	NA	111.60 ha

1.0 Introduction

1.1 Background

The Water Corporation is proposing to use Reserve 24734 in Rocky Gully (Rocky Gully Reserve as an environmental offset site (the Project Area). The proposed offset would be required to offset impacts on Black Cockatoo habitat and riparian vegetation. Water Corporation would seek to transfer ownership of the proposed offset site to the Department of Parks and Wildlife (DPaW) for conservation purposes if it was determined to meet the appropriate criteria as an offset.

The offsets referral guide (DSEWPaC, 2012a) requires reporting on the extent to which the proposed offset correlates to and adequately compensates for the impacts on the attributes of specific environmental values. For the purposes of this Project, these environmental values refer to Black Cockatoo foraging, breeding and roosting habitat, and riparian vegetation.

1.2 Location

The Project Area is located adjacent to the Rocky Gully townsite, approximately 110 km northwest of Albany and 360 km southeast of Perth. The Study Area incorporates a 10 km buffer around the Project Area. The Study Area was used to provide context for the desktop assessment and field survey results.

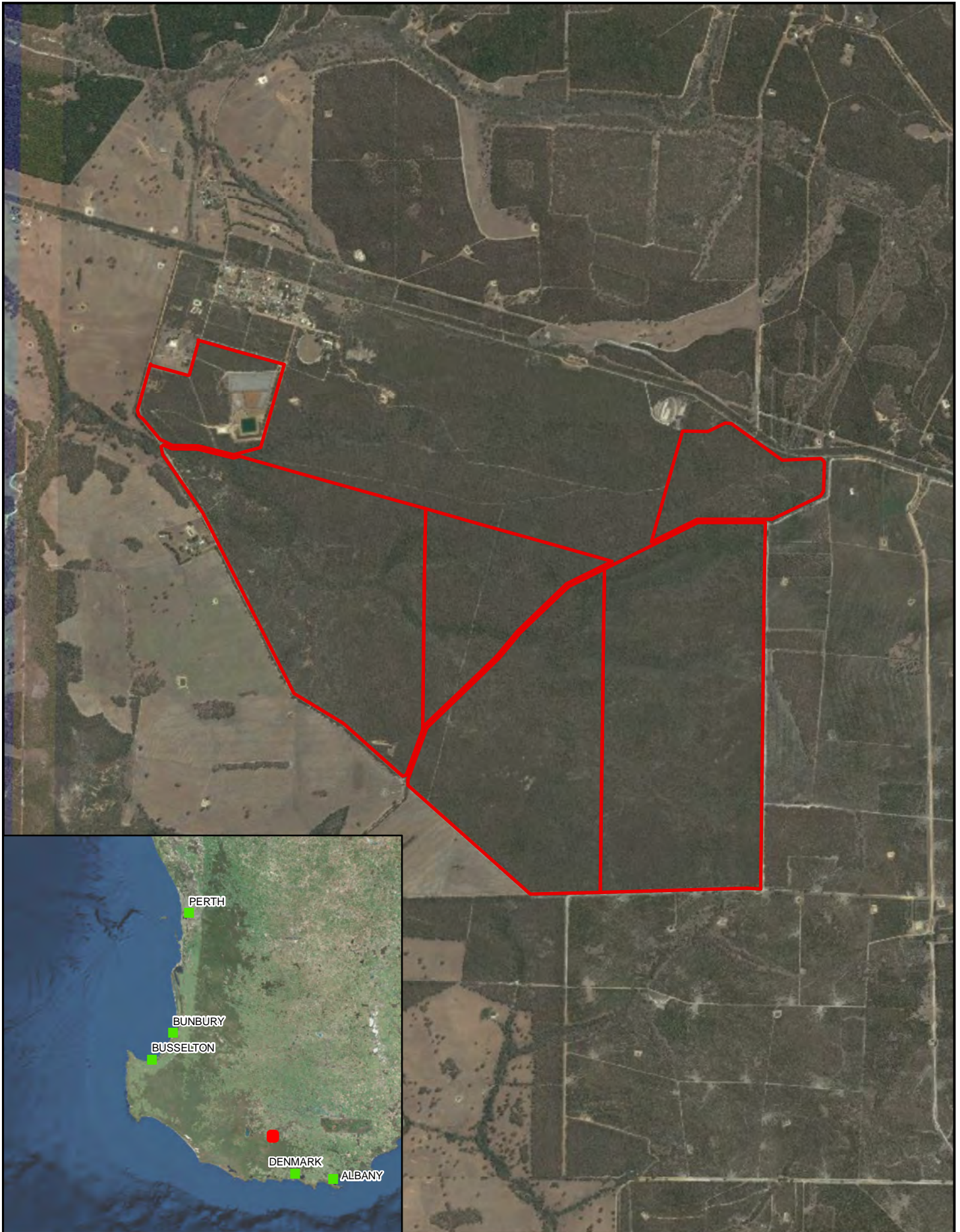
1.3 Objectives


The objective of the project is to assess the factors relevant to the offset proposal, including Black Cockatoo breeding, foraging and roosting habitat, and mapping riparian vegetation within the Project Area.

The specific objectives of the assessment were to:

- conduct a Level 1 flora and vegetation assessment
- map and delineate vegetation communities and vegetation condition
- conduct a Level 1 fauna assessment
- assess the extent and quality of Black Cockatoo foraging, roosting and breeding habitat
- assess extent and condition of riparian vegetation.

This technical document describes the existing environment, methodology, desktop and field results and provides a preliminary discussion of results.



<p>PROJECT ID 60507828 CREATED BY DGF APPROVED BY FDW LAST MODIFIED 08 AUG 2016</p> <p>AECOM www.aecom.com</p> <p>DATUM GDA 1994, PROJECTION MGA ZONE 50</p> <p>0 230 460 690 920 metres</p> <p>1:30,000 when printed at A4</p>	<p>LEGEND  Project Area</p> <p>Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerotrid, IGN, IGP, swisstopo, and the GIS User Community</p>	<p>Project Area</p> <p>WATER CORPORATION ROCKY GULLY FLORA VEGETATION AND FAUNA SURVEY</p> <p>Figure 1</p>
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2.0 Existing Environment

2.1 Climate

The Project Area is located in the southwest of Western Australia which experiences a Mediterranean climate. A Mediterranean climate is characterised by warm to hot dry summers and mild to cool wet winters. The Mediterranean climate in Australia is a result of the Indian Ocean High, a high pressure cell that shifts towards the poles in summer and the equator in winter, playing a major role in the formation of the deserts of Western Australia, and the Mediterranean climate of southwest and south-central Australia. Precipitation occurs during winter months, with the possibility of some summer storms.

The nearest Bureau of Meteorology (BoM) weather station is Rocky Gully station 9661. Rocky Gully station has recorded an average annual rainfall of 713.7 mm since 1954, with the majority of rainfall occurring during May to August (Figure 2 [BoM, 2012]). The months preceding the survey showed higher than average rainfall in January, March, April and May.

Average maximum temperatures peak between December and February and coincide with low rainfall averages (BoM, 2016). Temperatures at the time of the survey varied between 10.8-16.9°Celsius.

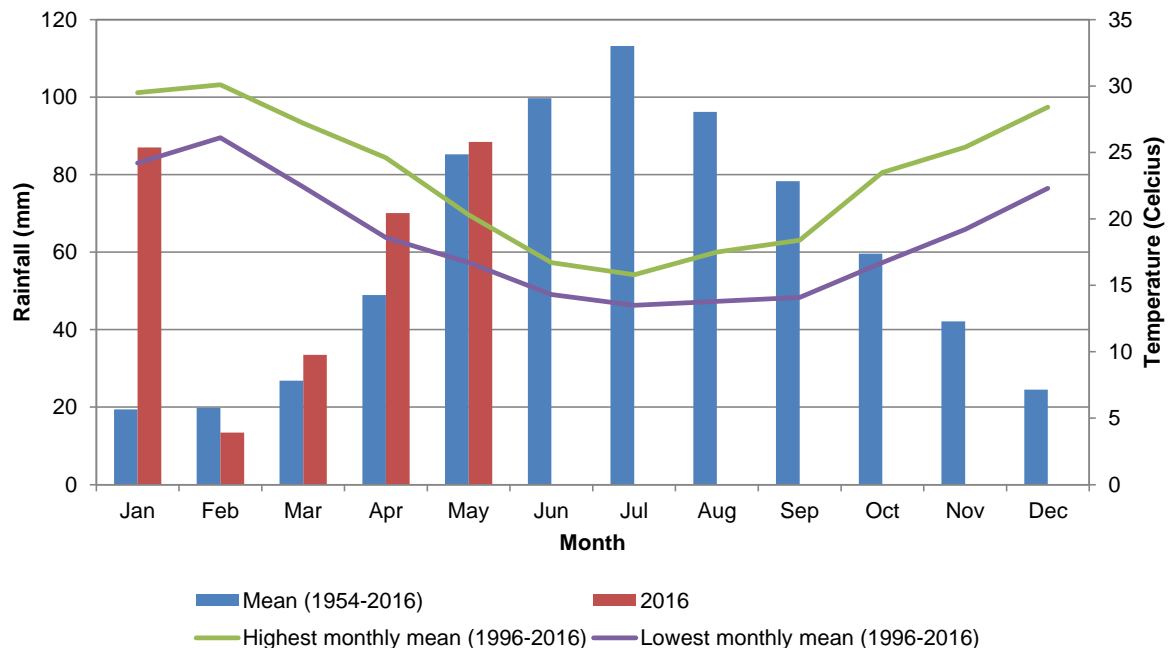


Figure 2 Rainfall data from Rocky Gully weather station (number 9661) showing mean monthly rainfall and rainfall received in the 12 months preceding the field survey (BOM, 2016)

2.2 IBRA Regions

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Commonwealth of Australia, 2013a). The Project Area lies within the Jarrah Forest IBRA region and, at a finer scale, within the Southern Jarrah Forest subregion (Mitchell *et al.*, 2002).

The Southern Jarrah Forest bioregion, described by Hearn *et al.* (2002), extends south of Collie where the plateau broadens and slopes gently to the south coast. The drainage broadens and levels on the surface in the east causing poor drainage and numerous wetlands. The west supports Jarrah-Marri forest grading to Marri-Wandoo woodlands in the east, with extensive swamp vegetation in the south-east dominated by Paperbarks and Swamp Yate. Land use is mostly grazing and dry-land agriculture, forestry and conservation. The area contains a number of rare plants, birds, frogs and critical weight range mammals (Bandicoot, Chuditch and Potoroo) and freshwater wetland *Baumea* reed beds.

2.3 Vegetation

Beard (1981) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. The EPA's objective is to retain at least 30% of all pre-European ecological communities, which is consistent with recognised retention levels (EPA, 2000; EPA, 2015). Beard (1981) mapping shows one vegetation association within the Project Area, vegetation association 3 Open Forest: Jarrah-Marri. There is 59.87% of the original extent of vegetation association 3 remaining in the Southern Jarrah Forest (Government of WA, 2015).

2.4 Soils

There are two dominant soil types within the Project Area as mapped on the Australian Soil Atlas. These include:

- Tf6: Undulating to hilly portions of dissected lateritic plateau at moderate elevation: chief soils are hard acidic and neutral yellow mottled soils containing small to large amounts of ironstone gravels. Associated are leached sands and soils containing ironstone gravels. This unit merges with unit Cd22
- Cd22: Flat to gently undulating portions of lateritic plateau at moderate elevation, occasional low hills, some tors: chief soils are leached sands, some only 6 inches thick, underlain by thick ironstone gravel and boulder layers and mottled kaolinic clays at depths below 2-5 feet. Associated are: soils containing ironstone gravels and other soils of unit Tf6 on slopes; flats of leached sands, some small areas of yellow soils containing ironstone gravel.

3.0 Legislative Framework

3.1 Overview

Table 2 summarises the key legislation governing the protection and management of Western Australia's conservation significant species and communities, which are further discussed below and in Appendix A.

Table 2 Relevant legislation, regulations and guidance

Legislation	Purpose
Commonwealth of Australia	
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity.
Western Australia	
<i>Wildlife Conservation Act 1950</i> (WC Act)	Provides for the conservation and protection of Western Australia's wildlife.
<i>Environmental Protection Act 1986</i> (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
<i>Biosecurity and Agriculture Management Act 2007</i> (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
EPA Position Statement No. 2 <i>Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation, with particular reference to the agricultural area</i>	Provides guidance on clearing of native vegetation, with particular reference to the agricultural area.
EPA Guidance Statement No. 51 <i>Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia</i>	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial flora and vegetation and their ecosystems.
EPA Position Statement No. 3 <i>Terrestrial Biological Surveys as an Element of Biodiversity Protection</i>	Provides guidance on the requirements of biological surveys in Western Australia.
EPA Guidance Statement No. 56 <i>Guidance for the Assessment of Environmental Factors – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia</i>	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial fauna.
<i>Land Administration Act 1997</i> (LAA)	An Act to consolidate and reform the law about Crown land and the compulsory acquisition of land generally, to repeal the <i>Land Act 1933</i> and to provide for related matters. The Act allows for the
<i>Rights in Water and Irrigation Act 1914</i> (RIWI Act)	An Act relating to rights in water resources, to make provision for the regulation, management, use and protection of water resources, to provide for irrigation schemes, and for related purposes.

3.2 Commonwealth

3.2.1 Matters of National Environmental Significance

Matters of National Environmental Significance (MNES) include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places

- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

3.2.2 Flora and fauna

The EPBC Act is the main piece of federal legislation protecting biodiversity in Australia. Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 3.

Table 3 Categories of Species Listed under Schedule 179 of the EPBC Act (Commonwealth)

Conservation	Code Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent

3.2.3 Vegetation Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 4.

Table 4 Categories of TECs that are listed under the EPBC Act

Conservation 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.

3.3 Western Australian

3.3.1 Flora and fauna

Plants and animals that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the WC Act. These categories are defined in Table 5.

Table 5 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Code	Category
CR	Critically endangered species
EN	Endangered species
VU	Vulnerable species
EX	Presumed extinct species
IA	Migratory birds protected under an international agreement (fauna only)
CD	Special conservation (fauna only)
OS	Special protection for reasons other than those already mentioned (fauna only)

Species that have not yet been adequately surveyed to warrant being listed under the WA Act are added to a Priority List by the State Minister for Environment. Categories and definitions of Priority flora and fauna species are provided in Table 6 and expanded in Appendix A.

Table 6 Conservation codes for WA flora and fauna as listed by DPaW and endorsed by the Minister for Environment

Conservation Code	Category
Priority One	Poorly Known Species
Priority Two	Poorly Known Species
Priority Three	Poorly Known Species
Priority Four	Rare, Near Threatened and other species in need of monitoring
Priority Five	Conservation Dependent species

3.3.2 Vegetation Communities

State listed TECs are not protected under any legislation, rather they are endorsed by the Minister for Environment. Categories of TECs are defined in Table 7. PECs are endorsed by the Minister for Environment as having insufficient information available to be considered a TEC, or which are rare but not currently threatened. These categories are described in Table 8.

Table 7 Conservation codes for State listed Ecological Communities

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

Table 8 Categories for Priority Ecological Communities

Conservation	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 Dependent ecological communities.

3.3.3 *Biosecurity and Agriculture Management Act 2007*

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth.

4.0 Methodology

4.1 Desktop Assessment

A detailed desktop assessment was completed. The desktop assessment focussed on defining the existing environment and determining the locations of Threatened and Priority flora, fauna, and communities. Desktop database searches were requested for the Project Area with a 10 km buffer. Sources consulted included:

- DPaW Threatened Species and Communities database including Threatened and Priority flora, fauna and communities (and additional Black Cockatoo observational data)
- Western Australian Herbarium (WAH) records
- NatureMap
- EPBC Act Protected Matters Search Tool (PMST).

The search results were reviewed to assess the potential presence of conservation significant environmental values. All conservation significant matters including flora, fauna and communities were reviewed and a likelihood of occurrence was completed based on the categories outlined in Table 9.

Table 9 Categories of likelihood of occurrence for species and communities

Likelihood Category	Flora	Fauna	Communities
Likely to occur	Habitat is present in the Project area and the species has been recorded in close proximity to the Project Area	Project Area is within the known distribution of the species, habitat is present in the Project Area and the species has been recorded in close proximity to the Project Area	Known occurrences of the community in close proximity to the Project area. Vegetation looks the same within the known occurrence and Project Area based on aerial imagery. Geographic location is similar to the Project Area
May occur	Habitat may be present and/or the species has been recorded in close proximity to the Project Area	Project Area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the Project Area	Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and Project Area based on aerial imagery. Geographic location is similar to the Project Area
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the Project Area	Project Area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the Project Area	Known occurrence of the community in close proximity to the Project Area however geographic location does not occur in Project Area

4.2 Field Surveys

All field surveys were undertaken by Senior Botanist Floora de Wit (collection permit SL011555) and Ecologist Jared Leigh on 11-15 July 2016.

4.2.1 Flora and vegetation

A Level 1 flora and vegetation survey was undertaken as described in Guidance Statement No. 51 (EPA, 2004a). The Level 1 survey comprised of low-intensity sampling using relevés at locations representative of healthy vegetation within the Project Area. Data collected at each relevé included GPS coordinates, species list, vegetation structure, landform and soils, vegetation condition, period since last fire, and description of disturbances (as outlined in Technical Guide for Flora Surveys; EPA & DPaW, 2015). The field survey focussed on mapping the vegetation communities within the Project Area using the National Vegetation Information System (NVIS) format. The Project Area was traversed by vehicle and on foot to document the flora and vegetation values.

Species that were unable to be identified in the field were collected and pressed for identification using the AECOM in-house Herbarium and the Western Australian State Herbarium (WAH). Nomenclature of the species recorded follows the protocol of the WAH.

Vegetation communities were mapped using interpretation of aerial imagery and quantitative data collected during the field survey. The naming of vegetation communities follows the National Vegetation Information System (NVIS) (Australian Government, 2003).

Vegetation condition was assessed at sample point locations supplemented by additional opportunistic observations as the Project Area was traversed. The categories of vegetation condition used were consistent with methods developed by Keighery (1994).

Table 10 Bushland condition ratings (Keighery, 1994)

Descriptor	Explanation
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.
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.
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 Riparian vegetation

Riparian vegetation was assessed using methods described by Waters and Rivers Commission (1999) including a detailed foreshore condition assessment (Table 11; Figure 3). It was proposed to demarcate the boundary of riparian vegetation by marking the edge using a hand-held GPS. During the field survey it was observed that the wetland system was extensive, extending from east to west, weaving, splitting, and joining up again numerous times throughout the Project Area. Tracks were also limited. Riparian vegetation was therefore mapped using sample point locations during the flora and vegetation assessment and through analysis of aerial imagery.

Table 11 Condition classes for a detailed assessment of foreshore condition (Water & Rivers Commission, 1999)

Category	Sub-category	Description
A	A1	Pristine. The river embankments and floodway are entirely vegetated with native species, and there is no evidence of human presence or livestock damage.
	A2	Near pristine. Native vegetation dominates. Some introduced weeds may be present in the understorey, but not to the extent that they displace native species. Otherwise there is no evidence of human impact. (A river valley in this condition is as good as will be found today)
	A3	Slightly disturbed. Native vegetation dominates, but there are some areas of human disturbance where soil may be exposed and weeds are relatively dense (such as along tracks). The native vegetation would quickly recolonise the disturbed areas if human activity declined.
B	B1	Degraded - weed infested. Weeds have become a significant component of the understorey vegetation. Although native species are dominant, a few have been

Category	Sub-category	Description
		replaced by weeds.
	B2	Degraded - heavily weed infested. In the understorey, weeds are about as abundant as native species. The regeneration of some tree and large shrub species may have declined.
	B3	Degraded - weed dominated. Weeds dominate the understorey, but many native species remain. Some trees and large shrub species may have declined or disappeared altogether.
C	C1	Erosion prone. Trees remain, and possibly some large shrubs or tree grasses, but the understorey consists entirely of weeds, mainly annual grasses. The trees are generally resilient or long lived species but there is little or no evidence of regeneration. The shallow-rooted weedy understorey provides no support to the soil, and only a small increase in physical disturbance will expose the soil and make the river embankments and floodway vulnerable to erosion.
	C2	Soil exposed. Older trees remain, but the ground is virtually bare. Annual grasses and other weeds have been removed by livestock trampling or grazing, or through over use by humans. Low-level soil erosion has begun, by the action of either wind or water.
	C3	Eroded Soil is washed away from between tree roots, trees are being undermined and unsupported embankments are subsiding into the river valley.
D	D1	Ditch – eroding. There is not enough fringing vegetation to control erosion Some trees and shrubs remain and act to retard erosion in certain spots, but are doomed to be undermined eventually.
	D2	Ditch - freely eroding. No significant fringing vegetation remains and erosion is completely out of control. Undermined and subsided embankments are common, and large sediment plumes are visible along the river channel.
	D3	Drain - weed dominated. The highly eroded river valley has been fenced off, preventing control of weeds by stock. Perennial (long lived) weeds have become established. The river has become a simple drain, similar or identical to a typical major urban drain.

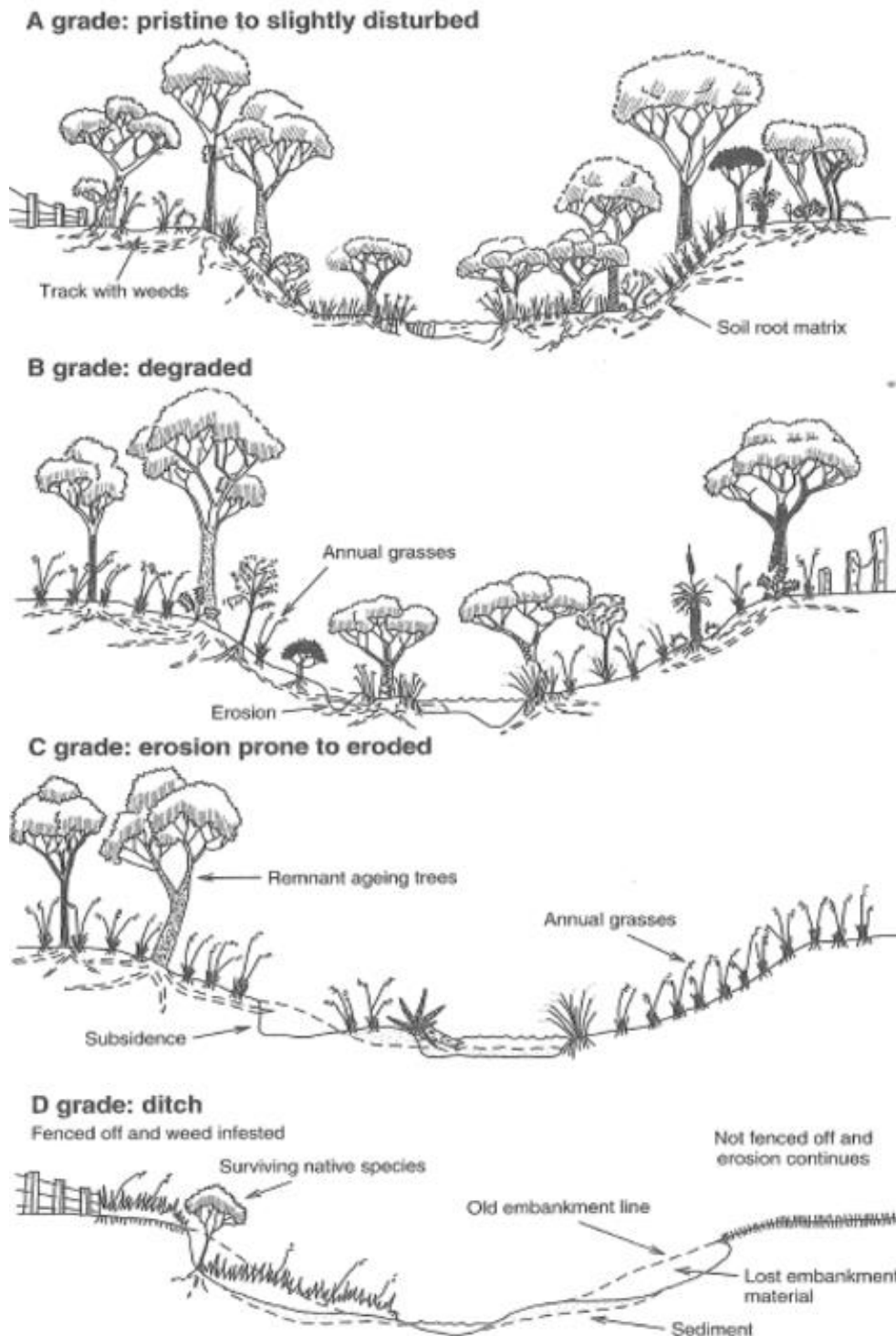


Figure 3 Foreshore condition assessment used to assess riparian vegetation condition (Water & Rivers Commission, 1999).

4.2.3 Fauna

The Level 1 fauna survey primarily focused on recording observations of fauna within the Project Area, which included evidence of fauna activity such as scats, tracks, burrows, foraging evidence and diggings. This survey was undertaken in accordance with EPA (2002) Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection, and EPA (2004b) Guidance Statement No. 56 Guidance for the Assessment of Environmental Factors – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Particular attention was given to locating species of conservation significance that have the potential to occur in

the Project Area, as identified in the desktop assessment. All observations were made during daylight hours of 0730 and 1700.

Microhabitat searches of leaf litter, bark, fallen logs and rocks were also conducted opportunistically when appropriate areas were located. Seven microhabitat searches were conducted across the Project Area (refer to Figure 4 for locations). Motion activated cameras (Scoutguard Zeroglow 10M) were also installed in the Project Area to observe fauna, particularly nocturnal fauna. These cameras were placed in three locations in habitats assessed as potentially containing conservation significant fauna, and were left out for the duration of the three night survey. Figure 4 also illustrates these locations.

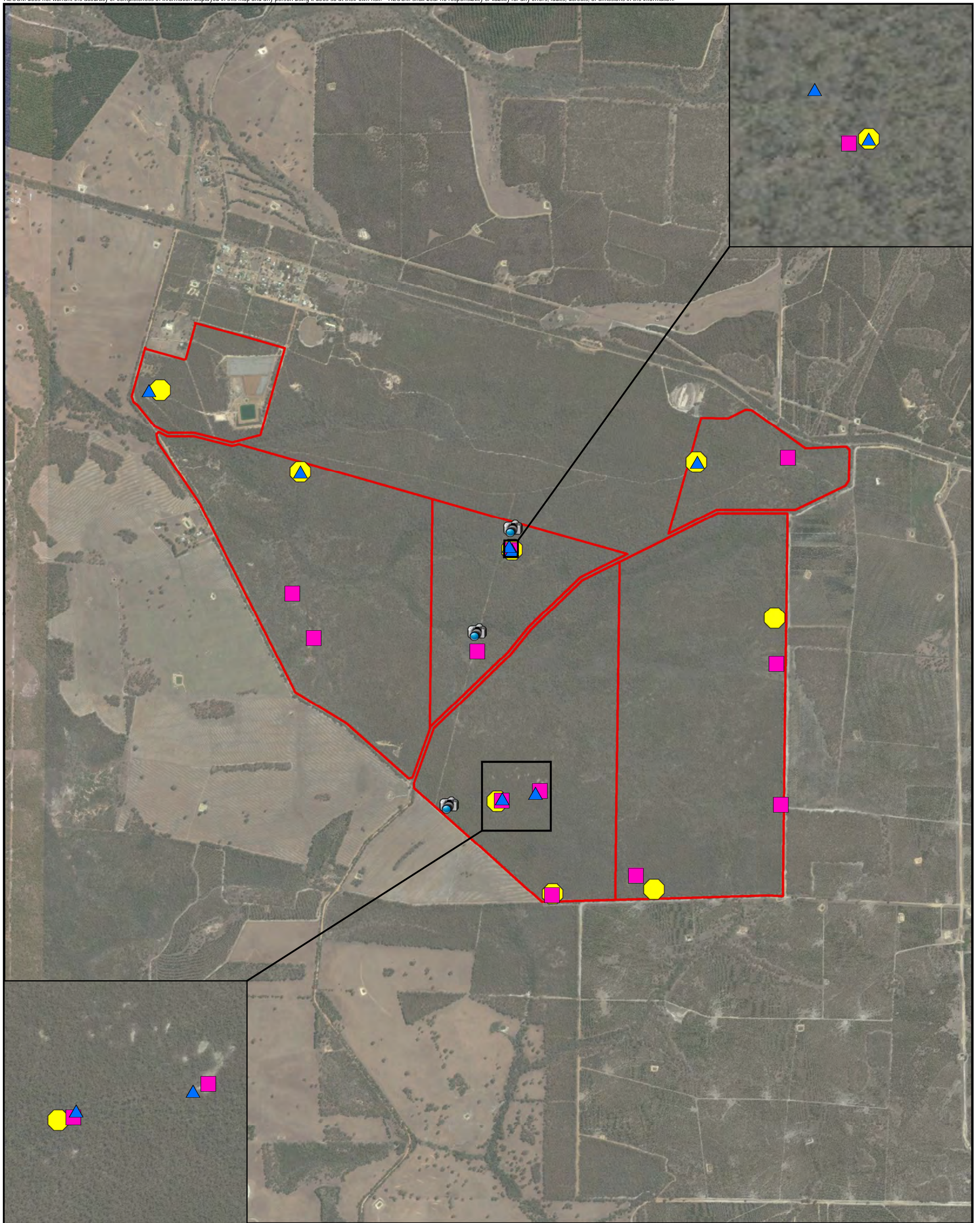
The taxonomy and nomenclature of vertebrate species for mammals, reptiles and amphibians is consistent with the Western Australian Museum's Checklist of Vertebrates of Western Australia (2010) and for bird species the Bird's Australia Checklist of Australian Birds by Christidis and Boles (2008).

4.2.3.1 Fauna habitats

The fauna habitats of the Project Area were mapped during the field survey, in conjunction with the vegetation mapping. Eleven detailed habitat assessments were completed throughout the Project Area. Fauna habitats were assessed for specific habitat components in order to determine the potential for these habitats to support conservation significant species.

Information collected included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presences and abundance of hollows (large / small), fallen logs (<10 cm / 10-30 cm / >30 cm), litter (course / fine), decorticated bark, bare ground, grass, stones and boulders (<20 cm / 20-60 cm / 60 cm – 2 m / >2 m), rock crevices, soil cracks, cryptogamic crust, vines, mistletoe, dense shrubs, water bodies etc.
- Presence of animal signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Fauna observations
- Connectivity and potential significance of habitat.

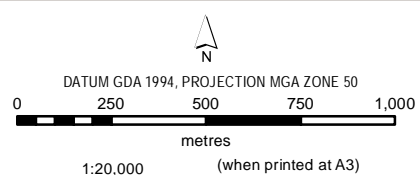


PROJECT ID 60507828
 CREATED BY DGF
 APPROVED BY FDW
 LAST MODIFIED 09 AUG 2016



LEGEND

- ▭ Project Area
- ▲ Microhabitat Search Locations
- Fauna Habitat Assessment Location
- Camera Locations
- ⬡ Black Cockatoo Foraging and Breeding Habitat Assessment Locations



Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Fauna Survey Assessment Locations

Water Corporation

*ROCKY GULLY FLORA
 VEGETATION AND FAUNA SURVEY*

Figure

4

4.2.3.2 Black Cockatoo assessment

A targeted Black Cockatoo assessment was conducted to identify potential breeding, roosting and foraging habitat for the three threatened Black Cockatoo species that occur in Western Australia. These are Carnaby's Black Cockatoo (*Calyptorhynchus latirostris* [Endangered under the EPBC Act and under the WC Act]), Baudin's Black Cockatoo (*Calyptorhynchus baudinii* [Vulnerable under the EPBC Act and Endangered under the WC Act]), and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso* [Vulnerable under the EPBC Act and under the WC Act]). Refer to Section 6.3.4 for further information on these species.

Surveys were conducted in accordance with DSEWPaC (2012b) Referral Guidelines for the three species of Black Cockatoos, as well as in accordance with the outcomes from a workshop recently hosted by the Department of the Environment and Energy (DoEE). The field survey was conducted by Floora de Wit (who has more than four years' experience conducting Black Cockatoo assessments) and Ecologist Jared Leigh (who has conducted multiple Black Cockatoo surveys).

Aerial photography was utilised to identify potentially suitable habitat for Black Cockatoos, and to inform the sample plan. The sample plan was then refined in the field, with the following assessments conducted at relevant sample points:

- foraging quality
- breeding habitat
- roosting habitat.

4.2.3.3 Breeding habitat

A Black Cockatoo breeding habitat assessment was conducted which focussed on quantifying potential breeding trees and associated habitat within the Project Area. Table 12 defines breeding habitat and identifies those trees that Black Cockatoos will utilise as breeding trees, according to DSEWPaC (2012b). Vegetation communities were assessed for their potential to provide breeding habitat by installing a 50 x 50 m quadrat as representative sample points. All trees within this quadrat were then assessed for their suitability as a breeding tree. A total of eight quadrats were assessed within the Project Area (refer to Figure 4). These quadrats were used to provide a representative sample to determine the total amount of breeding habitat (and approximate number of trees) within the Project Area. The following information was collected for potential breeding trees with a Diameter at Breast Height (DBH) >500 cm:

- location
- fire scarring present
- tree species
- DBH
- tree height
- number of hollows
- number of potentially suitable hollows
- hollow height, type and size
- occupancy
- evidence of use.

Photographs were also taken of each tree.

Table 12 Breeding habitat for the three Western Australian Threatened Black Cockatoo species

	Baudin's	Carnaby's	Forest Red-Tailed
Specific breeding habitat for the three Cockatoos	Nest in hollows in live or dead trees of <i>Eucalyptus diversicolor</i> , <i>Corymbia calophylla</i> , <i>E. wandoo</i> and <i>E. gomphocephala</i> .	Nest in hollows in live or dead trees of <i>E. salmonophloia</i> , <i>E. wandoo</i> , <i>E. gomphocephala</i> , <i>E. marginata</i> , <i>E. rudis</i> , <i>E. loxophleba</i> subsp. <i>loxophleba</i> , <i>E. accedens</i> , <i>E. diversicolor</i> and <i>Corymbia calophylla</i> .	Nest in hollows in live or dead trees of <i>E. diversicolor</i> and <i>Corymbia calophylla</i> , <i>E. wandoo</i> , <i>E. megacarpa</i> , <i>E. patens</i> , <i>E. gomphocephala</i> and <i>E. marginata</i> .
Definition of breeding habitat	'Breeding habitat' is defined in these referral guidelines as trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.		

Source: DSEWPaC (2012b).

4.2.3.4 Roosting habitat

Table 13 defines the suitable trees that the three Western Australian Black Cockatoo species may utilise as roosting trees. Both white-tailed Black Cockatoo species roost in or near riparian environments or near other permanent water sources. The Forest Red-Tailed Black Cockatoo prefers the edges of forests for roosting (DSEWPaC, 2012b). Potential roosting trees were searched for and assessed during the field survey.

Table 13 Suitable roosting trees for the three Western Australian Threatened Black Cockatoo species

Baudin's	Carnaby's	Forest Red-Tailed
<i>Corymbia calophylla</i> , <i>E. marginata</i> , <i>E. rudis</i> , <i>E. patens</i> , and <i>E. gomphocephala</i> .	<i>E. salmonophloia</i> , <i>E. wandoo</i> <i>Corymbia calophylla</i> , <i>Eucalyptus diversicolor</i> , <i>E. patens</i> , and <i>E. gomphocephala</i> .	<i>Corymbia calophylla</i> , <i>E. marginata</i> , and <i>E. gomphocephala</i> .

Source: DSEWPaC (2012b).

4.2.3.5 Foraging habitat

The quality of foraging habitat not only reflects the availability of food sources, but also the proximity to reliable water sources, connectivity to other suitable habitat, presence of potential breeding trees, and proximity to confirmed roost and breeding sites (amongst others). These parameters were utilised by the DotE to produce a draft quality of foraging habitat scoring system for its Referral Guidelines. AECOM has adapted this tool for use in offset assessments, presented in Table 15. This scoring system was utilised to assess potential foraging habitat for each Black Cockatoo species. Initially a desktop assessment was conducted to select sample point locations in varying representative habitats throughout the Project Area, and these sites were then refined in the field. 50 x 50 m quadrats were established in the field at each of these eight sites and the scoring assessment tool utilised.

The scoring tool is used by initially defining the quality of the overall habitat present (i.e. High, Quality, Valued, Low) and then adding or subtracting points from this depending on the ecological values of the habitat (i.e. proximity to water, proximity to a known roost site, evidence of foraging material etc.). This determines an overall quantitative rating. These scores were then used as representative scores for that vegetation unit. Table 15 defines the levels of foraging habitat quality used during the assessment.

Table 14 Black Cockatoo foraging assessment scoring

Score	Foraging Quality
1 - 3	Low
4 - 6	Valued
7 - 8	Quality
9 - 10	High

Table 15 Quality of foraging habitat assessment tool for the three Western Australian Threatened Black Cockatoo species

Score	Carnaby's	Baudin's	Forest Red-tailed
≥10 High	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing, and / or is Quality habitat described below with attributes contributing to meet a score of 10 or greater	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing, and / or is Quality habitat described below with attributes contributing to meet a score of 10 or greater	Quality foraging habitat that is being managed for Black Cockatoos, including successful rehabilitation, and/or has some level of protection from clearing, and / or is Quality habitat described below with attributes contributing to meet a score of 10 or greater
7 Quality	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (e.g. <i>Banksia</i> sp., <i>Hakea</i> sp. and <i>Grevillea</i> sp.) as well as eucalypt (not mallee) woodland and forest that is dominated by foraging species. Does not include orchards, canola, or areas under a RFA	Eucalypt (not mallee) woodlands and forest, and proteaceous woodland and heath, particularly Marri. Does not include orchards or areas under a RFA	Jarrah and Marri woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies. Does not include areas under a RFA
5 Valued	Pine plantation or introduced eucalypts	Pine plantation or introduced eucalypts	Introduced eucalypts as well as the introduced Cape lilac (<i>Melia acedarach</i>)
2 Moderate	Native shrubland, heathland and woodland that contains foraging species	Native shrubland, heathland and woodland that contains foraging species	n/a
1 Low	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)
Additions: Context adjustor – attributes improving habitat quality			
+3	Is within the Swan Coastal Plain	Is within the known foraging area	Jarrah and/or Marri shows good recruitment (i.e. evidence of young trees)
+3	Contains trees known to be used for breeding	Contains trees known to be used for breeding	Contains trees known to be used for breeding
+2	Primarily comprises Marri	Primarily contains Marri	Primarily contains Marri and/or Jarrah
+2	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo)		
+2	Known to be a large or key roosting site		
+1	Contains evidence of foraging by species		
+1	Is <12 km from known breeding location		

Score	Carnaby's	Baudin's	Forest Red-tailed
+1	Is <2 km from a watering point		
+1	Is within 6 km of known roosting site		
Subtractions: Context adjustor – attributes reducing habitat quality			
-3	Does not contain Marri and contains less than 25% proteaceous species		
-2	No other foraging habitat within 6 km		
-1	Is >6km from known roosting site		
-1	Does not contain evidence of foraging by species		
-1	Is >12 km from known breeding location		
-1	Is >2 km from watering point		
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or Marri canker)		

Source: 2016 DotE workshop (and subsequently modified by AECOM).

4.3 Survey Limitations

Limitation	Flora and Vegetation and Riparian Assessment	Fauna and Black Cockatoo Assessment
Competency/experience of consultant conducting survey	Nil. Floora de Wit has eight years' experience conducting surveys of similar scope and has extensive experience in the Jarrah Forest.	Nil. Floora de Wit has four years' experience conducting Black Cockatoo assessments. Jared is an ecologist with over 14 years' experience in the environmental industry and has conducted fauna surveys in a range of bioregions within Western Australia. Jared has also conducted multiple Black Cockatoo assessments.
Scope (i.e. what life forms were sampled)	Nil. As a Level 1 assessment, effort was made to document all species within each stratum present in the vegetation communities. Where species were unable to be identified, they were collected and identified at the WA Herbarium. Some juvenile and sterile species lacked suitable identification material and were therefore only identified to genus or family level.	<p>Minor. The Level 1 fauna survey:</p> <ul style="list-style-type: none"> - Assessed all fauna habitats within the Project Area - Documented secondary evidence (scats, diggings, burrows etc.) and fauna sightings - Conducted microhabitat searches at appropriate sites - Utilised motion activated cameras. <p>Although reptiles would generally have been in brumation and not sampled effectively, it is not the objective of a Level 1 survey to trap or sample for fauna groups extensively.</p> <p>Sufficient representative quadrats were assessed for breeding and foraging habitat for all three Western Australian Threatened Black Cockatoo species, within all the fauna habitats of the Project Area.</p>
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	Minor. Broad-based sampling was undertaken across the Project Area, with a minimum of three quadrats representing each vegetation community. A majority of the flora was sampled, with the exception of aquatic flora.	<p>Minor. Information gained for a Level 1 fauna survey was sufficient. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1730hrs). Therefore nocturnal species were only predominantly observed through indirect evidence, although three motion activated cameras were installed in appropriate habitats. Although reptiles would generally have been in brumation and not sampled effectively, it is not the objective of a Level 1 survey to trap or sample for fauna groups extensively.</p> <p>Sufficient representative quadrats were assessed for breeding and foraging habitat for all three Western Australian Threatened Black Cockatoo species, within all the fauna habitats of the Project Area.</p>

Limitation	Flora and Vegetation and Riparian Assessment	Fauna and Black Cockatoo Assessment
Sources of information	Nil. DPaW databases, Florabase, Naturemap and EPBC PMST were used to inform the desktop assessment and provide regional and local context.	Minor. DPaW database (with additional Black Cockatoo observational data), Naturemap and EPBC Act PMST were utilised to inform the Level 1 fauna and Black Cockatoo assessments. Minimal ecological information could be found for a number of the freshwater fish and invertebrates potentially occurring within the Project Area.
Completion (is further work needed)	Nil. As a proposed offset site, it is unclear whether further work would be required for targeting conservation significant flora species. If a comprehensive understanding of environmental values is required then additional surveys including quadrat-based sampling and targeted conservation significant flora surveys may be required.	Nil. The objectives of the proposed offset site fauna and Black Cockatoo assessments were met and no further work is required.
Timing, weather, season, cycle	Minor. The field survey was undertaken in July 2016, two months before the Spring season. Despite this timing, a number of species were in flower. The timing is likely to have affected species presence including daisies (Asteraceae family) and other annual species. Furthermore, some species lacked suitable identification material for a confident identification to species level. Despite this, the field survey is considered to have met the objectives of the Project therefore this limitation is not considered significant. The winter months are considered the ideal time for undertaking riparian/wetland assessments.	Minor. The survey was conducted during the colder months when some fauna groups (reptiles in particular) are not as active. This assessment was also limited to one survey period during one year, and predominantly during daylight hours. However, this does not significantly impact a Level 1 fauna or Black Cockatoo survey.
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	Nil. No evidence of disturbance was observed.	Nil. Neither the Level 1 fauna or Black Cockatoo survey were disrupted or impacted.
Intensity (was the intensity adequate)	Nil. Flora and vegetation was sampled from 18 relevés. This is considered suitable for a Level 1 survey requiring broad-based sampling. The riparian assessment was undertaken at xx locations to monitor the health of vegetation. This was further informed by the condition mapping undertaken as part of the Level 1 assessment.	Nil. The Project Area was surveyed over a two and a half day period which enabled sufficient time to assess the fauna habitats present, search for and collect opportunistic records for conservation significant species. The fauna survey was conducted in accordance with EPA Guidance Statement No. 56 (EPA, 2004b). It also enabled sufficient time to conduct the Black Cockatoo foraging, breeding and roosting assessments.
Resources (degree of	Nil. Plant material was sampled where	Nil. The resources (time, equipment

Limitation	Flora and Vegetation and Riparian Assessment	Fauna and Black Cockatoo Assessment
expertise available in plant/animal identification)	specimens were not able to be correctly identified in the field. These were identified at the WA Herbarium by Floora de Wit. One specimen was submitted to the WAH for confirmation as it may represent a Priority 3 species and it does not have ideal detection material present (flowers/fruits/seeds).	and expertise) were sufficient for a Level 1 fauna survey and the Black Cockatoo survey. Floora de Wit has four years' experience conducting Black Cockatoo assessments, and Jared is an ecologist with over 14 years' experience in the environmental industry who has also conducted multiple Black Cockatoo assessments.
Remoteness and/or access problems	Minor. Tracks were limited therefore the survey plan was revised to use existing tracks only. The forest was thick in places and difficult to traverse therefore large areas were not accessed. This is not considered a limitation as it did not affect the objective of the field survey.	Minor. Not all of the Project Area was covered on-ground due to the size of the Project Area and the limited availability of tracks. However, this minor limitation was not deemed significant as the requirements of the Level 1 fauna and Black Cockatoo survey were met.
Availability of contextual information on the region	Minor. No previous studies were found to be available in the public domain. The Beard pre-European vegetation was used for context, and there are several plant identification books relevant to the southwest of WA.	Minor. No previous studies were found to be available in the public domain.

5.0 Desktop Assessment Results

5.1 Threatened and Priority Ecological Communities

The database searches identified no Threatened Ecological Communities (TEC) or Priority Ecological Communities (PECs) that occur in the Study Area.

5.2 Conservation Significant Flora

A total of 29 Threatened and Priority flora species were identified from the database search as potentially occurring within the Project Area. Of these species, 11 are listed as Threatened under the WC Act and also under the EPBC Act. The remaining 18 species are listed as Priority Flora. The EPBC Act PMST results are included in Appendix B. The spatial location of desktop assessment results are shown in Figure 5.

Based on desktop assessment of specimen records and preferred habitat, it has been determined that 14 flora species of conservation significance are known or likely to occur in the Project Area and eight flora species of conservation significance may occur in the survey area (Table 16). The remaining seven species are considered unlikely to occur in the survey area.

Species for which no information was available except historical known records were automatically considered as 'May Occur'.

Table 16 Records of Threatened and Priority Flora from the vicinity of the Project Area identified from DPaW database searches and the EPBC Act PMST. Descriptions sourced from Florabase (WAH 1998-) and SPRAT (DotE, 2016).

Species	Cons Code	Source	Habitat	Flowering Period	Likelihood of Occurrence
<i>Andersonia auriculata</i>	P3	WAHerb, TPFL	Grows on grey or peaty sand, often over laterite. Swampy areas, granite outcrops.	Apr-Oct	Likely. Suitable habitat present and record from 1997 in the Study Area.
<i>Andersonia</i> sp. Amabile (N. Gibson & M. Lyons 355)	P3	WAHerb, TPFL	Often a coastal species. No habitat information. Previously recorded on grey/black clayey sand in sedgeland with <i>Synaphea intricata</i> , <i>Agonis linearifolia</i> , <i>A. parviceps</i> , <i>Anarthria prolifera</i> and <i>Pericalymma crassipes</i> .	Unknown	Likely. Suitable habitat present and record from 1997 in the Study Area.
<i>Banksia porrecta</i>	P4	WAHerb	White/grey sand, sandy loam. Previously recorded in low woodland and shrubland.	Jul-Aug	Likely. Suitable habitat present and record in Study Area from 2009.
<i>Caladenia christineae</i>	EPBC Act: VU, WC Act: EN	WAHerb, TPFL, EPBC Report	Sand, clayey loam, laterite. Margins of winter-wet flats, swamps, & freshwater lakes.	Sep-Nov	Likely. Record in study area from 2013 and suitable habitat present.
<i>Caladenia dorrienii</i>	EPBC Act: EN, WC Act: EN	WAHerb	Clayey loam. Moist sites adjacent to rivers and seasonal creeks.	Sep-Nov	May Occur. Record in study area from 1990, suitable habitat likely to be present.
<i>Caladenia harringtoniae</i>	EPBC Act: VU, WC Act: VU	WAHerb, TPFL, EPBC Report	Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops.	Oct-Nov	May Occur. Winter-wet flats present but no granite outcrops. Record in Study Area from 1997.
<i>Conostylis misera</i>	EPBC Act: EN, WA Act: VU	EPBC Report	Occurs in waterlogged flats of brown sandy clay loams under shrubs including <i>Pericalymma ellipticum</i> , <i>Hakeas</i> , <i>Melaleucas</i> and sedges.	Oct-Nov	May Occur. No record in the Study Area but suitable habitat is present.
<i>Diuris drummondii</i>	EPBC Act: VU, WC Act: VU	WAHerb, TPFL, EPBC Report	Recorded in low-lying depressions in peaty and sandy clay swamps. Plants are frequently observed standing in several centimetres of water even during the summer flowering period	Oct-Jan	Likely, recorded in 1993 within 1km of project area. Recorded in the study area in 2009.

Species	Cons Code	Source	Habitat	Flowering Period	Likelihood of Occurrence
<i>Diuris micrantha</i>	EPBC Act: VU, WC Act: VU	EPBC Report	Brown loamy clay. Winter-wet swamps, in shallow water.	Sep-Oct	May occur. Suitable habitat present but no known records in the Study Area.
<i>Drakaea micrantha</i>	EPBC Act: VU, WC Act: EN	WAHerb, TPFL	Previously recorded on cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed. The Dwarf Hammer-orchid occurs in infertile grey sands, in Jarrah (<i>Eucalyptus marginata</i>) and Common Sheoak (<i>Allocasuarina fraseriana</i>) woodland or forest associated with Banksia species. It is often found under thickets of Spearwood (<i>Kunzea ericifolia</i>).	Sep-Oct	Likely. Recorded in the study area in 2006 and suitable habitat present. Most likely to be found along tracks.
<i>Hemigenia rigida</i>	P1	WAHerb	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	Aug-Dec or Jan.	Likely. Recorded in study area in 1998 and suitable habitat present
<i>Hibbertia</i> sp. Tenterden (M. Sowry 154)	P2	WAHerb	No information		May Occur. Record in the Study Area from 2003.
<i>Montia australasica</i>	P2	WAHerb, TPFL	No information		May Occur. Record in the Study Area from 2003.
<i>Ornduffia submersa</i>	P4	WAHerb	No information		May Occur. Record in Study Area from 2000.
<i>Pentapogon quadrifidus</i> var. <i>quadrifidus</i>	P2	WAHerb, TPFL	Open winter wet flat in forest.	Unknown	Known, recorded in 1998
<i>Spyridium riparium</i>	P2	WAHerb	Sandy or gravelly soils over laterite. River banks, slopes.	Jul-Oct	Likely. Recorded within 1km from project area in 1980 and suitable habitat present.
<i>Stylidium lepidum</i>	P3	WAHerb	Gravelly sand or loam, clay. Winter-wet depressions.	Oct-Nov	Likely. Suitable habitat present and record in study area from 2003.

Species	Cons Code	Source	Habitat	Flowering Period	Likelihood of Occurrence
<i>Synaphea intricata</i>	P3	WAHerb, TPFL	Sand, peaty sand. Flats, swampy areas.	Sep-Oct	Likely. Suitable habitat present and record in study area from 2007.
<i>Synaphea</i> sp. Kworncup (D. Trenowden 429)	P2	WAHerb	No information		Likely. No habitat information available but record in Study Area from 2014.
<i>Tetralia</i> sp. Warren (M. McCallum Webster 23/2/1979)	P1	WAHerb	No information		May Occur. No habitat information and record in Study Area is from 1979.
<i>Wurmbea</i> sp. Cranbrook (A.R. Annels 3819)	P3	WAHerb	Valley floor	Sep	Likely. Suitable habitat present and record in the study area from 2015.
<i>Xanthosia eichleri</i>	P4	WAHerb	Grey sand over granite, sandy loam. Granite outcrops, jarrah/marri woodland.	Oct-Nov	Likely. Suitable habitat present.

5.3 Conservation significant fauna

The desktop fauna assessment identified 48 conservation significant fauna species that could potentially occur within the Project Area. Of these:

- six species are likely to occur
- 18 species may occur
- 24 species are unlikely to occur.

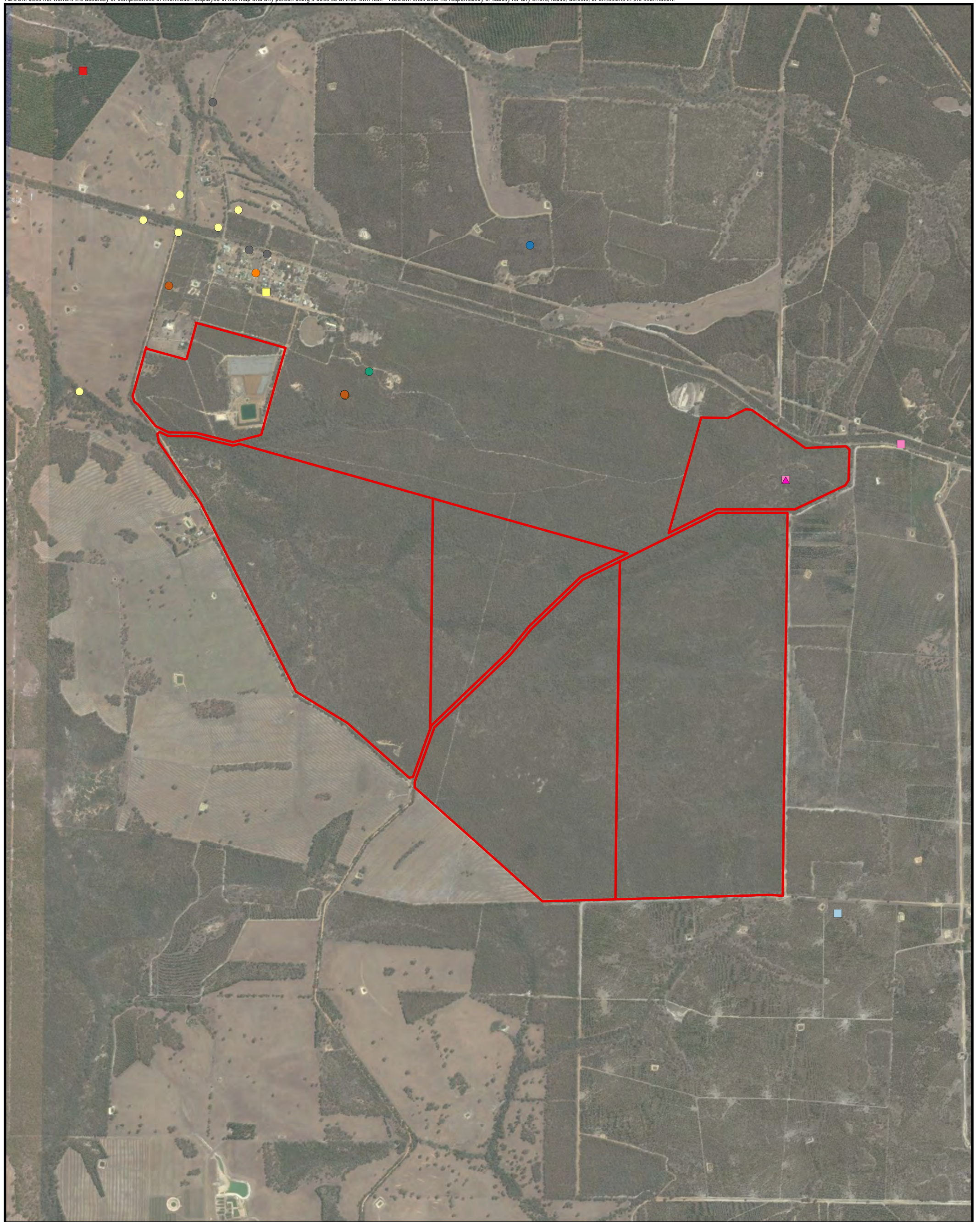
The species likely to occur in the Project Area include four bird and two mammal species. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the Project Area, and reviewing the recent records and distribution of the species. Table 17 identifies the six species likely to occur, and the 18 species that may occur within the Project Area. The conservation significant categories as defined by DPaW, the WC Act and EPBC Act are defined in Appendix A.

The full desktop assessment for all 48 fauna species and their likelihood of occurrence in the Project Area are presented in Appendix C.

Table 17 Desktop fauna assessment for the Project Area

Name	Common Name	Conservation Status		Source	DPaW Records		Likelihood of Occurrence
		Commonwealth	State		Most Recent	Number	
Birds							
<i>Apus pacificus</i>	Fork-tailed Swift	Marine / Migratory	IA	EPBC Act	-	-	May fly over the project area
<i>Ardea modesta</i>	Great Egret, White Egret	Migratory	IA	DPaW EPBC Act	2009	13	May occur
<i>Cacatua pastinator pastinator</i>	Muir's Corella	-	CD	DPaW	2013	6507	Likely
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	V	VU	DPaW EPBC Act	2013	271	Likely
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	V	EN	DPaW EPBC Act	2010	342	Likely
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	E	EN	DPaW EPBC Act	2013	25	Likely
<i>Falco peregrinus</i>	Peregrine Falcon	-	OS	DPaW NatureMap	2010	2	May occur
<i>Leipoa ocellata</i>	Malleefowl	V	VU	NatureMap	-	-	May occur
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory / Marine	IA	DPaW NatureMap EPBC Act	2009	1	May occur
<i>Motacilla cinerea</i>	Grey Wagtail	Migratory / Marine	IA	EPBC Act	-	-	May occur
<i>Platycercus icterotis</i> subsp. <i>xanthogenys</i>	Western Rosella (inland)	-	P4	NatureMap			May occur
Mammals							
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	V	VU	DPaW EPBC Act	2010	4	Likely
<i>Isoodon obesulus fusciventer</i>	Quenda, Southern Brown Bandicoot	-	P4	DPaW	2000	2	May occur
<i>Macropus irma</i>	Western Brush Wallaby	-	P4	DPaW	2012	5	Likely

Name	Common Name	Conservation Status		Source	DPaW Records		Likelihood of Occurrence
		Commonwealth	State		Most Recent	Number	
				NatureMap			
<i>Myrmecobius fasciatus</i>	Numbat	V	EN	DPaW	2014	1	May occur
<i>Phascogale tapoatafa</i> subsp. (WAM M434)	South-western Brush-tailed Phascogale, Wambenger	-	VU	DPaW	1992	9	May occur
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	V	EN	EPBC Act	-	-	May occur
Fish							
<i>Galaxias truttaceus hesperius</i>	Western Trout Minnow	CE	EN	EPBC Act	-	-	May occur
<i>Galaxiella munda</i>	Mud Minnow, Western Mud Minnow	-	VU	DPaW	1997	12	May occur
<i>Galaxiella nigrostriata</i>	Black-stripe Minnow	-	P3	DPaW	1997	4	May occur
<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	V	VU	DPaW EPBC Act	1997	4	May occur
Invertebrates							
<i>Austromerope poultoni</i>	a scorpionfly	-	P2	DPaW	2004	2	May occur
<i>Hylaeus globuliferus</i>	a bee	-	P3	NatureMap	-	-	May occur
<i>Pseudohydryphantes doegi</i>	Doeg's Watermite	-	P2	DPaW	1998	2	May occur



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LEGEND

Project Area

Fauna Search

- *Cacatua pastinator pastinator*
- *Calyptorhynchus banksii naso*
- *Calyptorhynchus baudinii*
- *Dasyurus geoffroi*
- *Macropus irma*
- *Phascogale tapoatafa subsp. (WAM M434)*
- *Pentapogon quadrifidus var. quadrifidus*
- ▲ *Pentapogon quadrifidus var. quadrifidus*

TPFL

WA Herb

- *Diuris drummondii*
- *Pentapogon quadrifidus var. quadrifidus*
- *Spyridium riparium*
- *Verticordia fimbrilepis subsp. australis*

Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Desktop Flora, Fauna and Vegetation Records

Water Corporation

ROCKY GULLY FLORA
 VEGETATION AND FAUNA SURVEY

Figure

5

6.0 Field Results and Discussion

6.1 Vegetation

6.1.1 Threatened and Priority Ecological Communities

No TECs or PECs were anticipated to occur in the Project Area and none were recorded.



6.1.2 Vegetation Communities

A total of three vegetation communities were described and mapped from 18 relevés within the Project Area during the field assessment. This includes two Jarrah Forest communities and one wetland community.

The wetland community encompasses a mosaic of various wetland species occurring in thickets throughout the Project Area. Foliage cover varies greatly throughout this community, likely dependant on water expression, proximity to the water table, and soil conditions. Access issues prevented us from completing more relevés in the riparian zone. For the purposes of the Level 1 assessment, capturing the riparian vegetation in one community was considered suitable. There are no clear boundaries evident on aerial imagery between the various thickets of wetland species.

Sites completed in ecotones were difficult to classify into a vegetation community and every attempt was made to ensure vegetation community descriptions incorporate common dominant species for the three strata described. For example, Site 16 was located in a seasonally-wet area that is subject to less inundation than other wetland communities. Therefore, the floristic composition present represents a mix of wetland species and Jarrah Forest species.

Table 18 Vegetation communities recorded in the Project Area including code and description using the NVIS system, size of community, representative photograph and survey effort

Code	Vegetation Description	Photograph
Jarrah Forest		
EmAtAp	<p><i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> mid open forest (2000 cm, 50%) over <i>Agonis theiformis</i>, <i>Bossiaea linophylla</i> and <i>Xanthorrhoea preissii</i> (200 cm, 30%) mid to tall shrubland over <i>Anarthria prolifera</i>, <i>Cheilanthes austrotenuifolia</i> and <i>Bossiaea ornata</i> mid to low open mixed sedge/shrub and forbland.</p> <p>Occasional <i>Banksia grandis</i> were observed, usually in poor condition with numerous dead and fallen trees. High diversity of other forbs and shrubs in this community including <i>Leucopogon</i> species, Fabaceae (pea) species, and <i>Lomandra</i>.</p> <p>Area: 223.96 ha Sites: four relevés (2, 3, 7, 12) Species richness: 63 native species</p>	
EmBIHa	<p><i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> mid open forest over <i>Bossiaea linophylla</i>, <i>Leucopogon obovatus</i> subsp. <i>revolutus</i> and <i>Hakea lissocarpha</i> mid open shrubland over <i>Hypocalymma angustifolium</i>, <i>Cyathochaeta avenacea</i> and <i>Astroloma pallidum</i> mid to low open mixed rush/shrubland.</p> <p>The most notable difference between EmBIHa and EmAtAp is the lack of tall shrubs of <i>Agonis theiformis</i> which has led to a more diverse low shrub and forb understory. Encompassed in this community are small bare areas of white sand and exposed granite, too small to map as separate communities for the purposes of this assessment.</p> <p>Area: 322.63 ha Sites: 6 relevés (1, 6, 9, 10, 11, 17), one ecotone releve (16) Species richness: 86 native species</p>	


Code	Vegetation Description	Photograph
Wetland		
MpAsCa	<p><i>Melaleuca preissiana</i>, <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and occasional <i>Eucalyptus rudis</i> low to mid woodland to open woodland over <i>Astartea scoparia</i>, <i>Taxandria parviceps</i> and <i>Melaleuca viminea</i> subsp. <i>viminea</i> tall shrubland over <i>Cyathochaeta avenacea</i>, <i>Leptocarpus kraussii</i> and <i>Philydrella drummondii</i> low sedgeland.</p> <p>The tall shrubland stratum occurs as a mosaic, with often only one of these species occurring as thickets at various locations. <i>Hypocalymma angustifolium</i> observed within ecotone between riparian vegetation and adjacent Jarrah Forest. Contains occasional <i>Juncus kraussii</i>.</p> <p>Area: 111.60 ha Sites: six releves (4, 5, 8, 14, 15, 18) Species richness: 50 native species</p>	



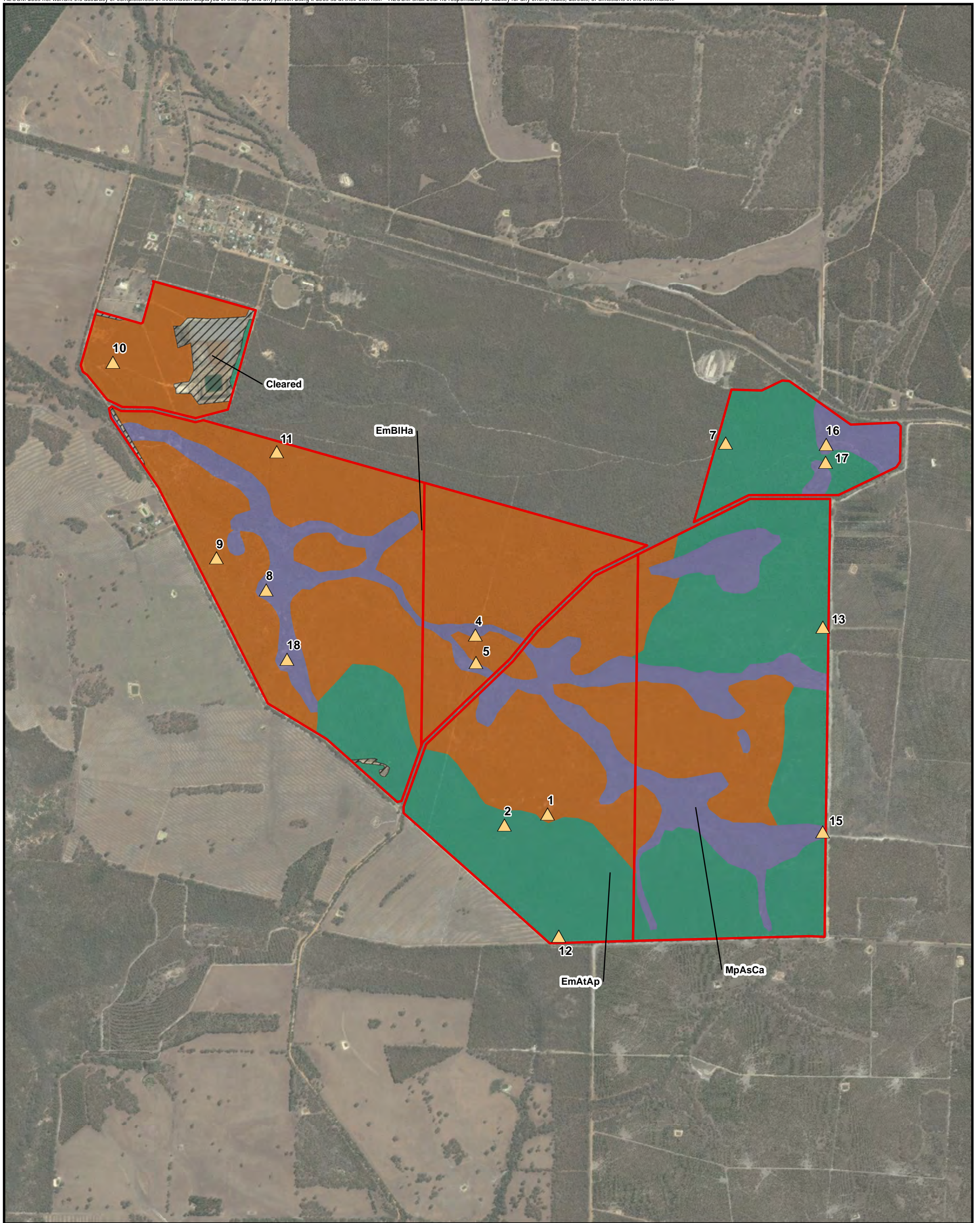
Plate 1 Bare areas in Community EmBIHa



Plate 2 Ecotone grading from wetland to adjacent Jarrah Forest



Plate 3 Example of wetland community density and thickets



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LEGEND

- Project Area
- ▲ Survey Effort
- Vegetation Community**
- Cleared
- EmAtAp
- EmBIHa
- MpAsCa

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 250 500 750 1,000

metres

1:17,500 (when printed at A3)

Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Vegetation Community Mapping	
Water Corporation	
ROCKY GULLY FLORA	
VEGETATION AND FAUNA SURVEY	
	Figure 6

6.1.3 Vegetation Condition

Vegetation condition within the Project area varied from Completely Degraded to Excellent. The majority was mapped as Excellent and extended over 654.25 ha (comprising 97.53 % of the total vegetated area). Completely Degraded vegetation encompassed cleared areas including the existing Water Corporation infrastructure and a gravel pit/rubbish dump. The major contributing factors causing degradation are vegetation clearing. This disturbance however only affected 12.64 ha (1.88 %) of the Project Area. Vegetation condition has been mapped in Figure 7.

Table 19 Vegetation condition mapped within the Project Area

Condition Rating	Area (ha)	Percentage of Project Area
Excellent	654.25	97.53 %
Very Good	3.12	0.46 %
Degraded	0.83	0.12 %
Completely Degraded	12.64	1.88 %

6.2 Flora

6.2.1 Threatened and Priority Flora

There are two flora species that were collected in the field that may represent a Priority flora species. One *Hibbertia* species was collected that may represent the Priority 4 *Hibbertia helianthemoides*. Due to lack of suitable identification material (no flowers), this was not able to be confirmed. This species was not identified in the desktop assessment, however the NatureMap search of the area (including a 20 km buffer) shows records of this species. This specimen was collected at one location and observed at two more locations.

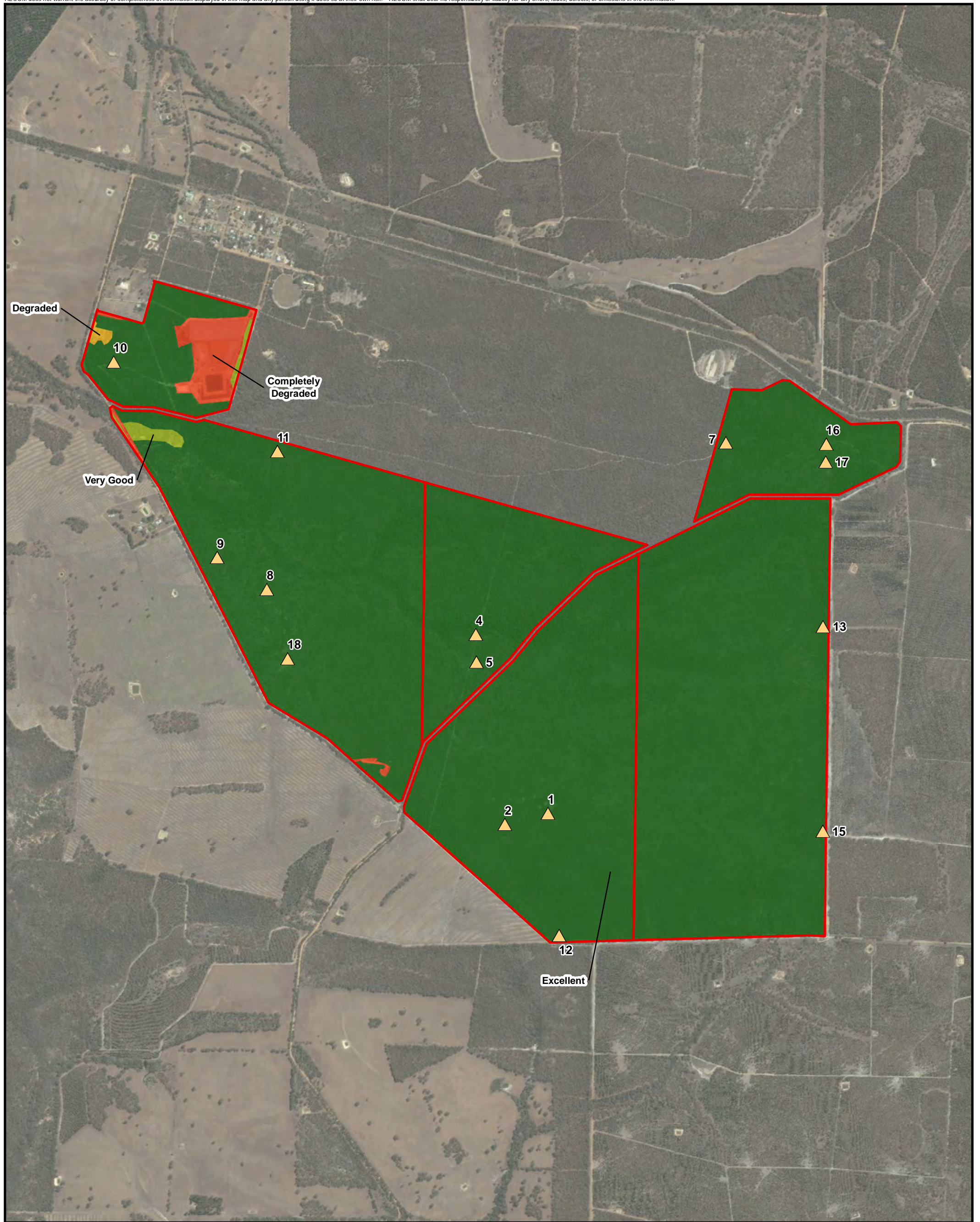
One *Andersonia* collection was made from an open area of white sandy soils. Old flowers and vegetative material were collected and submitted to the WAH for formal identification. There have been two Priority 3 *Andersonia* species collected from the area according to NatureMap and the TPFL database list. This specimen was collected at one location. It is anticipated that WAH identification will be confirmed in time for the submission of the final report.

Due to the survey timing, low-intensity sampling, and lacking quadrat data, it is possible that more Threatened and/or Priority flora species occur in the Project Area, particularly those considered likely to occur in the desktop assessment.

6.2.2 Inventory of Flora Species

A total of 119 species from 69 genera and 35 families were recorded within the Project Area during the field assessment. No weed species were recorded. Families with the highest representation are Fabaceae (16 taxa), Proteaceae (14 taxa), Myrtaceae (12 taxa), and Ericaceae (nine taxa).

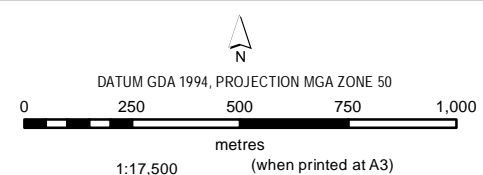
The full list of vascular flora species recorded and representative communities in which they occur in is presented in Appendix D.



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LEGEND
 Project Area
 Survey Effort
Vegetation Condition
 Excellent
 Very Good
 Degraded
 Completely Degraded



Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Vegetation Condition Mapping

Water Corporation

ROCKY GULLY FLORA
 VEGETATION AND FAUNA SURVEY

Figure

7

6.3 Fauna

6.3.1 Fauna species

Sixteen fauna species were recorded within the Project Area during the field survey. This comprised 10 bird, four mammal and one amphibian species. The observed species list is presented in Table 20. Of the 16 fauna species observed, one species was of conservation significance, Baudin's Black Cockatoo (listed as Vulnerable under the EPBC Act and Endangered under the WC Act).

Table 20 Fauna species observed in the Project Area

Name	Common Name	Conservation Status	
		Commonwealth	State
Birds			
<i>Artamus personatus</i>	Masked Woodswallow	-	-
<i>Barnardius zonarius semitorquatus</i>	Twenty-eight Parrot	-	-
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	Vu	V
<i>Corvus coronoides</i>	Australian Raven	-	-
<i>Cracticus tibicen</i>	Australian Magpie	-	-
<i>Dacelo novaeguineae</i>	Laughing Kookaburra*	-	-
<i>Dromaius novae-hollandiae</i>	Emu	-	-
<i>Pachycephala pectoralis</i>	Golden Whistler	-	-
<i>Petroica boodang</i>	Scarlet Robin	-	-
<i>Rhipidura albiscapa</i>	Grey Fantail	-	-
Mammals			
<i>Canis lupis familiaris</i>	Dog*	-	-
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	-	-
<i>Oryctolagus cuniculus</i>	European Wild Rabbit*	-	-
<i>Trichosurus vulpecula</i>	Common Brush-tail Possum	-	-
<i>Vulpes vulpes</i>	Red Fox*	-	-
Amphibians			
<i>Crinia georgiana</i>	Quacking Frog	-	-

6.3.2 Introduced Fauna

Four introduced fauna species were recorded in the Project Area. These comprised:

- Dog (*Canis lupis familiaris*)
- European Wild Rabbit (*Oryctolagus cuniculus*) Declared Pest - s22(2) (C3 Prohibited)
- Red Fox (*Vulpes vulpes*) Declared Pest - s22(2) (C3 Exempt)
- Laughing Kookaburra (*Dacelo novaeguineae*).

The European Wild Rabbit and the Red Fox are both listed as Declared Pests under the BAM Act. Generally these species were recorded intermittently throughout the Project Area, identified either by sight, call, scats, den or tracks.


6.3.3 Fauna habitat



Three main fauna habitats (including Cleared Areas) have been defined and mapped within the Project Area (refer to Table 21 and Figure 8). The delineation of fauna habitats was based on the fauna habitat field assessments and the vegetation mapping.

The most common fauna habitat was the Jarrah and Marri Forest at approximately 81% of the Project Area. This is a Jarrah and Marri dominated habitat that varies in density of understorey. It would generally support many of the common species of the area and would also be utilised by many of the conservation significant fauna species likely to occur in the Project Area such as Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Muir's Corella (*Cacatua pastinator pastinator*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Chuditch (*Dasyurus geoffroii*) and Western Brush Wallaby (*Macropus irma*).

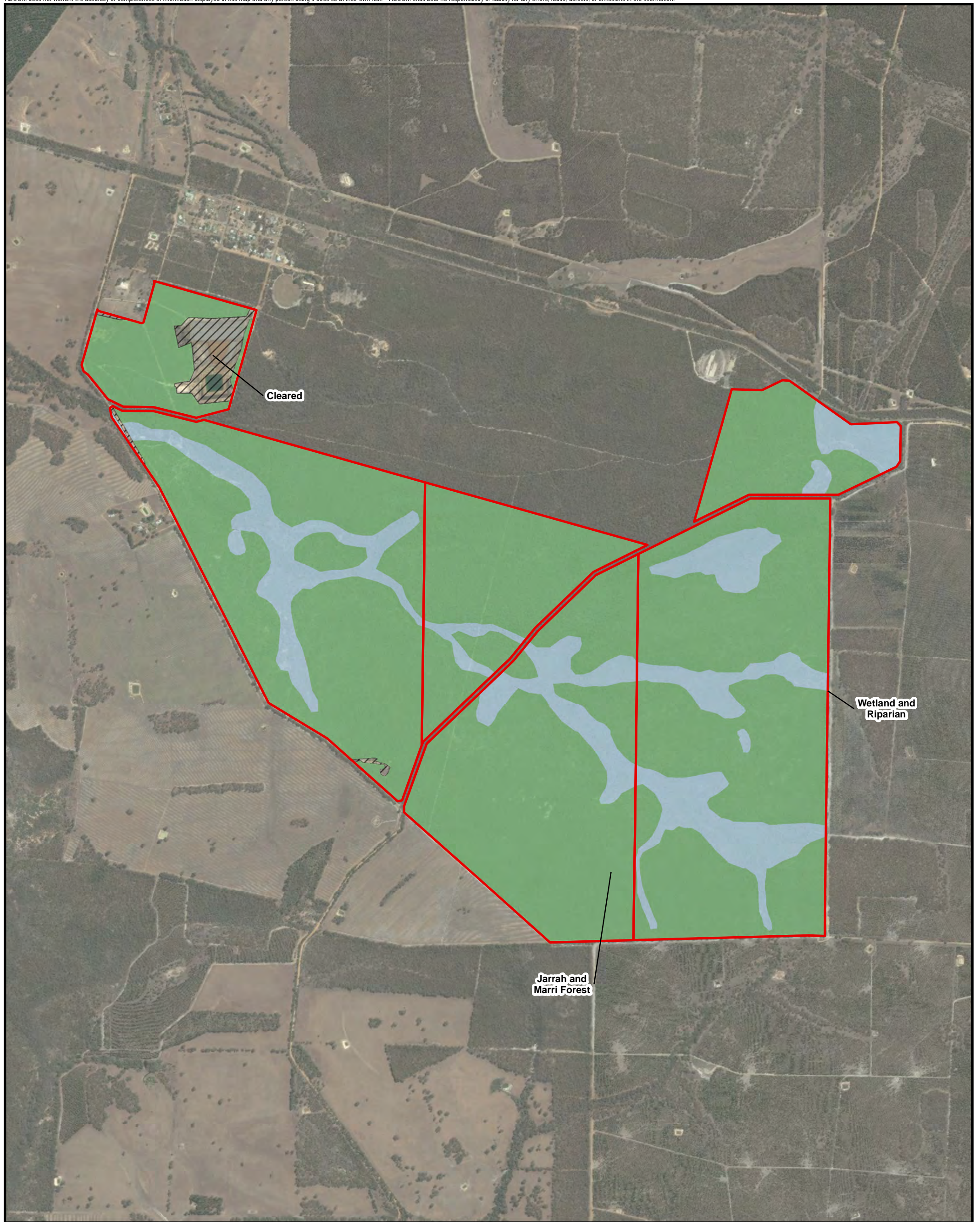
The second most common habitat was the Wetland and Riparian Habitat. This habitat covered approximately 17% of the Project Area. This habitat was varied and contained patches of open *Melaleuca* woodland, patches of tall shrubland and patches of open low sedgeland, with small water bodies and marsh areas. The conservation significant fauna species that would potentially utilise this habitat include Great Egret (*Ardea modesta*), Rainbow Bee-eater (*Merops ornatus*), Chuditch (*Dasyurus geoffroii*) and Western Brush Wallaby (*Macropus irma*).

Table 21 Fauna habitats of the Project Area

Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	Percentage (%)	Photos
Jarrah and Marri Forest	<p>This habitat was varied in density of understory, but generally contained an open Jarrah and Marri dominated overstorey. Habitat features included:</p> <ul style="list-style-type: none"> - mature trees over 30 m were absent - canopy cover of mature trees over 10 m was between 10 and 30% - shrub cover (<2 m) was varied and generally between 10 and 70% - hollows within mature trees were generally occasionally present - fallen logs of varied sizes were generally common to occasionally present - bare ground presence was varied, between rare to common, soils cracks were rare - course and fine litter were generally common - stone presence of any size was generally rare to absent - a cryptogamic crust was generally rare and vines were rare to occasionally present - proteaceous plant species cover was low and generally between 1 – 10% - water bodies were generally absent. 	<p>Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>), Muir's Corella (<i>Cacatua pastinator pastinator</i>), Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>), Baudin's Black Cockatoo (<i>Calyptorhynchus baudinii</i>), Chuditch (<i>Dasyurus geoffroii</i>) and Western Brush Wallaby (<i>Macropus irma</i>).</p>	546.60	81	

Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	Percentage (%)	Photos
Wetlands and riparian vegetation	<p>This habitat was varied and contained patches of open <i>Melaleuca</i> woodland, patches of tall shrubland and patches of open low sedgeland, with marshy areas and occasional small water body.</p> <p>Habitat features included:</p> <ul style="list-style-type: none"> - large and medium sized mature trees were generally absent, though some present in the ecotone areas with the Jarrah and Marri forest - low trees presence varied, with canopy cover up to 70% - hollows were absent - fallen logs were rare to occasionally present and were generally <10 cm diameter - coarse and fine litter were generally rare to occasionally present - bare ground presence was varied, from absent to abundant - stones and boulders were absent - dense shrub presence was absent to common - water was generally present, either as marshy areas or a defined drainage line or water body. 	Great Egret (<i>Ardea modesta</i>), Rainbow Bee-eater (<i>Merops ornatus</i>), Chuditch (<i>Dasyurus geoffroii</i>) and Western Brush Wallaby (<i>Macropus irma</i>).	111.61	17	 

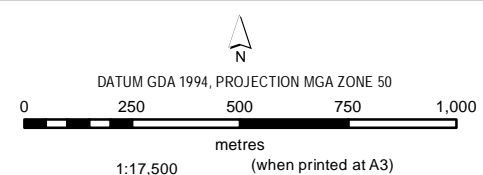
Fauna Habitat	Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	Percentage (%)	Photos
Cleared	Completely degraded and cleared areas.	Rainbow Bee-eater (<i>Merops ornatus</i>) and Western Brush Wallaby (<i>Macropus irma</i>).	12.64	2	



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LEGEND
 Project Area
Fauna Habitat
 Cleared
 Jarrah and Marri Forest
 Wetland and Riparian



Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
 Base Data: (c) Based on information provided by and

Fauna Habitat	
Water Corporation	Figure 8
ROCKY GULLY FLORA	
VEGETATION AND FAUNA SURVEY	

6.3.4 Black Cockatoos

6.3.4.1 Baudin’s Black Cockatoo

Baudin’s Black Cockatoo is distributed throughout the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Storr, 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin’s Black Cockatoo forages primarily in eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri (*Corymbia calophylla*), and seeds of *Eucalyptus* and proteaceous species (e.g. *Banksia* and *Hakea*), as well as orchard fruits and Pines (*Pinus* sp.). It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of *Xanthorrhoea* and the pith of *Anigozanthos flavidus* (Johnstone & Kirkby, 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Tuart (*Eucalyptus gomphocephala* [DSEWPaC, 2012b]). Baudin’s Black Cockatoo nests in spring in the deep southwest of Western Australia.

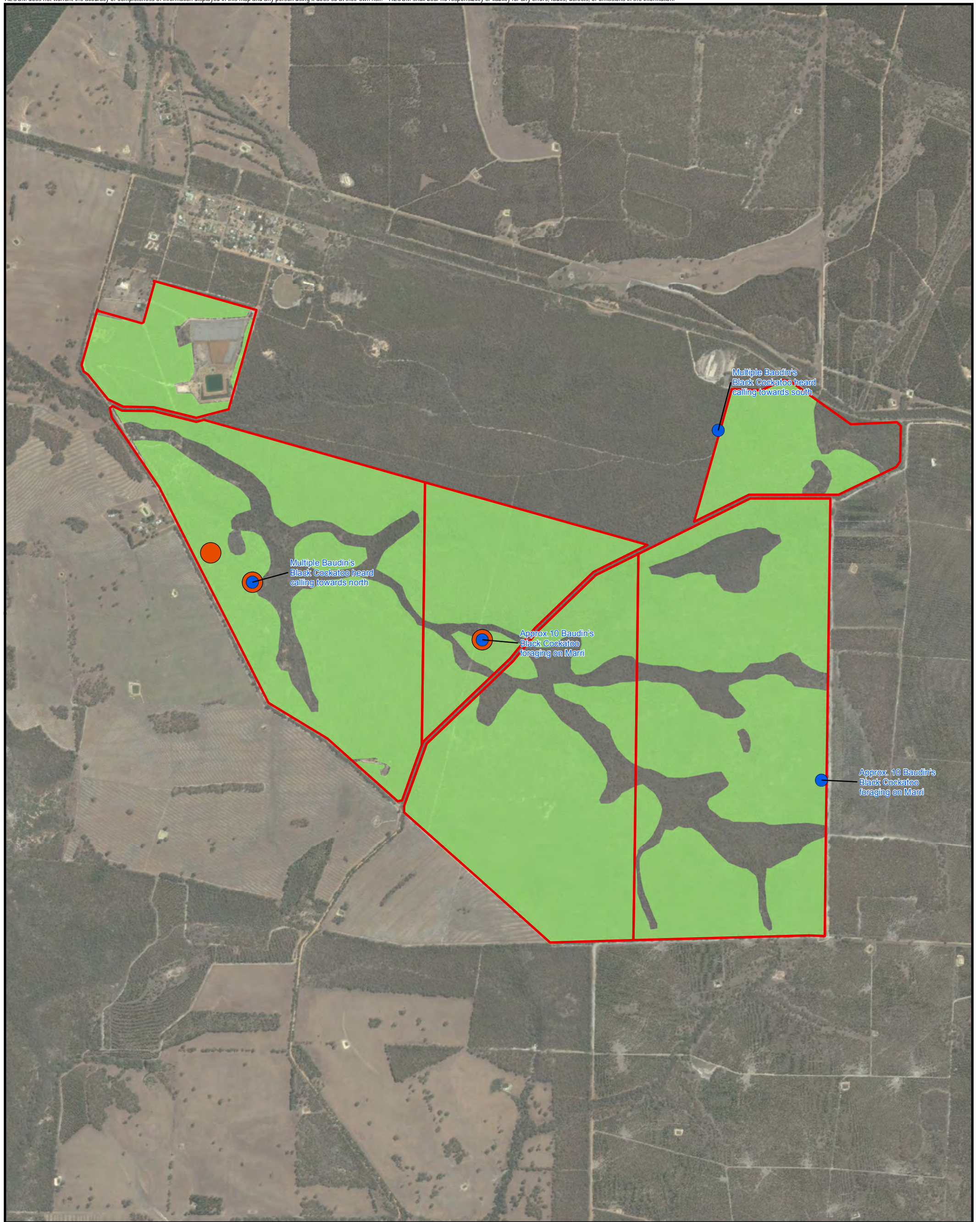
Baudin’s Black Cockatoo were observed four times during the field survey, either flying over the Project Area, foraging on Marri, or heard in close proximity. The details of these records are presented in Table 22 and locations illustrated on Figure 9.

Table 22 Baudin’s Black Cockatoo observations

Observation	Date	Coordinates	
Approx. 10 birds observed foraging on Marri	12/07/2016	-34.535353	117.044298
Multiple birds heard calling towards the south	12/07/2016	-34.519493	117.03838
Multiple birds heard calling towards the north	13/07/2016	-34.526662	117.012872
Approx. 10 birds observed foraging on Marri (Plate 4)	14/07/2016	-34.529149	117.025547



Plate 4 Baudin’s Black Cockatoos observed in the Project Area



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LEGEND

- Project Area
- Black Cockatoo Observations
- Potential Baudin's Black Cockatoo Foraging Evidence

Black Cockatoo Foraging Habitat

- High Quality

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

metres

1:17,500
(when printed at A3)

Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Black Cockatoo Foraging Habitat and Observations

<p>Water Corporation</p> <p>ROCKY GULLY FLORA</p> <p>VEGETATION AND FAUNA SURVEY</p>	<p>Figure</p> <p style="font-size: 2em;">9</p>
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6.3.4.2 Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPaC, 2012b). It has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) seeds, but also feeding on Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri (*Eucalyptus diversicolor*), Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone, 2016 pers. comm.). Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5–33 m above ground. Most nests are in very large and very old, mature Marri (*Corymbia calophylla*) (Johnstone, Kirkby & Sarti, 2013), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.).

The Forest Red-tailed Black Cockatoo was not recorded during the field survey.

6.3.4.3 Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin (DEC, 2009). This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill.

Carnaby's Black Cockatoo feed on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia*, *Grevillea* and *Hakea*), *Corymbia calophylla* (Marri), *Eucalyptus* (e.g. Jarrah [*Eucalyptus marginata*]), and seeds from the cones of Pine trees (*Pinus* sp.).

Carnaby's Black Cockatoo display strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum (*Eucalyptus salmonophloia*), York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*), Flooded Gum (*Eucalyptus rudis*), Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Tuart (*Eucalyptus gomphocephala* [DSEWPaC, 2012b]). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr, 1998). The species appears to be expanding its current breeding range westward and south into the Jarrah-Marri forests of the Darling Range and into the Tuart forests of the SCP (Johnstone and Kirkby, 2006). After breeding, Carnaby's Black Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July (DEC, 2009). Breeding has been recorded from early July to mid-December.

Carnaby's Black Cockatoo were not observed during the field survey.

6.3.5 Black Cockatoo foraging habitat

The Project Area contains a significant amount of small and mature Marri and Jarrah trees. It also contains and is located adjacent to several freshwater sources. It does not contain habitats dominated by proteaceous species.

6.3.5.1 Baudin's Black Cockatoo

Baudin's Black Cockatoos were observed foraging on Marri within the Project Area on 12th and 14th July 2016. Recent evidence of Baudin's Black Cockatoo foraging within the Project Area was recorded an additional three times during the field survey. Table 23 provides the details regarding these observations, locations are illustrated on Figure 9.

No Baudin's Black Cockatoo breeding or roosting sites are known within 12 km and six kilometres respectively of the Project Area and the site is outside of the known foraging area for Baudin's Black Cockatoo (DSEWPaC, 2012b). The foraging assessment determined that the Project Area contains approximately 547 ha of High quality foraging habitat for Baudin's Black Cockatoo. This 547 ha is comprised of Jarrah and Marri Forest fauna habitat. Refer to Figure 9.

Table 23 Potential Baudin’s Black Cockatoo foraging evidence

Observation	Date	Coordinates		Plate
Typical chewing on Marri nut	13 July 2016	-34.52535	117.010553	Plate 5 and Plate 6
Typical chewing on Marri nut	13 July 2016	-34.526662	117.012873	Plate 7
Typical chewing on Marri nut	12 July 2016	-34.529149	117.025547	Plate 8



Plate 5 Baudin’s Black Cockatoo foraging evidence



Plate 6 Baudin’s Black Cockatoo foraging evidence



Plate 7 Baudin’s Black Cockatoo foraging evidence



Plate 8 Baudin’s Black Cockatoo foraging evidence

6.3.5.2 Forest Red-tailed Black Cockatoo

There is a known Forest Red-tailed Black Cockatoo breeding location within 12 km of the Project Area, and the Marri and Jarrah present exhibit good recruitment. The foraging assessment determined that the 547 ha of the Jarrah and Marri Forest fauna habitat would provide High quality foraging habitat for the Forest Red-tailed Black Cockatoo. Figure 9 illustrates this foraging habitat.

6.3.5.3 Carnaby’s Black Cockatoo

The Project Area contains a significant amount of young and mature Jarrah and Marri trees with breeding potential, but does not contain habitats dominated by proteaceous species and is not within the Swan Coastal Plain (SCP). Both these factors influence the foraging quality assessment, however quality was still recorded as ‘High’ with the assessment showing 547 ha of the Jarrah and Marri forest considered suitable habitat (of High quality). Figure 9 illustrates this foraging habitat.

6.3.6 Breeding habitat

The Jarrah and Marri Forest fauna habitat within the Project Area has been defined as Quality breeding habitat due to the moderate density of potentially suitable breeding eucalypts (with a DBH >500 cm). In total, the Project Area contains approximately 547 ha of Quality Black Cockatoo breeding habitat. Plate 9 illustrates this potential breeding habitat. The mean number of potentially suitable breeding trees per quadrat was 12.625 (n = 8, SD 3.71). Therefore, within the approximate 547 ha of Quality breeding habitat, there is approximately 30,000 potentially suitable breeding trees.

The breeding habitat mapping is illustrated in Figure 10.



Plate 9 High quality breeding habitat

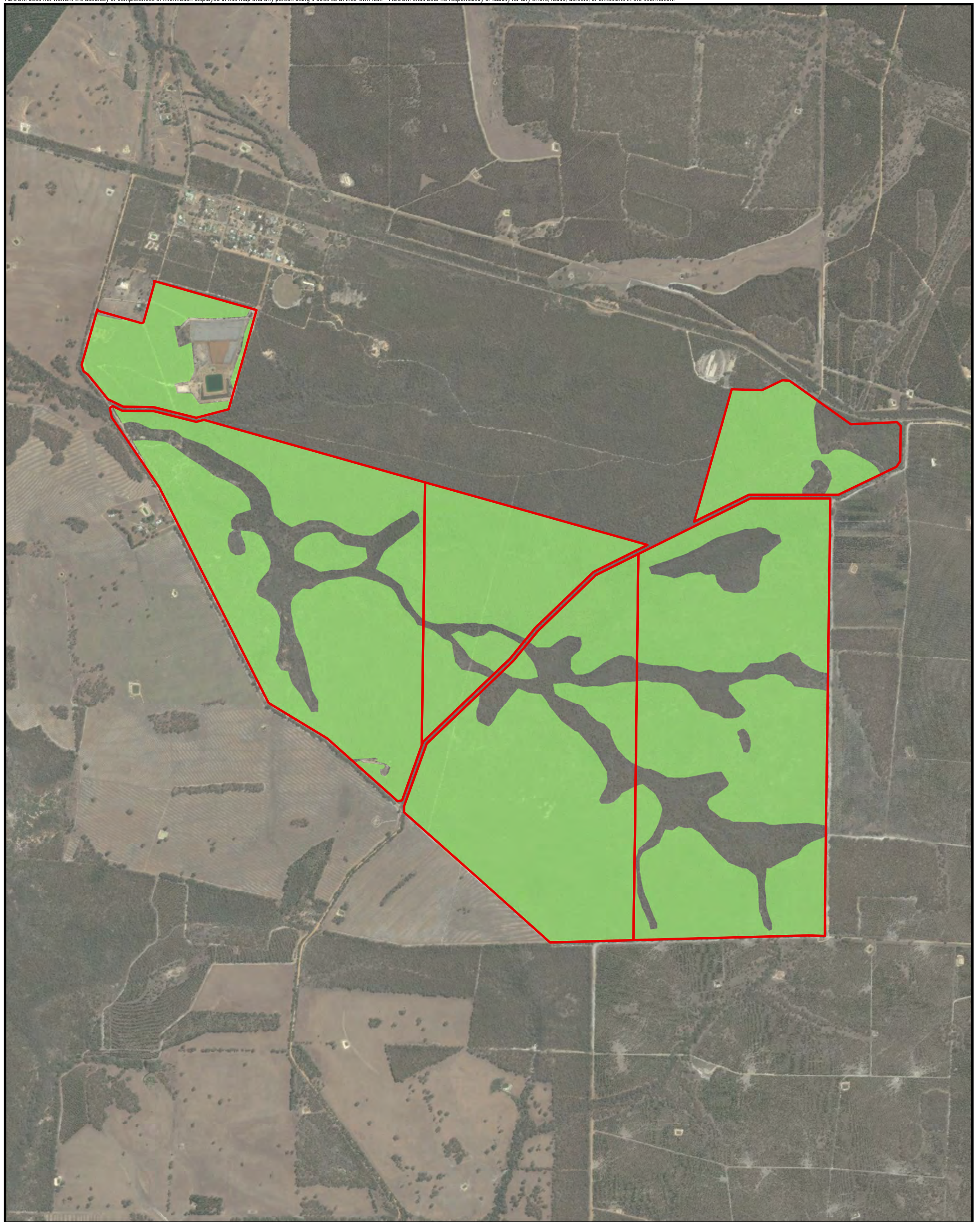
6.3.7 Roosting sites

Both white-tailed Black Cockatoo species typically roost in the tallest trees in the landscape in or near riparian environments or near other permanent water sources. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting (DSEWPac, 2012b). Evidence of roosting usually involves large amounts of bird scat beneath a large, mature tree, with a significant amount of broken branches on the ground. Searches for roosting evidence were undertaken alongside the other Black Cockatoo assessments and no Black Cockatoo roost sites were identified.

6.3.8 Fauna habitat linkages

Habitat linkages are typically areas or corridors of vegetation that link (larger) areas of fauna habitat. Linkages are important as they enable fauna to move freely between remnant bushland patches, therefore increasing gene-flow between populations. A study conducted by Gilbert *et al.* (1998) found that corridors and/or linkages do maintain species richness in the fragmented landscapes.

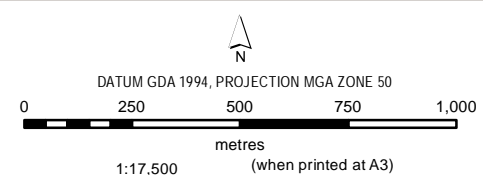
The Project Area does not provide a significant habitat linkage in terms of it connecting separate and potentially isolated areas of fauna habitat. However, the Project Area is located in an area with vast amounts of historic clearing for agriculture to the north, and significant adjacent areas containing tree plantations. To the south of the Project Area are large areas of State Forest / National Park. The Project Area therefore provides an area of good quality fauna habitat that acts as a buffer from the cleared agricultural lands to the State Forest / National Park.



PROJECT ID 60507828
 CREATED BY DGF
 APPROVED BY FDW
 LAST MODIFIED 09 AUG 2016



LEGEND
 Project Area
 Black Cockatoo Breeding Habitat
 Quality



Data sources: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Base Data: (c) Based on information provided by and

Black Cockatoo Breeding Habitat

Water Corporation

**ROCKY GULLY FLORA
 VEGETATION AND FAUNA SURVEY**

Figure

10

6.4 Riparian Assessment

The riparian vegetation was captured as vegetation community MpAsCa, which encompassed both narrow running streams (an expression of recent rains and groundwater rather than a permanent stream), open sumplands where soil was inundated but no water evident on the surface, and adjacent floodplain where riparian vegetation grades into Jarrah Forest communities. No weeds were observed during the field survey in the riparian vegetation. This is surprising as it is likely that some of the water tributaries are from adjacent cleared land. This could be representative of the timing of the field survey (winter rather than spring),

Riparian vegetation was considered as A grade vegetation in the pristine category:

- Pristine. The river embankments and floodway are entirely vegetated with native species, and there is no evidence of human presence or livestock damage

Except near the track, where riparian vegetation was considered in the A2 category:

- Near pristine. Native vegetation dominates. Some introduced weeds may be present in the understorey, but not to the extent that they displace native species. Otherwise there is no evidence of human impact. (A river valley in this condition is as good as will be found today).

7.0 References

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Appendix A

Conservation Code Categories

Appendix A – Conservation Categories

1.1 Western Australia

Plants and animals that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Wildlife Conservation Act (WC Act)*. These categories are defined in Table 1. Threatened species are published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as outlined in Table 1.

Species that have not yet been adequately surveyed to warrant being listed under Schedule 1 or 2 are added to the Priority Flora or Fauna Lists under Priority 1, 2 or 3. 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 list for other than taxonomic reasons, are placed in Priority 4 and require regular monitoring. Conservation Dependent species and ecological communities are placed in Priority 5. Categories and definitions of Priority Flora and Fauna species are provided in Table 2.

Table 1 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Conservation Code	Category
CR	<p>Critically endangered species</p> <p>Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EN	<p>Endangered species</p> <p>Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
VU	<p>Vulnerable species</p> <p>Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EX	<p>Presumed extinct species</p> <p>Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.</p>
IA	<p>Migratory birds protected under an international agreement</p> <p>Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.</p>

Table 2 Conservation codes for WA flora and fauna (DPaW 2015)

Conservation Code	Category
P1	<p>Priority One – Poorly Known Species</p> <p>Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
P2	<p>Priority Two – Poorly Known Species</p> <p>Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>
P3	<p>Priority Three – Poorly Known Species</p> <p>Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities 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 localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.</p>
P4	<p>Priority Four – Rare, Near Threatened and other species in need of monitoring</p> <p>a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>c) (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
P5	<p>Priority Five: Conservation Dependent species</p> <p>Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.</p>

1.2 Commonwealth

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Australia's central piece of environmental legislation which provides for the listing of nationally Threatened native species and ecological communities, native migratory species and marine species.

Threatened fauna and flora may be listed in any one of seven categories as defined in Section 179 of the EPBC Act. These categories are defined in Table 3.

Table 3 Categories of Species Listed under Schedule 179 of the EPBC Act 1999 [Commonwealth]

Conservation	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	<p>Conservation Dependent Taxa which at a particular time if, at that time:</p> <ul style="list-style-type: none"> a) 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 b) the following subparagraphs are satisfied: <ul style="list-style-type: none"> i. the species is a species of fish ii. 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 iii. the plan of management is in force under a law of the Commonwealth or of a State or Territory iv. cessation of the plan of management would adversely affect the conservation status of the species.

2.0 Threatened and Priority Ecological Communities

2.1 Western Australia

State listed TECs are not protected under any legislation, rather they are endorsed by the Environment Minister. Categories of TECs are defined in Table 4. Priority Ecological Communities are endorsed by the Environment Minister as having insufficient information available to be considered a TEC, or which are rare but not currently threatened. Categories are described in Table 5.

Table 4 Conservation codes for state-listed Threatened Ecological Communities

Conservation Code	Category
PD	<p>Presumed Totally Destroyed</p> <p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An Ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed</p>
CR	<p>Critically Endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <ol style="list-style-type: none"> i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ol style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>
EN	<p>Endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most</p>

Conservation Code	Category
	<p>of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C).</p> <p>A) The geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 20 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 20 years) the community is unlikely to be capable of being substantially rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 20 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. <p>The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 20 years).</p>
<p>VU</p>	<p>Vulnerable</p> <p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatened processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C).</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.</p> <p>C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium or long term future because of existing or impending threatening processes.</p>

Table 5 Categories for Priority Ecological Communities

Conservation	Code Category
P1	<p>Priority One: poorly-known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
P2	<p>Priority Two: poorly-known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Priority Three: poorly known ecological communities</p> <ol style="list-style-type: none"> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation ii. communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat iii. communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>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. These communities require regular monitoring.</p> <ol style="list-style-type: none"> i. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	<p>Priority Five: Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

2.2 Commonwealth

Communities can be classified as TECs under the *Environment Protection and Biodiversity Conservation Act 1999*. The EPBC act protects Australia’s ecological communities by providing for:

- Identification and listing of ecological communities as threatened
- Development of conservation advice and recovery plans for listed ecological communities
- Recognition of key threatening processes
- Where appropriate, reducing the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 6.

Table 6 Categories of TECs that are listed under the EPBC Act

Conservation 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.

Appendix B

EPBC Act Protected Matters Search Report



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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/05/16 12:52:04

[Summary](#)

[Details](#)

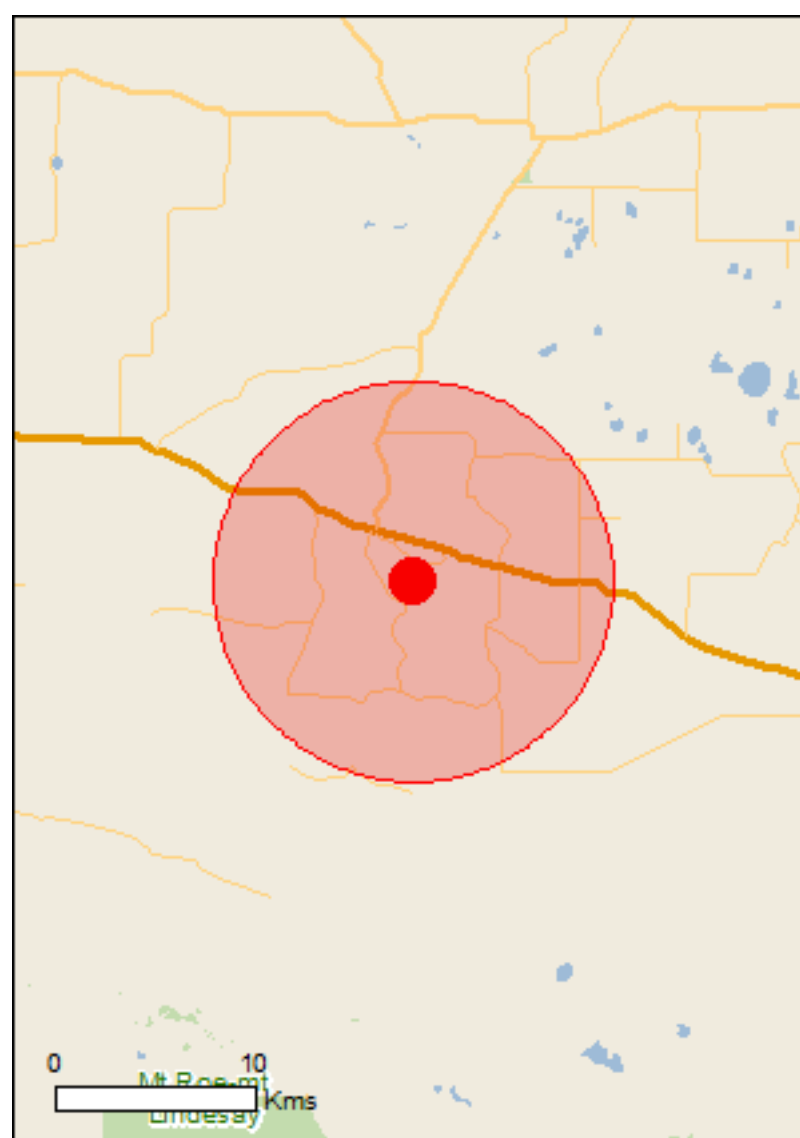
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

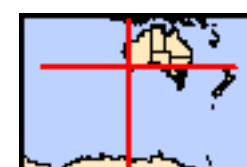
[Acknowledgements](#)



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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	16
Listed Migratory Species:	7

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 <http://www.environment.gov.au/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 Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	8
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	19
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	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.

Name	Status	Type of Presence
Proteaceae Dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
------	--------	------------------

Birds

Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
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Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
--	------------	--

Calyptorhynchus baudinii Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding likely to occur within area
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Calyptorhynchus latirostris Carnaby's Cockatoo, Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
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Fish

Galaxias truttaceus hesperius Spotted Galaxias (western subspecies), Western Spotted Galaxias, Western Trout Galaxias [81282]	Critically Endangered	Species or species habitat likely to occur within area
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Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
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Mammals

Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
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Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat may occur within area
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Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
--	------------	--

Plants

Caladenia christineae Christine's Spider Orchid [56716]	Vulnerable	Species or species habitat likely to occur within area
--	------------	--

Name	Status	Type of Presence
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat likely to occur within area
Conostylis misera Grass Conostylis [21320]	Endangered	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[[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.

Name

Commonwealth Land -

Listed Marine Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Birds

[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species habitat likely to occur within area

[Ardea alba](#)

Great Egret, White Egret [59541]

Species or species habitat likely to occur within area

[Ardea ibis](#)

Cattle Egret [59542]

Species or species habitat may occur within area

[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle [943]

Species or species habitat likely to occur within area

[Merops ornatus](#)

Rainbow Bee-eater [670]

Species or species habitat may occur within area

[Motacilla cinerea](#)

Grey Wagtail [642]

Species or species habitat may occur within area

[Pandion haliaetus](#)

Osprey [952]

Species or species habitat may occur within area

[Tringa nebularia](#)

Common Greenshank, Greenshank [832]

Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves

[[Resource Information](#)]

Name	State
------	-------

Mount Roe

WA

Tootanellup

WA

Regional Forest Agreements

[[Resource Information](#)]

Note that all areas with completed RFAs have been included.

Name	State
------	-------

[South West WA RFA](#)

Western Australia

Invasive Species

[[Resource Information](#)]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-34.5278 117.02475

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](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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.

Appendix C

Desktop Fauna Assessment

Appendix C Fauna Desktop Results

The fauna desktop assessment identified 48 Threatened and Priority fauna species that could potentially occur in the Project Area. Of these, six species are considered likely to occur, 18 species may occur (or fly over) and 24 species are considered unlikely to inhabit the Project Area, based on the presence of potentially suitable habitat and recent records of these species in the Study Area. The fauna desktop assessment has been provided as Table 1.

Table 1 Desktop fauna assessment for the Rocky Gully Offset Project Area

Name	Common Name	Conservation Status		Source	DPaW Records		Likelihood of Occurrence
		Commonwealth	State		Most Recent	Number	
Birds							
<i>Apus pacificus</i>	Fork-tailed Swift	M / Mig	IA	EPBC Act	-	-	May fly over the project area
<i>Ardea modesta</i>	Great Egret, White Egret	Mig	IA	DPaW EPBC Act	2009	13	May occur
<i>Ardea ibis</i>	Cattle Egret	Mig	IA	EPBC Act	-	-	Unlikely
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	EN	DPaW EPBC Act	2013	41	Unlikely
<i>Cacatua pastinator pastinator</i>	Muir's Corella	-	CD	DPaW	2013	6507	Likely
<i>Calidris ruficollis</i>	Red-necked Stint	Mig / M	IA	DPaW	2013	166	Unlikely
<i>Calidris subminuta</i>	Long-toed Stint	Mig	IA	DPaW	2009	1	Unlikely
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	V	VU	DPaW EPBC Act	2013	271	Likely
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	V	EN	DPaW EPBC Act	2010	342	Likely
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	E	EN	DPaW EPBC Act	2013	25	Likely
<i>Falco peregrinus</i>	Peregrine Falcon	-	OS	DPaW Naturemap	2010	2	May occur
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M	-	EPBC Act	-	-	Unlikely
<i>Ixobrychus minutus</i>	Little Bittern	-	P4	DPaW	2009	31	Unlikely
<i>Leipoa ocellata</i>	Malleefowl	V	VU	Naturemap	-	-	May occur
<i>Merops ornatus</i>	Rainbow Bee-eater	Mig / M	IA	DPaW Naturemap EPBC Act	2009	1	May occur

Name	Common Name	Conservation Status		Source	DPaW Records		Likelihood of Occurrence
		Commonwealth	State		Most Recent	Number	
<i>Motacilla cinerea</i>	Grey Wagtail	Mig / M	IA	EPBC Act	-	-	May occur
<i>Oxyura australis</i>	Blue-billed Duck	-	P4	DPaW	2013	538	Unlikely
<i>Platycercus icterotis</i> subsp. <i>xanthogenys</i>	Western Rosella (inland)	-	P4	Naturemap			May occur
<i>Psophodes nigrogularis</i> subsp. <i>oberon</i>	Western Whipbird (Mallee)	-	P4	Naturemap	-	-	Unlikely
<i>Psophodes nigrogularis</i> subsp. <i>nigrogularis</i>	Western Whipbird (western heath)	E	EN	Naturemap	-	-	Unlikely
<i>Pandion haliaetus</i>	Osprey	Mig / M	IA	EPBC Act	-	-	Unlikely
<i>Tringa glareola</i>	Wood Sandpiper	Mig / M	IA	DPaW	2006	2	Unlikely
<i>Tringa nebularia</i>	Common Greenshank	Mig / M	IA	DPaW EPBC Act	2013	152	Unlikely
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (southwestern)	-	P3	DPaW	1999	1	Unlikely
Mammals							
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	E	CE	DPaW	-	1	Unlikely
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	V	VU	DPaW EPBC Act	2010	4	Likely
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle	-	P4	DPaW	1974	1	Unlikely
<i>Isoodon obesulus fusciventer</i>	Quenda, Southern Brown Bandicoot	-	P4	DPaW	2000	2	May occur
<i>Macropus eugenii</i> subsp. <i>derbianus</i>	Tammar Wallaby (WA subsp)	-	P5	Naturemap	-	-	Unlikely
<i>Macropus irma</i>	Western Brush Wallaby	-	P4	DPaW Naturemap	2012	5	Likely
<i>Macrotis lagotis</i>	Bilby	V	VU	DPaW	1975	3	Unlikely
<i>Myrmecobius fasciatus</i>	Numbat	V	EN	DPaW	2014	1	May occur

Name	Common Name	Conservation Status		Source	DPaW Records		Likelihood of Occurrence
		Commonwealth	State		Most Recent	Number	
<i>Phascogale tapoatafa</i> subsp. (WAM M434)	South-western Brush-tailed Phascogale, Wambenger	-	VU	DPaW	1992	9	May occur
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	V	EN	EPBC Act	-	-	May occur
<i>Pseudomys occidentalis</i>	Western Mouse	-	P4	Naturemap	-	-	Unlikely
<i>Setonix brachyurus</i>	Quokka	V	VU	DPaW EPBC Act	1997	1	Unlikely
Reptiles							
<i>Elapognathus minor</i>	Short-nosed Snake	-	P2	DPaW	1997	4	Unlikely
Fish							
<i>Galaxias truttaceus hesperius</i>	Western Trout Minnow	CE	EN	EPBC Act	-	-	May occur
<i>Galaxiella munda</i>	Mud Minnow, Western Mud Minnow	-	VU	DPaW	1997	12	May occur
<i>Galaxiella nigrostriata</i>	Black-stripe Minnow	-	P3	DPaW	1997	4	May occur
<i>Geotria australis</i>	Pouched Lamprey	-	P1	DPaW	1945	1	Unlikely
<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	V	VU	DPaW EPBC Act	1997	4	May occur
Amphibians							
<i>Spicospina flammocaerulea</i>	Sunset Frog	E	VU	DPaW	2008	78	Unlikely
Invertebrates							
<i>Austromerope poultoni</i>	a scorpionfly	-	P2	DPaW	2004	2	May occur
<i>Hylaeus globuliferus</i>	a bee	-	P3	Naturemap	-	-	May occur
<i>Pseudohydryphantes doegi</i>	Doeg's Watermite	-	P2	DPaW	1998	2	May occur
<i>Synemon gratiosa</i>	Graceful Sunmoth	-	P4	Naturemap	-	-	Unlikely

Appendix D

Vascular Flora Species Recorded within each Community

Appendix D Vascular Flora Species Recorded within each Community, Rocky Gully 2016

Family	Taxon	EmBIHa	EmAtAp	MpAsCa
Anarthriaceae	<i>Anarthria prolifera</i>	x	x	
	<i>Lyginia barbata</i>			x
Apiaceae	<i>Xanthosia atkinsoniana</i>	x		
	<i>Xanthosia candida</i>	x		
	<i>Xanthosia rotundifolia</i>	x		
Asparagaceae	<i>Acanthocarpus preissii</i>	x		
	<i>Chamaescilla corymbosa</i>	x		x
	<i>Lomandra hermaphrodita</i>	x	x	
	<i>Lomandra nigricans</i>		x	
	<i>Lomandra sericea</i>		x	
	<i>Lomandra sonderi</i>		x	x
Asteraceae	<i>Craspedia variabilis</i>			
	<i>Lagenophera huegelii</i>	x	x	x
	<i>Senecio diaschides</i>			x
Boryaceae	<i>Borya sphaerocephala</i>	x		
Cyperaceae	<i>Cyathochaeta avenacea</i>	x	x	x
	<i>Lepidosperma gracile</i>	x	x	
	<i>Lepidosperma pubisquameum</i>	x		
	<i>Lepidosperma squameum</i>	x	x	
	<i>Mesomelaena tetragona</i>	x		
	<i>Tetragonia octandra</i>		x	
Dasyopogonaceae	<i>Dasyopogon bromeliifolius</i>		x	
Dilleniaceae	<i>Hibbertia amplexicaulis</i>	x		x
	<i>Hibbertia commutata</i>	x		
	<i>Hibbertia cunninghamii</i>	x		x
	<i>Hibbertia hypericoides</i>	x	x	
	<i>Hibbertia hypericoides/helianthemoides</i> (P4)	x	x	
Droseraceae	<i>Drosera erythrorhiza</i>	x		x
	<i>Drosera glanduligera</i>	x		
	<i>Drosera macrantha</i> subsp. <i>macrantha</i>	x	x	
Ericaceae	<i>Andersonia caerulea</i>			
	<i>Astroloma ciliatum</i>	x		x
	<i>Astroloma pallidum</i>	x	x	x
	<i>Leucopogon australis</i>		x	x
	<i>Leucopogon capitellatus</i>	x	x	x
	<i>Leucopogon obovatus</i> subsp. <i>revolutus</i>	x	x	
	<i>Leucopogon pendulus</i>	x	x	x
	<i>Leucopogon</i> sp.		x	
	<i>Leucopogon verticillatus</i>	x	x	x
SUBMIT - <i>Andersonia</i>	x			

Family	Taxon	EmBIHa	EmAtAp	MpAsCa
Fabaceae	<i>Acacia alata</i>		X	
	<i>Acacia browniana</i>	X	X	
	<i>Acacia divergens</i>			X
	<i>Acacia drummondii</i> subsp. <i>drummondii</i>		X	
	<i>Acacia extensa</i>	X	X	X
	<i>Acacia myrtifolia</i>		X	X
	<i>Acacia saligna</i>			X
	<i>Acacia stenoptera</i>	X		X
	<i>Bossiaea linophylla</i>	X	X	X
	<i>Bossiaea ornata</i>	X	X	
	<i>Daviesia incrassata</i> subsp. <i>incrassata</i>	X	X	X
	<i>Gompholobium knightianum</i>		X	
	<i>Gompholobium marginatum</i>	X	X	
	<i>Hovea chorizemifolia</i>	X	X	
	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>	X	X	
	<i>Kennedia coccinea</i>	X		
Goodeniaceae	<i>Dampiera linearis</i>	X	X	
	<i>Lechenaultia ?biloba</i>	X	X	
Haemodoraceae	<i>Conostylis ?aculeata</i>	X		
	<i>Conostylis laxiflora</i>	X		
	<i>Conostylis setigera</i> subsp. <i>setigera</i>	X	X	
Hemerocallidaceae	<i>Dianella revoluta</i>	X		X
Iridaceae		X	X	X
	<i>Patersonia juncea</i>	X		
	<i>Patersonia occidentalis</i>	X	X	X
Juncaceae	<i>Juncus kraussii</i>			X
Lauraceae				X
	<i>Cassytha glabella</i>			X
Myrtaceae	<i>Agonis theiformis</i>	X	X	
	<i>Astartea scoparia</i>			X
	<i>Babingtonia camphorosmae</i>	X		X
	<i>Corymbia calophylla</i>	X	X	X
	<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	X	X	X
	<i>Eucalyptus rudis</i>			X
	<i>Hypocalymma angustifolium</i>	X		X
	<i>Kunzea micrantha</i> subsp. <i>micrantha</i>			X
	<i>Melaleuca densa</i>			X
	<i>Melaleuca preissiana</i>	X		X
	<i>Melaleuca viminea</i> subsp. <i>viminea</i>			X
	<i>Taxandria parviceps</i>		X	X
	Orchidaceae	<i>Pterostylis nana</i>		X
<i>Pyrorchis nigricans</i>		X	X	
Philydraceae	<i>Philydrella drummondii</i>			X
Phyllanthaceae	<i>Phyllanthus calycinus</i>	X		
Pittosporaceae	<i>Billardiera laxiflora</i>			X
Poaceae	<i>Tetrarrhena laevis</i>	X	X	X
Polygalaceae			X	
	<i>Comesperma calymega</i>		X	

Family	Taxon	EmBIHa	EmAtAp	MpAsCa
Proteaceae	<i>Banksia dallanneyi</i> var. <i>dallanneyi</i>	x	x	
	<i>Banksia formosa</i>	x		
	<i>Banksia grandis</i>		x	
	<i>Grevillea depauperata</i>	x	x	x
	<i>Hakea amplexicaulis</i>	x	x	
	<i>Hakea lissocarpa</i>	x	x	
	<i>Hakea prostrata</i>			x
	<i>Hakea trifurcata</i>	x		x
	<i>Hakea undulata</i>	x		
	<i>Hakea varia</i>	x		x
	<i>Persoonia longifolia</i>	x	x	
	<i>Petrophile diversifolia</i>		x	
	<i>Petrophile serruriae</i>	x		
	<i>Synaphea petiolaris</i> subsp. <i>petiolaris</i>	x		
Pteridaceae	<i>Cheilanthes austrotenuifolia</i>		x	
Ranunculaceae	<i>Clematis pubescens</i>	x		
Restionaceae	<i>Alexgeorgea nitens</i>	x		
	<i>Desmocladius fasciculatus</i>	x	x	
	<i>Hypolaena exsulca</i>	x		x
	<i>Leptocarpus kraussii</i>	x		x
Rubiaceae	<i>Opercularia echinocephala</i>	x	x	
	<i>Opercularia</i> sp.		x	
	<i>Opercularia vaginata</i>	x		
Rutaceae	<i>Boronia fastigiata</i>	x		
Stylidiaceae	<i>Stylidium brunonianum</i>	x	x	x
	<i>Stylidium amoenum</i>	x	x	x
	<i>Stylidium piliferum</i>	x		
	<i>Stylidium repens</i>	x	x	
	<i>Stylidium tenue</i>	x		
Thymeliaceae	<i>Pimelea ?suaveolens</i>	x	x	
Violaceae	<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	x		
Xanthorrhoeaceae	<i>Xanthorrhoea gracilis</i>		x	
	<i>Xanthorrhoea preissii</i>			
Zamiaceae		x	x	x
	<i>Macrozamia riedlei</i>	x	x	x



Appendix D

Certificate of Title – Rocky Gully



REGISTER NUMBER 1940/DP203465	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED**

VOLUME **LR3168** FOLIO **362**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 1940 ON DEPOSITED PLAN 203465

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: CONSERVATION AND PARKS COMMISSION OF 17 DICK PERRY AVENUE
KENSINGTON WA 6151

(XE N653886) REGISTERED 22/6/2017

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. N653885 PART RESERVE 52970 FOR THE PURPOSE OF CONSERVATION PARK REGISTERED 22/6/2017.
2. N653886 VESTED. PURSUANT TO SECTION 7 OF THE CONSERVATION AND LAND MANAGEMENT ACT 1984. REGISTERED 22/6/2017.

- Warning:
- (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.
 - (2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
 - (3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP203465
 PREVIOUS TITLE: LR3021-931
 PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
 LOCAL GOVERNMENT AUTHORITY: SHIRE OF PLANTAGENET
 RESPONSIBLE AGENCY: DEPARTMENT OF PARKS AND WILDLIFE

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 1940/DP203465 VOLUME/FOLIO: LR3168-362

PAGE 2

NOTE 1: N653882 CORRESPONDENCE FILE 00358-2017-01RO.



REGISTER NUMBER 1941/DP203465	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED**

VOLUME **LR3168** FOLIO **363**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 1941 ON DEPOSITED PLAN 203465

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: CONSERVATION AND PARKS COMMISSION OF 17 DICK PERRY AVENUE
KENSINGTON WA 6151

(XE N653886) REGISTERED 22/6/2017

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. N653885 PART RESERVE 52970 FOR THE PURPOSE OF CONSERVATION PARK REGISTERED 22/6/2017.
2. N653886 VESTED. PURSUANT TO SECTION 7 OF THE CONSERVATION AND LAND MANAGEMENT ACT 1984. REGISTERED 22/6/2017.

- Warning:
- (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.
 - (2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
 - (3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP203465
 PREVIOUS TITLE: LR3021-931
 PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
 LOCAL GOVERNMENT AUTHORITY: SHIRE OF PLANTAGENET
 RESPONSIBLE AGENCY: DEPARTMENT OF PARKS AND WILDLIFE

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 1941/DP203465 VOLUME/FOLIO: LR3168-363

PAGE 2

NOTE 1: N653882 CORRESPONDENCE FILE 00358-2017-01RO.



REGISTER NUMBER 1942/DP203465	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED**

VOLUME **LR3168** FOLIO **364**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 1942 ON DEPOSITED PLAN 203465

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: CONSERVATION AND PARKS COMMISSION OF 17 DICK PERRY AVENUE
KENSINGTON WA 6151

(XE N653886) REGISTERED 22/6/2017

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 PREVIOUS TITLE: LR3021-931
 PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
 LOCAL GOVERNMENT AUTHORITY: SHIRE OF PLANTAGENET
 RESPONSIBLE AGENCY: DEPARTMENT OF PARKS AND WILDLIFE

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 1942/DP203465 VOLUME/FOLIO: LR3168-364

PAGE 2

NOTE 1: N653882 CORRESPONDENCE FILE 00358-2017-01RO.



REGISTER NUMBER 1943/DP203465	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED**

VOLUME **LR3168** FOLIO **365**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 1943 ON DEPOSITED PLAN 203465

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: CONSERVATION AND PARKS COMMISSION OF 17 DICK PERRY AVENUE
KENSINGTON WA 6151

(XE N653886) REGISTERED 22/6/2017

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 RESPONSIBLE AGENCY: DEPARTMENT OF PARKS AND WILDLIFE

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QUALIFIED

REGISTER NUMBER: 1943/DP203465 VOLUME/FOLIO: LR3168-365

PAGE 2

NOTE 1: N653882 CORRESPONDENCE FILE 00358-2017-01RO.



Appendix E

Offsets Calculator

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Greenbushes - Kirup
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator							
Impact calculator	Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
	<i>Ecological communities</i>						
	Area of community	No		Area			
				Quality			
				Total quantum of impact	0.00		
	<i>Threatened species habitat</i>						
	Area of habitat	Yes		Area	5.8	Hectares	
				Quality	6	Scale 0-10	
				Total quantum of impact	3.48	Adjusted hectares	
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees	No						
Condition of habitat Change in habitat condition, but no change in extent	No						
<i>Threatened species</i>							
Birth rate e.g. Change in nest success	No						
Mortality rate e.g. Change in number of road kills per year	No						
Number of individuals e.g. Individual plants/animals	No						

Offset calculator																				
Offset calculator	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source			
	<i>Ecological Communities</i>																			
	Area of community	No					Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)										
							Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
									Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
	<i>Threatened species habitat</i>																			
	Area of habitat	Yes	3.48	Adjusted hectares	Rocky Gully - Advanced Offset	20	Start area (hectares)	26	Risk of loss (% without offset)	20%	Risk of loss (% with offset)	10%								
									Time over which loss is averted (max. 20 years)	20	Future area without offset (adjusted hectares)	20.8	Future area with offset (adjusted hectares)	23.4	2.60	90%	2.34	1.84		
									Time until ecological benefit	1	Start quality (scale of 0-10)	9	Future quality without offset (scale of 0-10)	8	Future quality with offset (scale of 0-10)	9	1.00	80%	0.80	0.79
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source			
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
<i>Threatened species</i>																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary								
Summary	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
						Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
						Birth rate	0	
Mortality rate	0				\$0.00		\$0.00	
Number of individuals	0				\$0.00		\$0.00	
Number of features	0				\$0.00		\$0.00	
Condition of habitat	0				\$0.00		\$0.00	
Area of habitat	3.48	3.30	94.92%	Yes	\$0.00	#DIV/0!	#DIV/0!	
Area of community	0				\$0.00		\$0.00	
					\$0.00	#DIV/0!	#DIV/0!	



Appendix F

Stakeholder Consultation



Government of **Western Australia**
Department of **Lands**

Regional and Metropolitan Services

Our ref: 04587-1953 Job No: 161850
Your ref: JT1 2009 12102 V02
Enquires: John Andrioff
Ph: (08) 6552 4471 Fax: (08) 6552 4417
Email: john.andrioff@lands.wa.gov.au

7 October 2016

Brian Handcock
Manager – Procurement & Property Branch
Water Corporation
PO Box 100
LEEDERVILLE WA 6902

RESERVE 24734, ROCKY GULLY – SHIRE OF PLANTAGENET

I refer to our meeting on 3 October 2016 regarding the proposed amendment of Reserve 24734, including other priority elements identified by Water Corporation (WC).

It is Department of Lands (DoL) understanding that this proposal will endeavour to achieve the following actions:

- a) The excision of lots 1940, 1941, 1942 and 1943 on Deposited Plan 203465 from Reserve 24734, which will result the reserve comprising Lot 133 on Deposited Plan 91123, and
- b) The creation of an 'A' class reserve over Lots 1940, 1941, 1942 and 1943 for the purpose of Conservation of Flora and Fauna vested in the Conservation and Parks Commission under the *Conservation and Land Management Act 1984*.

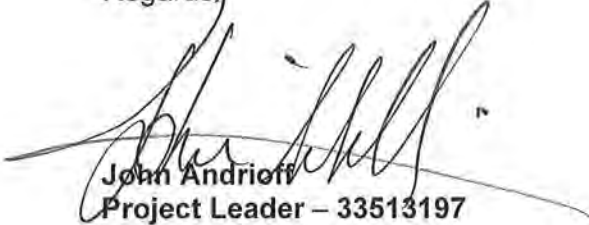
Under DoL's current Memorandum of Understanding with the Department of Mines and Petroleum (DMP), comment has been sought from DMP regarding this proposal.

In this instance DoL is able to confirm that it supports this proposal subject to:

1. Receipt of DMP comments and the resolution of any issues that may arise, if required;
2. Prior to DoL seeking statutory approval for 'A' classification further details will be required on the nature of the project(s) that will benefit from the offset approval;
3. DoL has received from DPaW a copy of Shire of Plantagenet approval of this proposal.

If you require contacting me regarding the above subject item, please do so on the details provided below.

Regards,


John Andrioff
Project Leader – 33513197
Case Management
South West and Great Southern



Ms Suzanne Brown
 Manager Environment & Aboriginal Affairs Branch
 Water Corporation
 PO Box 100
 LEEDERVILLE WA 6902

Dear Ms Brown

PROPOSED LAND TRANSFER FOR ENVIRONMENTAL OFFSETS - ROCKY GULLY RESERVE 24734

I refer to your letter of 12 June 2015, in relation to Water Corporation's proposal to use Reserve 24734 at Rocky Gully as a strategic environmental offset to satisfy future clearing permit conditions. I understand that Water Corporation proposes to transfer the reserve to the Department of Parks and Wildlife (Parks and Wildlife) for inclusion in the conservation estate.

The Department of Environment Regulation (DER) has reviewed the information provided and I can advise that I agree to the use of Reserve 24734 as a strategic offset, subject to the following conditions:

1. Use of the offset site will not be automatically accepted in every instance. In each case Water Corporation must demonstrate how the offset counterbalances the significant residual impacts of the associated clearing. Where relevant, this may include a requirement to provide site level information verifying the environmental values of the offset site.
2. The quantification of each offset will be determined in accordance with the *WA Environmental Offsets Guidelines August 2014* and the *WA Environmental Offsets Policy September 2011*, as amended. For indicative purposes, the application of the Department of the Environment's (DotE) offset calculator would likely involve the use of the following standard values for the offset site:

DotE offset calculator field	Standard value for offset calculations
Time over which loss is averted	20 – Maximum. Vegetation will be secured in perpetuity.
Time until ecological benefit	1 – 1 year to transfer the reserve to conservation estate.
Risk of loss without offset	20% – Site reserved for water services.
Risk of loss with offset	10% – Site will be transferred to conservation estate.
Confidence in result (averted risk of loss)	90% – High level of confidence.

3. Prior to use of the offset site, Water Corporation must provide the following:
- evidence that the reserve has been transferred to Parks and Wildlife for conservation; or
 - written evidence from the Departments of Lands and Parks and Wildlife that demonstrates, to the satisfaction of DER, the timeframe within which the reserve will be transferred to Parks and Wildlife for conservation.

I would appreciate Water Corporation's acknowledgement of the terms set out above.

In relation to Water Corporation's proposed land bank model, I note your reference to the use of the WA Environmental Offsets Register (EOR) (<https://offsetsregister.wa.gov.au/>) which provides a central public record of offset agreements in WA. I agree to the use of the EOR as a means for recording the progressive use of the offset site including the recording of corresponding GIS spatial information.

If you have any queries regarding the matters raised above please contact Senior Clearing Regulation Officer, Ms Samara Rogers on 6467 5046.

Yours sincerely



M Warnock
SENIOR MANAGER
CLEARING REGULATION

*Officer delegated under Section 20
of the Environmental Protection Act 1986*

16 September 2015



Government of **Western Australia**
Department of **Parks and Wildlife**
Parks and Visitor Services Division

Your ref: JT1 2009 12102 V02
Our ref: 2009/2702
Enquiries: Ms Shannon Hassell
Phone: 9219 8770
Email: Shannon.hassell@dpaw.wa.gov.au

Mr Brian Handcock
Manager, Property Portfolio
Corporate Real Estate Branch
Water Corporation
PO Box 100,
LEEDERVILLE WA 6902

Dear Brian

PROPOSED TRANSFER OF ROCK GULLY RESERVE No. 24734

I refer to your letter of 6 October 2015 to the Department of Lands Mr Ron Pumphrey and our meeting of 21 October 2015 concerning the relinquishment and transfer of the Rocky Gully Reserve No. 24734.

The Department of Parks and Wildlife (Parks and Wildlife) confirms that it would accept the transfer of this reserve to be vested in the Conservation Commission of WA as a conservation reserve. Water Corporation's excision and retention of part of the reserve (on Lot 133) containing water infrastructure is agreed by Parks and Wildlife.

Preferably, Parks and Wildlife seeks a change in purpose from "Water" to "Conservation of Flora and Fauna" and a reclassification as Class A. However, any change in the vesting and purpose of this reserve would need to be supported by the Departments of Lands and Mines and Petroleum.

I would appreciate your assistance with seeking agreement from Mr Pumphrey to the transfer and his advice on how the support of the Department of Mines and Petroleum could be achieved in a timely manner.

Yours sincerely

Shannon Hassell
Land Administration Officer

21 October 2015
Cc: Mr Ron Pumphrey
Department of Lands
Via email: ron.pumphrey@lands.wa.gov.au

