Community	EPBC Act	BC Act/DBCA	Description
Shrublands on dry clay flats (SCP10a) TEC	Critically Endangered TEC (part)	Endangered	A distinctive feature of the particular clay pan wetlands that comprise the ecological community is the suite of geophytes and annual flora that germinates, grows and flowers sequentially as these areas dry over summer, producing a floral display for over three months. The clay pans have very high species richness, a number of local endemics and are the most floristically diverse of the SCP wetlands
Low lying *Banksia attenuata* woodlands or shrublands (SCP21c) PEC	A component of the *Banksia* TEC	Priority 3	This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana, Banksia attenuata, B. menziesii, Regelia ciliata, Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland.
Casuarina obesa association PEC		Priority 1	Thomas Rd to Serpentine River, Swan Coastal Plain. No detailed information to assess if distinct community.

3.6 Conservation significant flora

The *NatureMap* database search identified the presence/potential presence of 15 conservation significant flora taxa within 5 km of the survey area. The search recorded:

- Five taxa listed under the EPBC Act and/or *Biodiversity Conservation Act 2016* (BC Act)
- One Priority 1 taxon
- One Priority 2 taxon
- Five Priority 3 taxa
- Three Priority 4 taxa.

The DBCA Threatened and Priority flora searches (TPFL and WAHERB) supplied by the PTA identified 72 records of conservation significant flora taxa within a 5 km buffer of the survey area (Figure 5, Appendix A). The DBCA database searches contained no species names or identifiers, therefore no comparisons with the NatureMap searches results could be made.

The DBCA database search results indicate 20 records of conservation significant flora occur within the survey area.

3.7 Conservation significant fauna

The *NatureMap* database search identified the presence/potential presence of nine conservation significant fauna species within 5 km of the survey area, excluding marine listed species as no marine habitat is present within the survey area. The search recorded:

- Four species listed under the EPBC Act and/or BC Act as Endangered or Vulnerable
- Four Priority 4 species
- One species of special conservation interest (conservation dependent fauna).

The DBCA Threatened and Priority fauna search supplied by the PTA identified 91 records of conservation significant fauna taxa within a 5 km buffer of the survey area (Figure 5, Appendix A). The DBCA database searches contained no species names or identifiers, therefore no comparisons with the *NatureMap* searches results could be made.

The DBCA database search results indicate six records of conservation significant fauna occur within the survey area.

Black cockatoos

Available Carnaby's Cockatoo mapping (GoWA 2019) provides locations of confirmed and possible breeding areas, confirmed, unconfirmed and buffered roosting areas, and feed areas (as outlined by Glossop et al. (2011)). This mapping indicates the survey area contains plant species which Carnaby's cockatoos show a preference for when feeding (mapped as feed area requiring investigation). There are no confirmed breeding or roosting locations occurring within 5 km of the survey area. However, the 2018 Great Cocky Count (Peck et al. 2018) reports a confirmed roost for Carnaby's Cockatoo in the Lowlands area.

4. Field survey

The results presented below are collated from desktop sources, the one day site visit and two day field survey.

4.1 Broad vegetation types

Ten broad vegetation types as well as dirt tracks were mapped by GHD within the survey area. Nine of the vegetation types were represented by remnant native vegetation, the eighth vegetation type, scattered natives over weeds, describes highly modified vegetation that has been altered by partial clearing, dieback and weeds. Vegetation types identified within the survey area are described in Table 5 and mapped in Figure 6, Appendix A.

The vegetation types mapped by GHD refined the boundaries of the 12 vegetation associations mapped by Keighery et al. (1995) and updated by DBCA (2017). Four vegetation associations have been merged into broader vegetation types. *Amphibromus nervosus* grasslands (anG) has been merged into scattered natives over weeds because this area is now represented by isolated sedges of *Juncus pallidus* over pasture weeds. Other sumplands has been merged into the *Melaleuca* woodland vegetation type due to similar dominant upper strata species. *Corymbia calophylla* and *Melaleuca rhaphiophylla* woodland and *Eucalyptus rudis Melaleuca* woodland have also been merged into one vegetation type due to similarities in dominant upper strata species. Conversely vegetation association *Banksia, Allocasuarina fraseriana* and/or *Melaleuca preissiana* Woodlands to Forests has been split into two vegetation types; *Allocasuarina Banksia* woodland and a small isolated patch of *Banksia ilicifolia* woodland. This was due to the dominance of *Banksia ilicifolia* within the area and lack of other dominant/ co dominate upper strata *Banksia* spp., the dominance of *B. ilicifolia* in this area has implications when classifying the community as a conservation significant (see further detail in section 4.3).

The vegetation within the survey area represents a unique combination of upland and lowland vegetation communities that is influenced by landform and soil types. Whilst the survey area is bordered to the east and west by Pinjarra Plain, the soils within the survey area predominately Bassendean sands (Keighery et al. 1995). The Pinjarra Plain is exposed along the Serpentine River and in the seasonally waterlogged areas to the north of the survey area. There were four upland vegetation types mapped by GHD that predominately occurred on Bassendean sands. The two dominant vegetation types were *Banksia* woodland types that represented 68 % (775.8 ha) of the survey area. The lower lying vegetation types were mapped primarily on Pinjarra Plain soils, which is where the most isolated vegetation type was mapped, Tuart woodlands 0.05 % (0.6 ha) of the survey area.

The vegetation types are considered to be representative of the Southern River, Guilford and Bassendean Complex-Central and South Complexes. Based on landforms and previous literature (e.g. Keighery et al. 1995 and Gibson et al. 1994) the vegetation types identified within the survey area are considered to align with the following FCT's:

- FCT4 – *Melaleuca preissiana* damplands
- FCT5 – Mixed shrub damplands
- FCT11 – Wet forests and woodlands
- FCT21a – Central *Banksia attenuata – Eucalyptus marginata* woodlands
- FCT21c – Low lying *Banksia attenuata* woodlands or shrublands
- FCT22 – *Banksia ilicifolia* woodlands
- FCT23a – Central *Banksia attenuata – B. menziesii* woodlands.

Table 5 Vegetation types described within the survey area

Vegetation type and description	Extent (ha)	FCT alignment	Photograph
Upland vegetation types			
***Eucalyptus Banksia* woodland (EBw)** *Eucalyptus marginata and Allocasuarina fraseriana isolated trees* over *Banksia menziesii*, *B. attenuata* and *Xylomelum occidentale* low woodland over *Kunzea glabrescens* tall sparse shrubland over *Stirlingia latifolia, Dasypogon bromeliifolius* and *Desmocladus flexuosus* herbland. This is the most dominant vegetation type within the survey area	712.6	21a and 23	
***Allocasuarina Banksia* woodland (ABw)** *Allocasuarina fraseriana* and/or *Melaleuca preissiana* mid open woodland over *Banksia menziesii* and *B. attenuata* low woodland over *Kunzea glabrescens* tall shrubland over *Dasypogon bromeliifolius* and *Desmocladus flexuosus* herbland. Higher densities of *A. fraseriana* were recorded within this vegetation type along with occasional stands of *M. preissiana*, when compared to EBw	63.2	21c	

Vegetation type and description	Extent (ha)	FCT alignment	Photograph
***Banksia ilicifolia* woodland (Biw)** *Banksia ilicifolia* low woodland over *Xanthorrhoea preissii* low open shrubland over *Dasypogon bromeliifolius* and *Patersonia occidentalis* herbland This type was recorded from a small pocket located in the north western extent of the survey area	3.3	22	
***Corymbia calophylla* open woodland (Cw)** *Corymbia calophylla* tall open woodland over *Melaleuca preissiana* and/ or *Eucalyptus rudis* isolated trees over *Kunzea glabrescens* tall shrubland over weeds Located within the south eastern extent and part of the southern tributary of the Serpentine River.	14.4	-	

Vegetation type and description	Extent (ha)	FCT alignment	Photograph
Lowland vegetation types			
***Banksia Kunzea* woodland (BKw)** *Banksia attenuata* and *B. ilicifolia* woodland over *Kunzea glabrescens* tall shrubland over *Calytrix angulata* low open shrubland over *Patersonia occidentalis* and *Desmocladus flexuosus* open herbland. It should be noted that when Keighery et al. (1995) surveyed the site *K. glabrescens* had not been recognised and was considered the same as *K. ericifolia. Kunzea glabrescens* was identified as a new taxon separate from *K. ericifolia* by Toelken (1996). Specimens collected by GHD within the survey area were identified as *K. glabrescens.*	146.9	21c	
***Eucalyptus Melaleuca* woodland (EMw)** *Eucalyptus rudis* tall woodland over *Melaleuca preissiana* and *M. rhaphiophylla* low woodland over *Dielsia stenostachya* and *Juncus pallidus* closed sedgeland Mapped within the north and south western extents of the survey area	19.7	4	

Vegetation type and description	Extent (ha)	FCT alignment	Photograph
***Eucalyptus rudis* forest (Ef)** *Eucalyptus rudis* tall closed forest over *Astartea* sp. tall sparse shrubland over *Pteridium esculentum* closed fernland and *Lepidosperma longitudinale* open sedgeland. This vegetation type follows the Serpentine River. The density of *E. rudis* decreases with increasing distance from the river.	36.0	11	
***Melaleuca* woodland (Mw)** *Melaleuca preissiana* with occasional *M. rhaphiophylla* low open woodland over tall open shrubland *Kunzea glabrescens* tall open shrubland over *Astartea* sp. isolated shrubs over *Lyginia imberbis* and *Dasypogon bromeliifolius* open herbland Mapped in areas of poor drainage within the survey area.	4.8	5	

Vegetation type and description	Extent (ha)	FCT alignment	Photograph
Tuart woodland (Tw) *Eucalyptus gomphocephala* open forest over *Kunzea glabrescens* tall isolated shrubs over *Pteridium esculentum* sparse fernland and *Desmocladus flexuosus* open sedgeland. Restricted to one small patch on the northern side of the River.	0.6	-	
Scattered natives over weeds (Sn) *Eucalyptus marginata, Corymbia calophylla, Melaleuca preissiana* and /or *Banksia* spp. other weedy grasses and herbs. Characterised as highly modified areas of vegetation where weedy species dominate.	120.6	N/A	
Track Gravel and/ or dirt vehicle tracks	16.9	N/A	

4.2 Vegetation condition

The vegetation condition ranged from Excellent to Degraded across the survey area. The majority of the survey area was in Excellent or Very Good condition. In these areas the vegetation structure is intact and there are minimal disturbances. Areas mapped as scattered natives over weeds (Sn) are Degraded in condition as they have been historically cleared/partially cleared to support grazing by livestock. Whilst there is no grazing of livestock today, native species such as kangaroos maintain grazing at high level and contribute to weed spread (as well as keeping weed loads low) (Keighery et al. 1995).

Dieback is present at localised spots throughout the survey area and has contributed to a decline in vegetation condition. A number of patches of *Banksia* Woodland have been impacted by Dieback, which has resulted in death of *Banksia* individuals; these patches have been mapped as Good in condition and occur in the southern part of the survey area. A large patch of *Eucalyptus Banksia* woodland in the north of the survey area was also mapped in Good condition due to sparse occurrences of natives within the mid and lower stratums.

Banksia Kunzea woodland vegetation type, is synonymous to *Banksia* Woodland over *Kunzea ericifolia* Closed Tall Shrubland vegetation association mapped by Keighery et al. (1995). Keighery et al. (1995) reported that this association may be linked with regrowth after dieback infection, however, noted that *Kunzea ericifolia* (now recognised as *K. glabrescens* within the survey area) occurs naturally across the SCP in low lying areas. Dieback does appear to have been introduced along the southern boundary from drainage associates with roadworks. (Keighery et al. 1995) noted that in these areas the *Banksia* trees appeared dead or dying, GHD also observed *Banksia* deaths in this area during the field survey.

The north western corner of the survey area was mapped by Keighery et al. (1995) as part of the *Banksia, Allocasuarina fraseriana*, and/or *Melaleuca preissiana* Woodlands to Forests association in Very Good condition. The area has since been subjected to fire and possibly Dieback. As a result the canopy cover is dominated by *B. ilicifolia* amongst stags of what may have historically been other *Banksia* spp. and/or *Allocasuarina*. This area was mapped as Good in condition and separated out from Keighery et al. (1995) original vegetation association due to its modification in species dominance.

The extents of the vegetation condition ratings within the survey area are presented in Table 6 and mapped in Figure 7, Appendix A

Table 6 Vegetation condition and extent

Vegetation condition	Extent (ha)
Excellent	354.8
Very Good	441.9
Good	202.7
Degraded	122.7
Tracks	16.9
Total	**1,139.0**

4.3 Conservation significant communities

Based on the results of the desktop searches, previous literature (e.g. Keighery et al. 1995 and Gibson et al. 1994) dominant species, landform features and field observations four conservation significant ecological communities were considered likely to occur within the survey area:

- *Banksia* woodlands of the SCP TEC
- Low lying *Banksia attenuata* woodlands or shrublands (SCP21c) PEC

- *Banksia* dominated woodlands of the SCP IBRA region PEC
- Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC.

All conservation significant communities considered likely to occur within the survey area are described in detail below and mapped in Figure 8, Appendix A.

Banksia Woodlands of the SCP TEC

The *Banksia* Woodlands of the SCP was listed in September 2016 as an Endangered TEC under the EPBC Act. The Commonwealth TEC encompasses a number of FCTs, some of which are also listed as State TECs/PECs. The low lying *Banksia attenuata* woodland or shrublands (FCT21c) and the Central *Banksia attenuata – B. menziesii* woodlands (FCT23a) are both listed as sub-communities of the *Banksia* Woodlands of the SCP TEC.

The Threatened Species Scientific Community (TSSC) (2016) provides criteria and guidance for determining whether the TEC is present, such as:

- A prominent tree layer of *Banksia*, with scattered eucalypts and other tree species often present among, or emerging above, the canopy
- The understorey is a species rich mix of sclerophyllous shrubs, graminoides and forbs
- High endemism and considerable localised variation in species composition across its range
- Minimum patch size and condition requirements.

Based on the vegetation association and condition mapping by Keighery et al. (1995), updates from DBCA and field survey results the *Eucalyptus Banksia* woodland (EBw), *Allocasuarina Banksia* woodland (ABw) and *Banksia Kunzea* woodland (BKw) vegetation types are considered likely to meet the key diagnostic characteristics for the *Banksia* Woodlands of the SCP TEC. There are five separate patches present within the survey area which are considered representative of the *Banksia* TEC (Table 7). These patches also encompass the Low lying *Banksia attenuata* woodland or shrublands (FCT21c) PEC and *Banksia* dominated woodlands of the SCP IBRA region PEC areas.

Table 7 Approximate extent of *Banksia* Woodlands of the SCP TEC within the survey area

Patch ID	Vegetation type	Extent (ha)
1	EBw	48.0
	Patch total	48.0
2	ABw	63.2
	BKw	41.9
	EBw	459.2
	Patch total	564.3
3	EBw	6.5
	Patch total	6.5
4	BKw	37.7
	EBw	127.6
	Patch total	165.3
5	BKw	67.3
	EBw	71.3
	Patch total	138.6
Total		**922.7**

Low lying Banksia attenuata woodland or shrublands (FCT21c) PEC

FCT21c is described as a low lying *Banksia attenuata* woodland or shrublands that occurs sporadically between Gingin and Bunbury. This community is largely restricted to the Bassendean dune system and tends to occupy low lying sites. The *Allocasuarina Banksia* woodland (ABw) and *Banksia Kunzea* woodland (BKw) vegetation types mapped within the survey area are considered representative of FCT21c. These vegetation types included species such as *Banksia attenuata, B. menziesii, Melaleuca preissiana, Eucalyptus marginata*, *Kunzea glabrescens, Patersonia occidentalis* and *Desmocladus flexuosus,* which are all typical and common species of FCT21c. There is approximately 210.1 ha of FCT21c present in the survey area.

Banksia dominated woodlands of the SCP IBRA region PEC

Banksia dominated woodlands of the SCP IBRA region is a Priority 3 PEC listed by DBCA. DBCA (2019) describes the Banksia PEC as having a canopy that is most commonly dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*. Other *Banksia* species that can dominate in the community are *B. prionotes* or *B. ilicifolia*. The PEC differs from the EPBC Act listed *Banksia* woodlands of the SCP TEC in that it has no minimum condition and patch size thresholds.

The Central *Banksia attenuata – Eucalyptus marginata* woodlands (FCT21a) and Central *Banksia attenuata – B. menziesii* woodlands (FCT23a) were identified within the survey area. These FCTs are not listed as conservation significant communities under the BC Act or by the DBCA. However both FCT21a and FCT23a are considered a component of the *Banksia* dominated woodlands of the SCP IBRA region PEC due to key structural features.

Vegetation type *Eucalyptus Banksia* woodland (EBw) is considered representative of the *Banksia* dominated woodlands of the SCP IBRA region (PEC). There is 712.6 ha of the *Banksia* dominated woodlands of the SCP IBRA region (PEC) within the survey area

Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain (PEC)

Vegetation type Tuart woodland is considered to align with the Tuart *(Eucalyptus gomphocephala)* woodlands of the SCP PEC, listed as Priority 3 PEC by DBCA. This PEC differs from the TEC in that it has no minimum condition or patch size thresholds. There is 0.6 ha of the PEC present within the survey area.

4.4 Conservation significant flora

Four conservation significant flora have historically been recorded within the survey area:

- *Caladenia huegelii* (listed as EN under the EPBC Act and CR under the BC Act)
- *Drakaea elastica* (listed as EN under the EPBC Act and CR under the BC Act)
- *Johnsonia pubescens* subsp. *cygnorum* (P2) listed by DBCA
- *Dillwynia dillwynioides* (P3) listed by DBCA

During the field survey a new location of *Johnsonia pubescens* subsp. *cygnorum* (P2) was recorded. The location of this conservation significant species is illustrated on Figure 8, Appendix A.

4.5 Significant weeds

During the field survey four Declared Pests as listed under the *Biosecurity and Management Act 2007* were recorded in multiple locations throughout the survey area. One taxon is also listed as Weeds of National Significance (WoNS):

- **Gomphocarpus fruticosus* (Narrowleaf Cottonbush) – Declared Pest
- **Echium plantagineum* (Paterson's Curse) – Declared Pest
- **Zantedeschia aethiopica* (Arum lily) – Declared Pest
- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WoNS

Locations of the Declared Pests and WoNS recorded during the field survey are shown in Figure 7, Appendix A

4.6 Broad fauna habitats

Four broad habitats were identified within the survey area based on the mapped vegetation types. The fauna habitats are described in Table 8 and mapped in Figure 9, Appendix A.

The survey area is an intact area of native vegetation dominated by mixed Eucalyptus and Banksia woodlands interspersed with partial clearings and lower elevation areas with associated damp land vegetation associations. The survey area is mostly surrounded by cleared land with low density semi-rural residential properties and has limited connectivity to other areas of bushland. The Serpentine River intersects the central part of the survey area and there is some connectivity along this river via riparian woodland, and remnant patches of scattered trees in the surrounding setting provide some canopy connectivity. Access to the survey area is via a private road and locked gate which has minimised vehicle and bike activity as well as illegal dumping.

Table 8 Broad fauna habitats within the survey area

Habitat type and description	Value	Extent (ha)	Photographs
Mixed Eucalyptus Banksia Woodland Corresponding vegetation associations: EBW, ABw, BiW, BKw The habitat comprises Bassendean sand plain supporting emergent Marri and Jarrah trees over a mature canopy of *Banksia* with Sheoaks and Paperbarks in lower lying areas. The midstorey varies from open, moderately dense, or scattered patches of Bassendean derived mixed shrubs such as *Jacksonia*, *Acacia* and *Kunzea*. Lower strata vegetation consists of a diverse mix of low shrubs and forbs including Xanthorrhoea and Loxocarya. This habitat type contains good structural diversity and is likely to provide a variety of micro-habitat types including logs, soft sand, leaf litter and woody debris for a range of small to medium sized terrestrial vertebrate mammals and reptiles. The mid strata shrubs and trees support a range of small insectivorous and nectar feeding birds. Emergent mature Jarrah and Marri trees are present and provide potential breeding habitat for black cockatoos. <u>Conservation Significant Fauna</u> This habitat provides resources for conservation significant fauna including: • Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (foraging, and potential breeding and roosting) • Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (foraging, and potential breeding and roosting) • Baudin's Cockatoo (*Calyptorhynchus baudinii)* (foraging and potential roosting) • Quenda (*Isodoon fusciventer*) (foraging) • South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) (foraging, shelter/refuge) • Coastal Plains Skink (*Ctenotus ora*) (foraging/shelter). • Chuditch (*Dasyurus geoffroii*) (foraging)	High	940.3	 

Habitat type and description	Value	Extent (ha)	Photographs
Flooded Gum Melaleuca woodlands Corresponding vegetation associations: Mw, Cw This habitat comprised an overstorey of Paperbarks with occasional emergent Marri and Flooded gum over sparse to dense shrublands and mixed herbs and sedges, and introduced species such as Arum Lily. This habitat type occurs in lower elevation poor retainage damplands and ephemeral swamp areas, There is moderate structural diversity and is likely to be seasonally inundated. The midstorey and understorey may be dense enough to support small ground dwelling mammals and reptiles, however, the waterlogged soils may prevent soil living fauna from utilizing the area. The Quenda would not utilise areas that are seasonally inundated, but would utilise habitat on the margins that are dense and accessible. <u>Conservation Significant Fauna</u> This habitat provides resources for conservation significant fauna including: • Carnaby's Cockatoo (potential breeding and roosting) • Forest Red-tailed Black Cockatoo (potential breeding and roosting) • Baudin's Cockatoo (potential roosting) • Southern Brown Bandicoot (foraging) • Quenda (resident, foraging) • Chuditch (*Dasyurus geoffroii*) (foraging)	Moderate	24.5	 

Habitat type and description	Value	Extent (ha)	Photographs
Riparian Corresponding vegetation associations: Ef, Emw, Tw Riparian habitat includes banks of the Serpentine River, the waterway and associated tributaries, and sumpland areas. This habitat type comprises dense and very tall stands of Flooded gum forest with occasional Tuart and Paperbarks over Bracken and sedges. This habitat type contains good structural diversity and is likely to provide a variety of micro-habitat types including large logs and other fallen timber, dense patches of ferns and thick litter. This habitat is likely to provide excellent cover and foraging opportunities for birds and reptiles, and there is extensive signs of Quenda foraging activity. The understorey vegetation also provides refuge and foraging opportunities for mammals such as the Quenda and habitat on the river margins for Rakali. The Serpentine River provides habitat for aquatic species such as fish, crustaceans and amphibians. <u>Conservation Significant Fauna</u> This habitat provides resources for conservation significant fauna including: • Carnaby's Cockatoo (potential breeding and roosting) • Forest Red-tailed Black Cockatoo (potential breeding and roosting) • Baudin's Cockatoo (potential roosting) • Rakali (*Hydromys chrysogaster*) (feeding and shelter) • Quenda (resident, foraging) • Carter's Freshwater Mussel (*Westralunio carteri*) (resident) • Pouched lamprey (*Geotria australia*) • Chuditch (*Dasyurus geoffroii*) (foraging, movement corridor regionally)	High	36.6	 

Habitat type and description	Value	Extent (ha)	Photographs
Pasture with scattered trees Corresponding vegetation associations: Sn This habitat type is largely cleared except for remnant trees and few shrubs. It contains poor structural diversity with a scattered overstorey, limited mid-storey and understorey of pasture weeds. The scattered trees include mainly Jarrah, Marri and occasional Flooded gum and or *Banksia* species. Tree density varies from very sparse to small clusters. A lack of low strata native vegetation coverage (native understorey and ground layer) is replaced by pasture and weed grasses and exotic herbaceous species which makes the area largely unsuitable for most small mammals, and reptiles. The mature trees provide opportunistic foraging, and potential breeding and may provide potential roosting habitat (dependant on size of each tree) for black cockatoo species. This habitat type includes patches of highly degraded clay pan supporting weed species. <u>Conservation Significant Fauna</u> The habitat within the survey area provides resources for conservation significant fauna including: • Carnaby's Cockatoo (foraging, potential breeding and roosting) • Forest Red-tailed Black Cockatoo (foraging, potential breeding and roosting) • Baudin's Cockatoo (foraging and potential roosting) • South-western Brush-tailed Phascogale (foraging, shelter/refuge)	Moderate	120.6	 
Tracks		16.9	

4.7 Black cockatoo habitat assessment

4.7.1 Foraging habitat

During the one day field visit, Carnaby's Cockatoos were seen and heard calling over the survey area. Forest Red-tailed Black Cockatoos were also observed feeding at two locations during the subsequent two day field assessment. Foraging evidence (chewed Marri, Jarrah, Banksia and Allocasuarina nuts) was recorded extensively throughout the Mixed Eucalyptus Banksia Sheoak, and Scattered native tree habitat types with both Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo distinctive mandible marks evident.

The type and quality of plant species provides extensive and high quality food resources for both Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo. The survey area is also considered to contain foraging and potential roosting habitat for Baudin's Cockatoo, however no evidence of feeding or roosting was observed. A summary of potential black cockatoo habitat available within the survey area is provided in Table 9. Foraging, potential breeding and roosting habitat for Black Cockatoos is mapped in Figure 9, Appendix A. Foraging evidence recorded during the survey is mapped in Figure 10, Appendix A

4.7.2 Breeding habitat

From tree density plots the potential breeding trees (DBH greater than 50 cm) were recorded within all four of the major habitat types. Potential breeding trees were recorded at greatest density within the Riparian habitat and lowest density recorded in the Scattered native tree habitat (Table 10). The presence of extensive and high quality foraging resource throughout the survey area enhances the value potential breeding trees.

4.7.3 Roosting habitat

The survey area does not support any known roosts, however the 2018 Great Cocky Count (Peck et al. 2018) reports multiple confirmed roost sites for Carnaby's Cockatoo within a 12 km radius of the Lowlands survey area.

Table 9 Black cockatoo habitat within the survey area

Habitat type	Extent (ha)	Foraging	Potential breeding	Potential roosting
Mixed Eucalyptus Banksia Sheoak woodland	940.3	high	yes	no
Scattered native trees	120.6	low/ mod	yes	no
Flooded Gum Melaleuca woodland	24.5	low/mod	yes	no
Riparian	36.6	low/mod	yes	yes

Table 10 Potential breeding tree density

Habitat type	No. of plots sampled	Density range (trees/ha)	Mean (trees/ha)	Estimated trees in habitat type
Mixed Eucalyptus Banksia Sheoak woodland	23	0 - 16	6.3	5,923
Scattered native trees	5	0 - 8	2.4	289
Flooded Gum Melaleuca woodland	5	0 - 8	4.0	98
Riparian	5	32 - 76	48.8	1,786

4.8 Conservation significant fauna

The DBCA are currently using camera traps within the survey area to detect fauna species present. During the site visit, GHD ecologists were shown photographs of some of the conservation significant fauna species recorded within the site, these included:

- Chuditch (*Dasyurus geoffroii*) (a single male individual)
- Rakali (*Hydromys chrysogaster*)
- Pouched lamprey (*Geotria australia*)
- Carters Freshwater Mussel (*Westralunio carteri*)
- Quenda (*Isodoon fusciventer*)
- Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*).

Property owner and resident Margaret Richardson provided anecdotal evidence on the conservation significant fauna within the reserve:

- Quenda are frequently observed around the immediate homestead where they shelter from foxes and are also seen throughout much of the reserve
- Tammar Wallabies (*Notamacropus eugenii derbianus)* have been recorded historically on the reserve but not seen for many years
- Brush-tailed Phascogales have been recorded in the woodland areas
- Carter's Freshwater Mussels were collected upstream of the reserve in a study and are thought to spawn in the Serpentine River within the reserve; Pouched lamprey were also captured in this study
- Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo are both frequent visitors and residents at the reserve.

Sheenan et al. (2017) reported that the riverine system within the site provides spawning grounds for Carters Freshwater Mussels and Pouched lamprey. Carter's Freshwater Mussels were recorded within the Serpentine River in the survey area during the survey. The river also provides important habitat for threatened mammals including Rakali and Quenda. Signs of presence, and direct observation of all conservation significant fauna recorded during the survey are presented in Figure 10, Appendix A.

Likelihood of occurrence assessment

An assessment of the likelihood of occurrence for conservation significant fauna in the survey area was conducted. This assessment was based on species biology, habitat requirements, the quality and connectivity of available habitat, and local and regional occurrence of species records. The assessment identified eight species that are known to occur within the survey area. A summary of the assessment is provided in Table 11.

Table 11 Summary of conservation significant fauna likelihood of occurrence assessment

Species	Common Name	BC Act / DBCA	EPBC	Likelihood of occurrence
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	VU	**Known** Confirmed present. Extensive signs of foraging on Marri, Jarrah and *Allocasuarina* nuts was recorded, as well as small flocks of active cockatoos observed. The survey area has foraging, potential breeding and roosting habitat.
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	EN	**Known** Confirmed present. Extensive signs of foraging of *Banksia attenuata, B. grandis, B. menziesii* and *B. ilicifolia*. The survey area has foraging, potential breeding and roosting habitat.
Calyptorhynchus baudinii	Baudin's Cockatoo	VU	VU	**Likely** The survey area has foraging and potential roosting habitat
Oxyura australis	Blue-billed Duck	P4		**Unlikely** This species prefers large deep lakes and wetlands which the site does not provide. The Serpentine River represents limited and sub-optimal habitat.
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU	**Known** Confirmed present
Hydromys chrysogaster	Water-rat, Rakali	P4		**Known** Confirmed present. This species is likely to be a resident along the Serpentine Rv.
Isoodon fusciventer	Quenda, South-western Brown Bandicoot	P4		**Known** Confirmed present. Foraging signs (diggings) recorded during the field survey.
Notamacropus eugenii derbianus	Tammar Wallaby	P4		**Unlikely** Historically recorded on site. The site lacks suitable and/or connected habitat for the Tammar Wallaby.
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale	CD		**Known** Confirmed present.
Westralunio carteri	Carter's Freshwater Mussel	VU	VU	**Known** Confirmed present. This species recorded within Serpentine River during the field survey.
Geotria australia	Pouched lamprey	P3		**Known** Confirmed present

5. Opportunities for on ground management work

Based on discussions with stakeholders and the two-day field survey the following on ground maintenance will need to be considered:

- Maintenance of existing fences and gates, fencing upgrade/replacement in the southern part of the survey area
- Weed management and targeted control for significant weeds including but not limited to Arum lily (*Zantedeschia aethiopica*), Bridal creeper (*Asparagus asparagoides*), Cotton bush (*Gomphocarpus fruticosus*) and **Echium plantagineum* (Paterson's Curse)
- Feral animal control including rabbits, foxes, pigs, goats, dogs and possibly cats
- Potential control of native fauna such as kangaroos to minimise weed invasion into area of Banksia Woodlands
- Revegetation of areas along the Serpentine River and in patches of degraded Banksia Woodland. Revegetation will improve fauna habitats by increasing foraging, breeding and shelter values, particularly for the eight conservation significant fauna species
- Continued dieback management through implementation of the existing Hygiene Management Plan maintenance of dieback vehicle wash-down bays and signage throughout the reserve.
- Consider installation of artificial nest tubes for Carnaby's and Forest Red-tailed Black Cockatoos, and nest boxes for Brush-tailed Phascogale
- Consider including the survey area in the Great Cocky Count autumn roost survey, which is coordinated by Birdlife Australia. This may establish whether the survey area is being used as a Black Cockatoo roost survey area.

6. References

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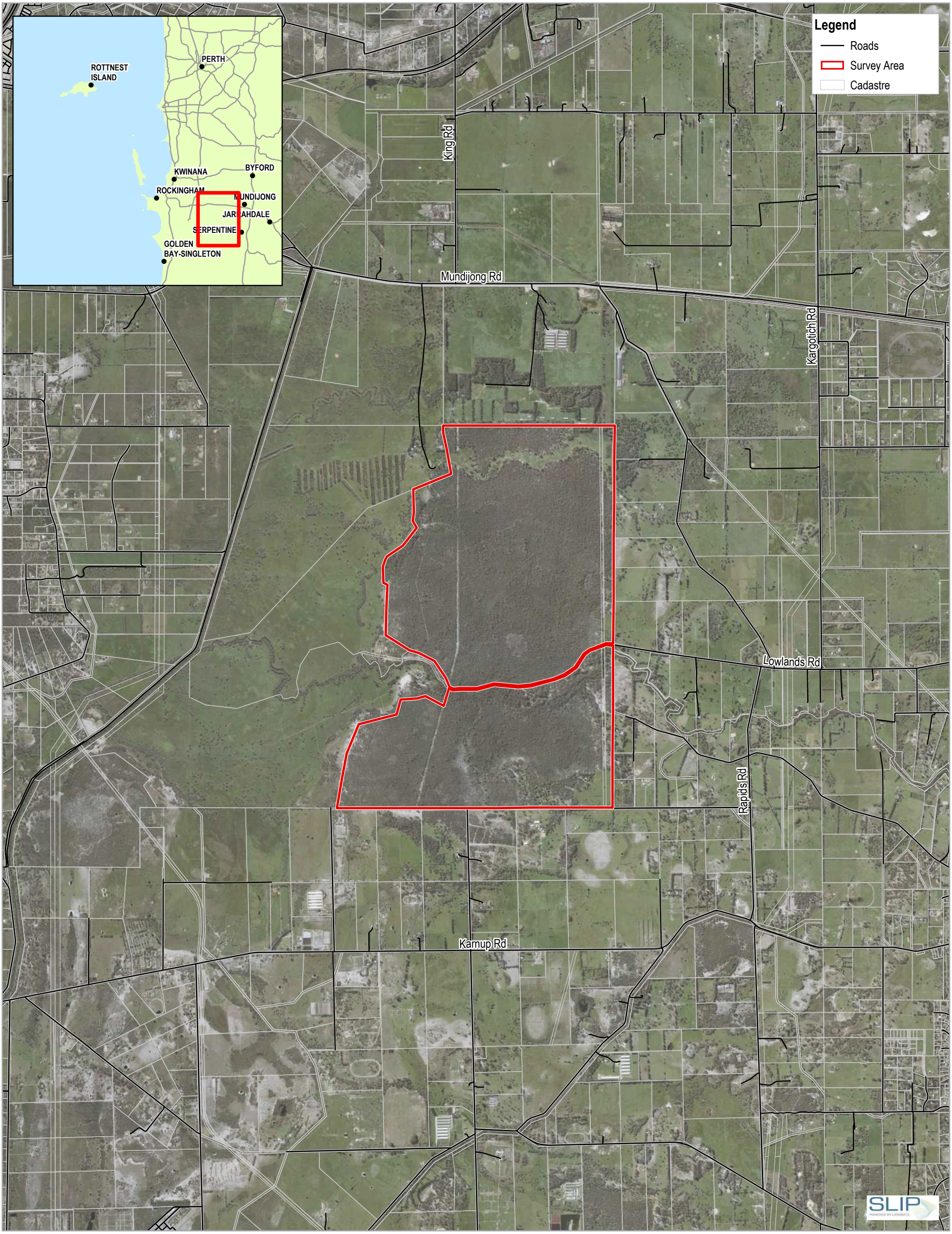
Appendices

Appendix A – Figures



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N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Lowlands Site Location

Project No. **61-38451-03**
Revision No. **0**
Date **25/11/2019**

FIGURE 1

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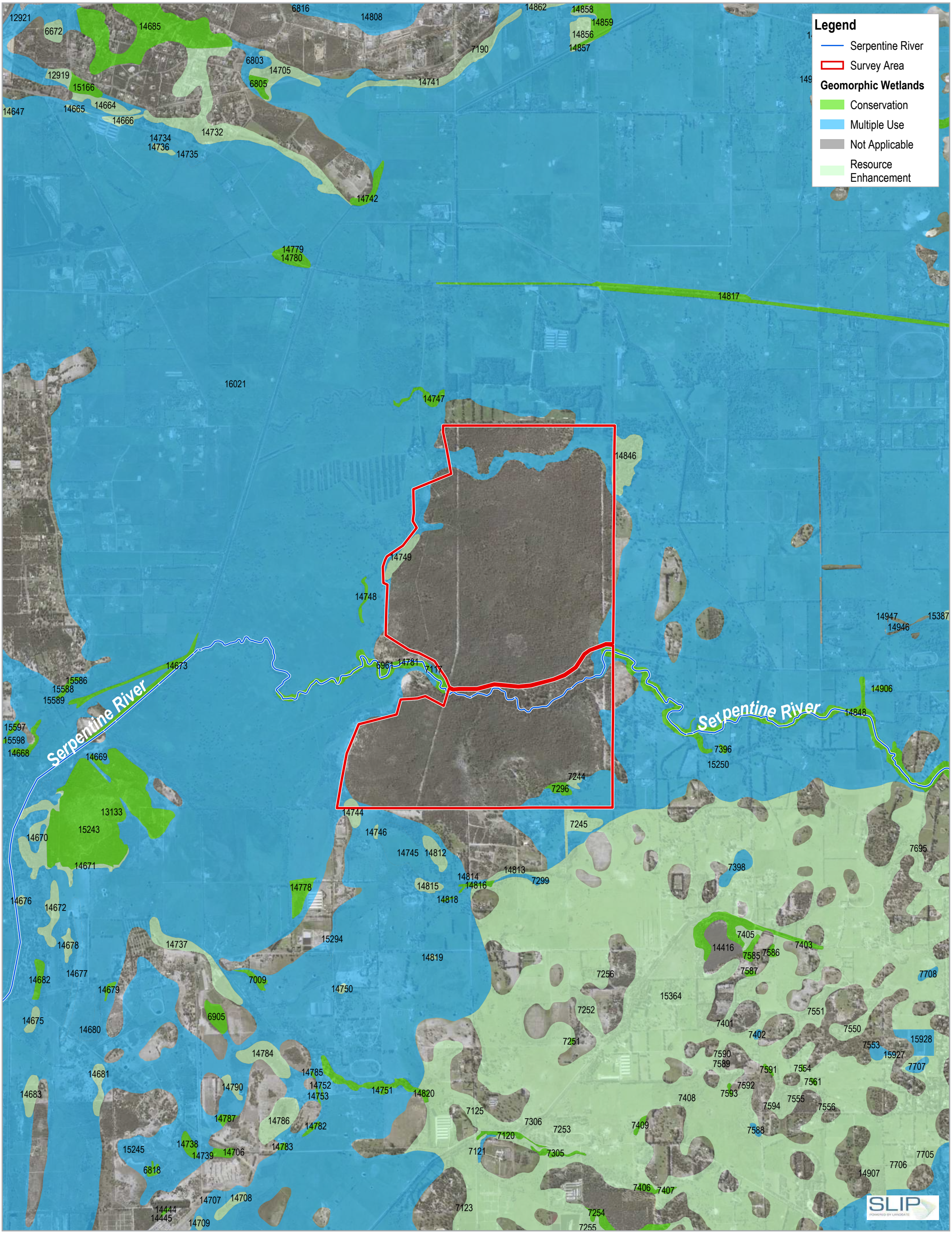

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Kilometres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Hydrological constraints

Project No. **61-38451-03**
Revision No. **0**
Date **25/11/2019**

FIGURE 2

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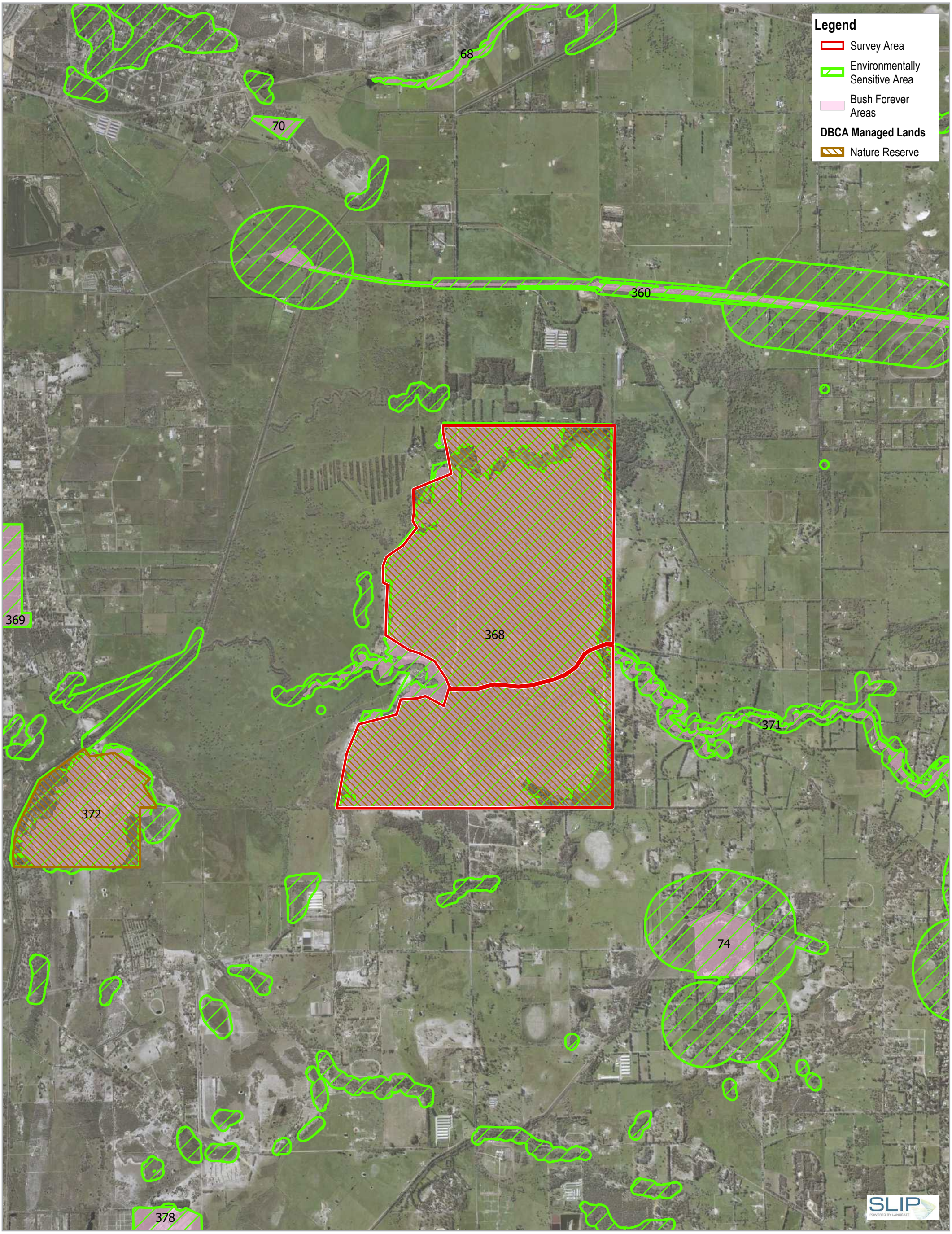

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Land use constraints

Project No. **61-38451-03**
Revision No. **0**
Date **25/11/2019**

FIGURE 3

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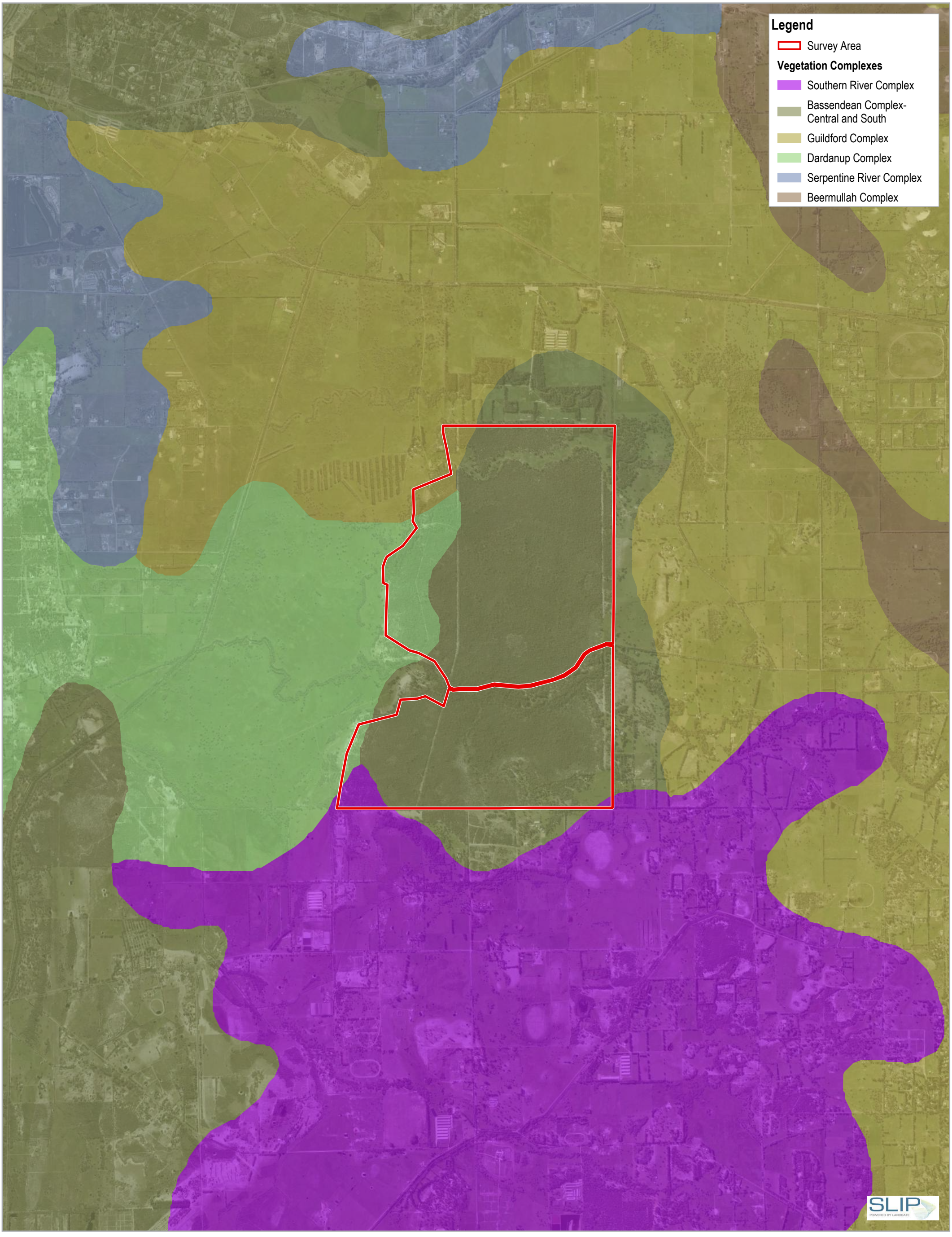
Data source: GHD: Survey Area - 20190826; DBCA: DBCA Managed Lands - 20190826; DoP: Bush Forever Areas - 20190826; DWER: Environmentally Sensitive Areas - 20190826; Landgate: Imagery - April 2019. Created by: bmorgan



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Kilometres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Vegetation Complexes

Project No. **61-38451-03**
Revision No. **0**
Date **25/11/2019**

FIGURE 4

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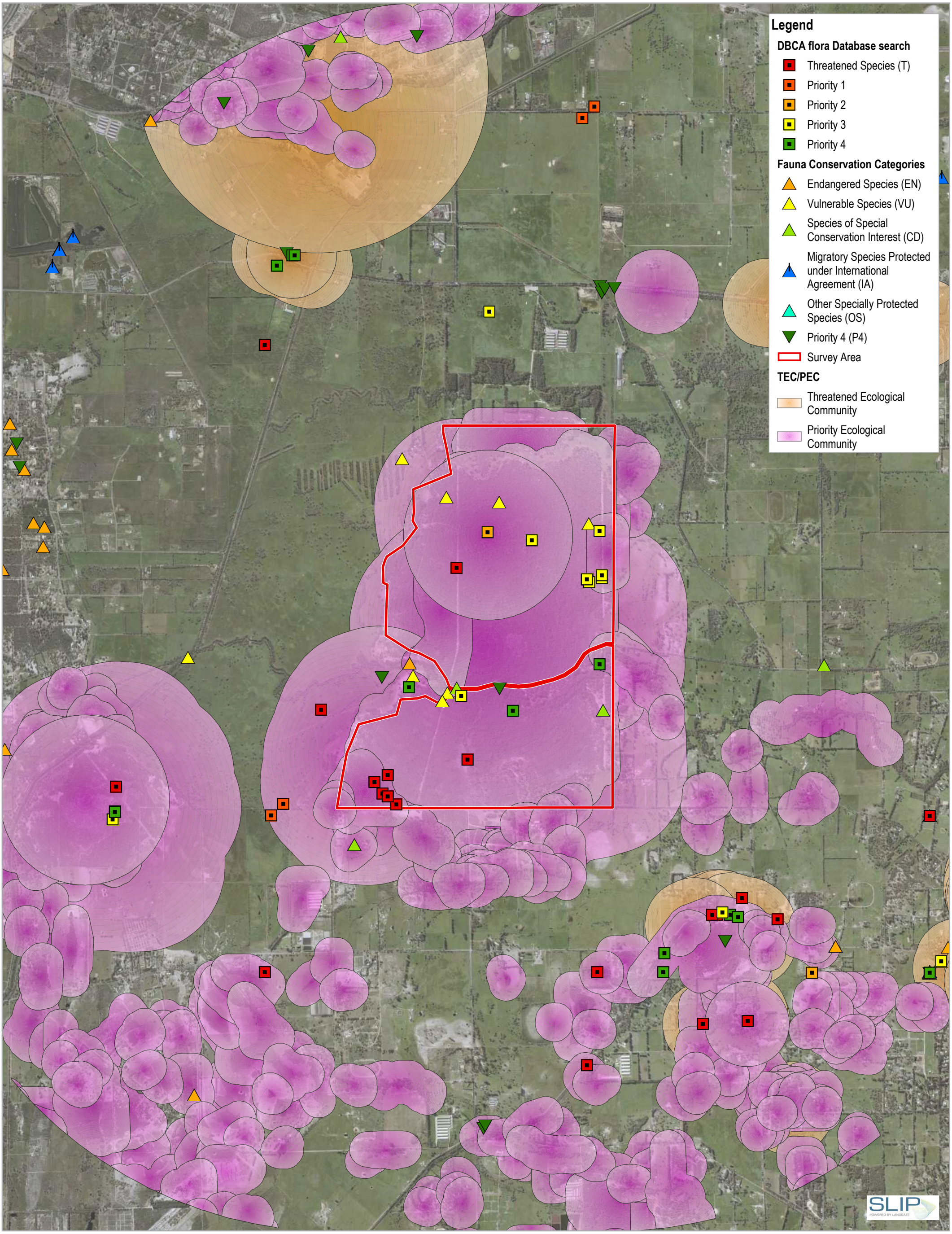

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Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Biological Constraints

Project No. **61-38451-03**
Revision No. **0**
Date **25/11/2019**

FIGURE 5

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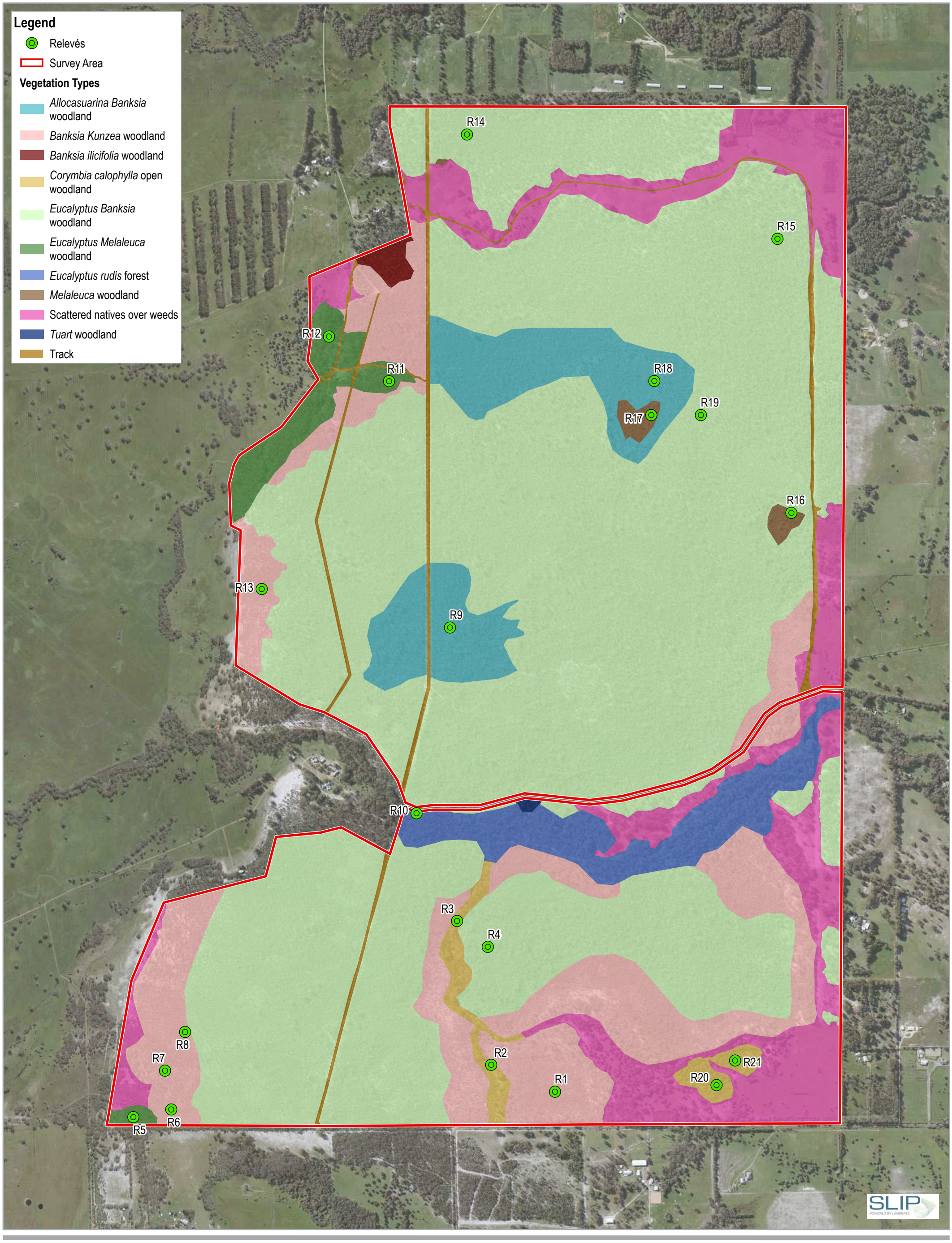

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Vegetation types and sample sites

Project No. **61-38451-03**
Revision No. **0**
Date **7/02/2020**

FIGURE 6

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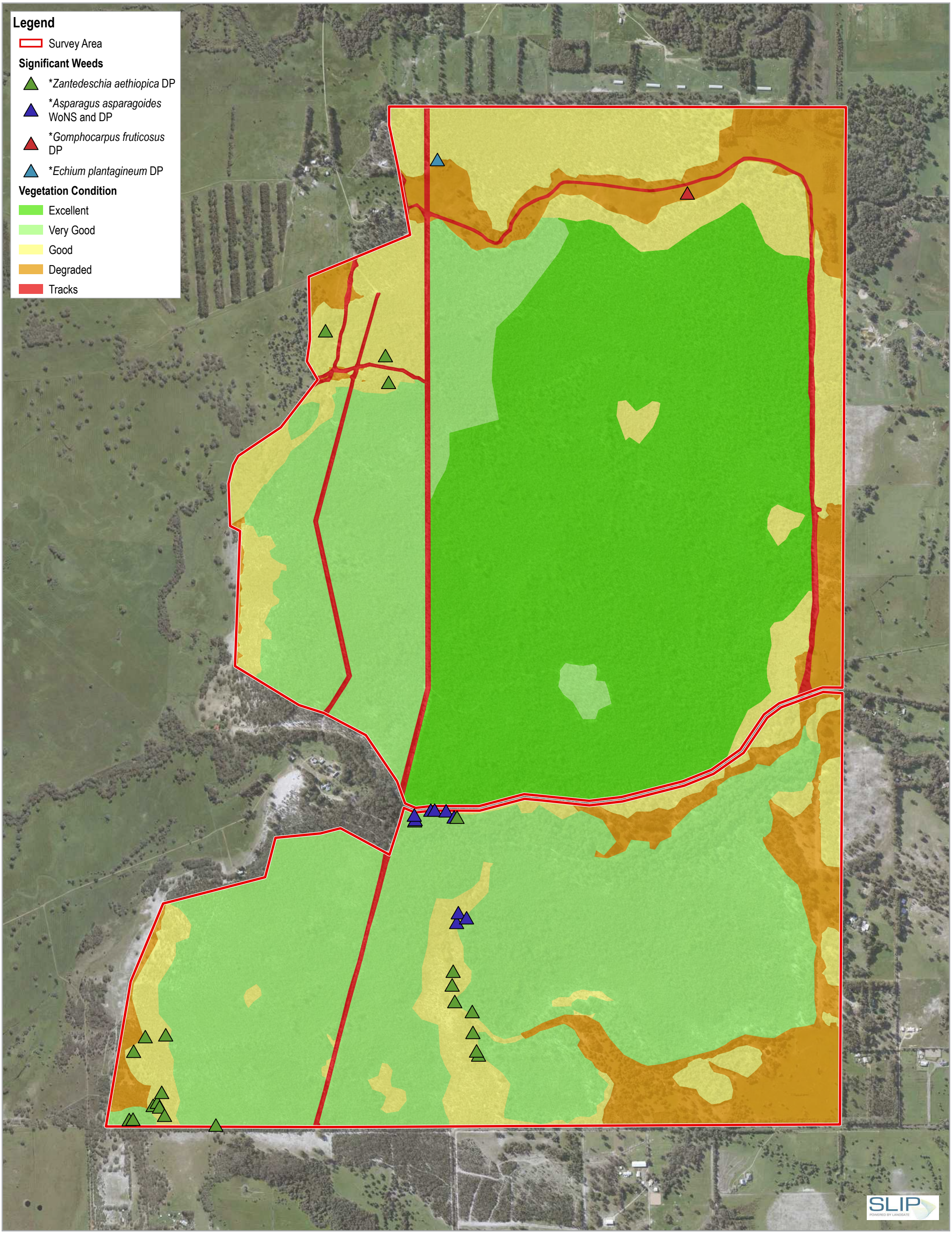

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Metres

Map Projection: Transverse Mercator
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Grid: GDA 1994 Perth Coastal Grid 1994

N

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Vegetation condition and significant weeds

Project No. **61-38451-03**
Revision No. **0**
Date **7/02/2020**

FIGURE 7

G:\61\38451\GIS\Maps\Working\613845103\613845103_Lowlands.aprx\613845103_007_VegCondition_RevA
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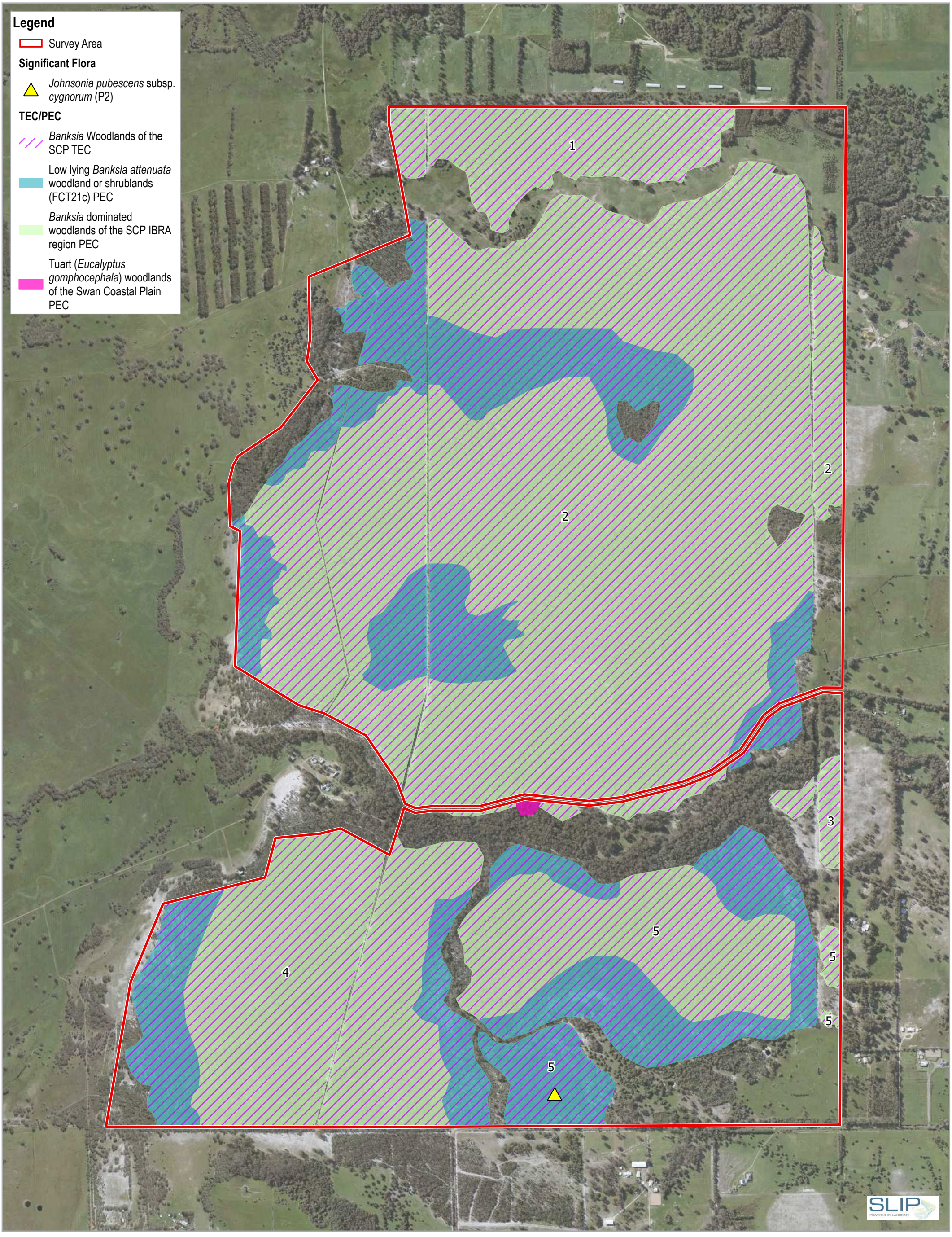

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Metres

Map Projection: Transverse Mercator
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Grid: GDA 1994 Perth Coastal Grid 1994

N

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Conservation significant communities and significant flora

Project No. **61-38451-03**
Revision No. **0**
Date **7/02/2020**

FIGURE 8

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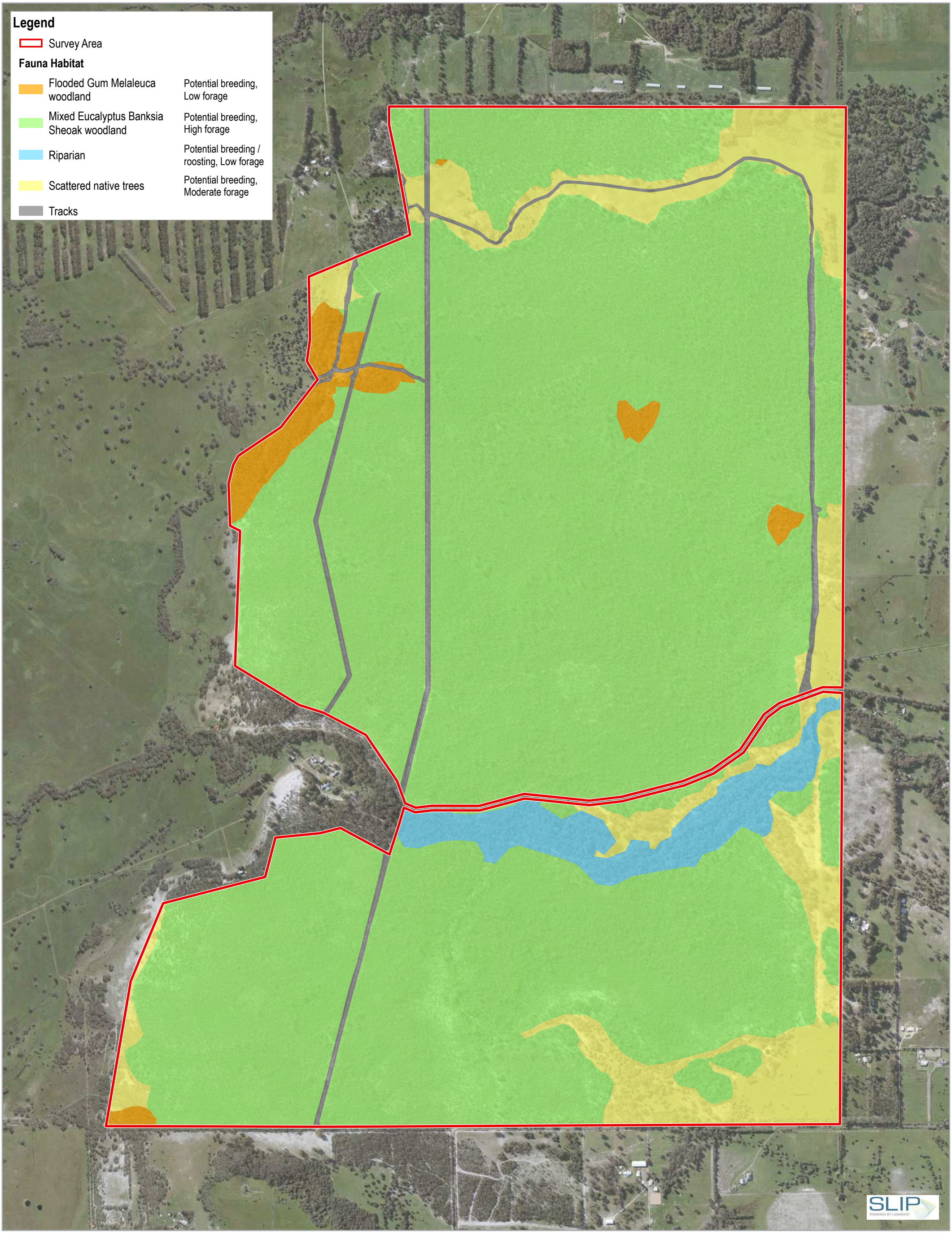

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Metres

Map Projection: Transverse Mercator
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N

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Fauna habitats and Black Cockatoo values

Project No. **61-38451-03**
Revision No. **0**
Date **7/02/2020**

FIGURE 9

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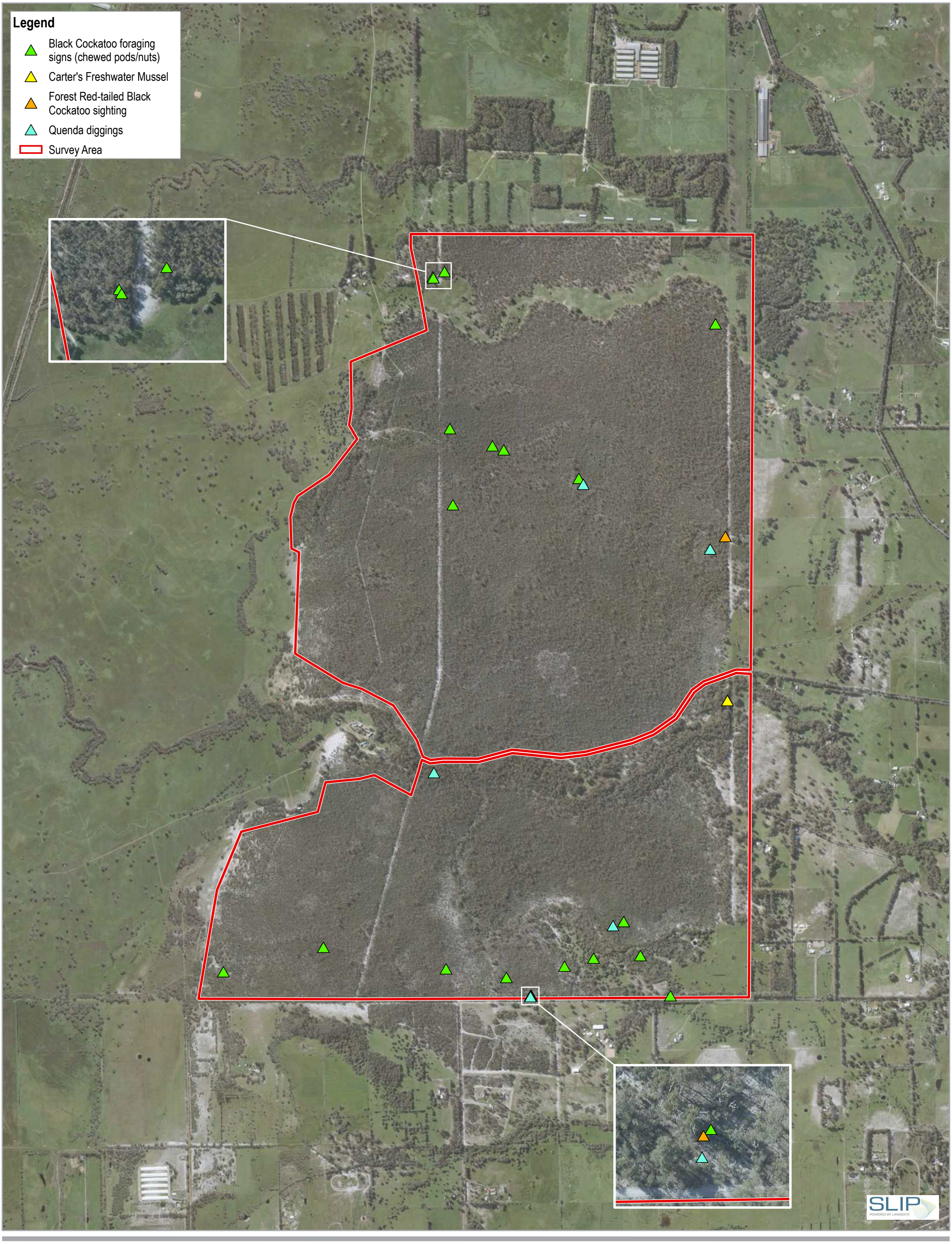

Paper Size ISO A3

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Metres

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Grid: GDA 1994 Perth Coastal Grid 1994

N

GHD

PTA
PTA Potential Offset Site Environmental Assessment Lowlands

Significant fauna observations

Project No. **61-38451-03**
Revision No. **0**
Date **7/02/2020**

FIGURE 10

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Appendix B – Desktop searches

NatureMap Flora (5 km buffer)

NatureMap fauna (5 km buffer

Mardella CS flora report

Created By Guest user on 17/07/2019

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 54' 50" E,32° 19' 50" S
Buffer 5km
Group By Family

Family	Species	Records
Apiaceae	1	1
Apocynaceae	1	2
Asteraceae	1	1
Cyperaceae	2	2
Fabaceae	3	10
Hemerocallidaceae	1	4
Myrtaceae	2	5
Orchidaceae	2	9
Proteaceae	2	7
TOTAL	**15**	**41**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
1.	41801	*Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)*		P3	
Apocynaceae					
2.	6573	*Parsonsia diaphanophleba*		P4	
Asteraceae					
3.	7829	*Angianthus drummondii*		P3	
Cyperaceae					
4.	759	*Carex tereticaulis*		P3	
5.	1033	*Tetraria australiensis*		T	
Fabaceae					
6.	14932	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	
7.	3863	*Dillwynia dillwynioides*		P3	
8.	20462	*Jacksonia gracillima*		P3	
Hemerocallidaceae					
9.	19272	*Johnsonia pubescens subsp. cygnorum*		P2	
Myrtaceae					
10.	13512	*Eucalyptus rudis subsp. cratyantha*		P4	
11.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
Orchidaceae					
12.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
13.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
Proteaceae					
14.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
15.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	

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 wholely 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.

Mardella CS fauna report

Created By Guest user on 17/07/2019

Kingdom	Animalia
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 54' 50" E,32° 19' 50" S
Buffer	5km
Group By	Species Group

Species Group	Species	Records
Bird	4	9
Invertebrate	1	2
Mammal	6	20
TOTAL	**11**	**31**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Bird					
1.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
2.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
3.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
4.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
Invertebrate					
5.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Mammal					
6.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
7.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
8.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
9.	48024	*Notamacropus eugenii subsp. derbianus (Tammar Wallaby, Tammar)*		P4	
10.	25508	*Phascogale tapoatafa (Brush-tailed Phascogale)*		S	
11.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	

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 wholely 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 C – Vegetation Data

Relevé Data

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R1	Proteaceae	*Banksia attenuata*		Upper	30_10	10
R1	Proteaceae	*Banksia ilicifolia*		Upper	30_10	10
R1	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	8
R1	Loranthaceae	*Nuytsia floribunda*		Upper	<2T10	10
R1	Iridaceae	*Patersonia occidentalis*		Lower	<10	0.5
R1	Restionaceae	*Desmocladus flexuosus*		Lower	70_30	0.3
R1	Dilleniaceae	*Hibbertia hypericoides*		Lower	<2N	0.5
R1	Fabaceae	*Hovea trisperma*		Lower	<2T10	0.2
R1	Poaceae	*Briza maxima*	*	Lower	<2N	0.2
R1	Fabaceae	*Gompholobium tomentosum*		Lower	<2T10	0.2
R1	Proteaceae	*Petrophile linearis*		Lower	<2T10	0.3
R1	Anarthriaceae	*Lyginia barbata*		Lower	<10	0.3
R1	Zamiaceae	*Macrozamia riedlei*		Lower	<10	0.5
R1	Myrtaceae	*Calytrix angulata*		Lower	<10	0.1
R1	Myrtaceae	*Melaleuca thymoides*		Mid	<10	1.5
R1	Colchicaceae	*Burchardia congesta*		Lower	<2T10	0.5
R1	Asparagaceae	*Lomandra caespitosa*		Lower	<2N	0.3
R1	Stylidiaceae	*Stylidium brunonianum*		Lower	<10	0.3
R1	Ericaceae	*Leucopogon parviflorus*		Lower	<2T10	0.2
R1	Proteaceae	*Banksia menziesii*		Upper	30_10	8
R1 opp	Casuarinaceae	*Allocasuarina fraseriana*		Upper	opp	15
R1 opp	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	opp	0.5
R1 opp	Hemerocallidaceae	*Johnsonia pubescens* subsp. *cygnorum*	P2	Lower	opp	0.3
R1 opp	Dilleniaceae	*Hibbertia vaginata*		Lower	opp	0.3
R1 opp	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	opp	1
R1 opp	Hemerocallidaceae	*Tricoryne elatior*		Lower	opp	0.3
R2	Myrtaceae	*Corymbia calophylla*		Upper	<10	20

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R2	Loranthaceae	*Nuytsia floribunda*		Upper	<2T10	15
R2	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<10	1.5
R2	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	3
R2	Orobanchaceae	*Orobanche minor*	*	Lower	<2N	0.3
R2	Asteraceae	*Ursinia anthemoides*	*	Lower	<10	0.1
R2	Poaceae	*Ehrharta calycina*	*	Lower	<2N	0.3
R2	Dilleniaceae	*Hibbertia hypericoides*		Lower	<2N	0.5
R2	Commelinaceae	*Cartonema philydroides*		Lower	<2N	0.3
R2	Poaceae	*Rytidosperma* sp.		Lower	<2N	0.3
R2	Restionaceae	*Desmocladus flexuosus*		Lower	<2N	0.1
R2	Poaceae	*Aira caryophyllea*	*	Lower	<2N	0.1
R2 opp	Asteraceae	*Sonchus oleraceus*	*	Lower	opp	0.2
R2 opp	Solanaceae	*Solanum nigrum*	*	Lower	opp	0.2
R2 opp	Proteaceae	*Stirlingia latifolia*		Lower	opp	0.5
R2 opp	Asteraceae	*Podotheca angustifolia*		Lower	opp	0.2
R2 opp	Asteraceae	*Hyalosperma cotula*		Lower	opp	0.1
R2 opp	Primulaceae	*Lysimachia arvensis*	*	Lower	opp	0.1
R2 opp	Araceae	*Zantedeschia aethiopica*	*DP	Lower	opp	0.5
R2 opp	Asparagaceae	*Dichopogon capillaris*		Lower	opp	0.3
R2 opp	Asteraceae	*Lagenophora huegelii*		Lower	opp	0.1
R2 opp	Fabaceae	*Hardenbergia comptoniana*		Lower	opp	cr
R2 opp	Asteraceae	*Arctotheca calendula*	*	Lower	opp	0.1
R2 opp	Geraniaceae	*Pelargonium capitatum*	*	Lower	opp	0.2
R3	Myrtaceae	*Eucalyptus rudis*		Upper	30_10	20
R3	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R3	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	30_10	1.5
R3	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	8

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R3	Iridaceae	*Patersonia occidentalis*		Lower	<10	0.5
R3	Cyperaceae	*Lepidosperma* sp.		Lower	30_10	0.5
R3	Restionaceae	*Leptocarpus coangustatus*		Lower	<10	0.5
R3	Juncaceae	*Juncus pallidus*		Lower	<10	0.5
R3	Asteraceae	*Ursinia anthemoides*	*	Lower	<2N	0.2
R3	Dilleniaceae	*Hibbertia hypericoides*		Lower	<2N	0.2
R3	Commelinaceae	*Cartonema philydroides*		Lower	<2N	0.2
R3	Fabaceae	*Acacia saligna*		Mid	<2T10	1
R3	Araliaceae	*Trachymene pilosa*		Lower	<2N	0.1
R3	Poaceae	*Ehrharta calycina*	*	Lower	<2N	0.2
R3	Dennstaedtiaceae	*Pteridium esculentum*		Lower	<10	0.5
R3	Cyperaceae	*Mesomelaena pseudostygia*		Lower	<2T10	0.5
R3	Orchidaceae	*Pyrorchis nigricans*		Lower	<2T10	0.1
R3	Asparagaceae	*Laxmannia squarrosa*		Lower	<2T10	0.1
R3	Violaceae	*Hybanthus calycinus*		Lower	<2T10	0.2
R3 opps	Asparagaceae	*Asparagus asparagoides*	*DP & WoNS	Lower	opp	cr
R3 opps	Casuarinaceae	*Allocasuarina fraseriana*		Upper	opp	15
R3 opps	Myrtaceae	*Corymbia calophylla*		Upper	opp	20
R4	Myrtaceae	*Eucalyptus marginata*		Upper	<10	20
R4	Casuarinaceae	*Allocasuarina fraseriana*		Upper	30_10	15
R4	Proteaceae	*Banksia menziesii*		Upper	30_10	10
R4	Proteaceae	*Banksia ilicifolia*		Upper	<10	10
R4	Proteaceae	*Banksia attenuata*		Upper	30_10	10
R4	Myrtaceae	*Kunzea glabrescens*		Upper	30_10	3
R4	Proteaceae	*Stirlingia latifolia*		Lower	30_10	0.5
R4	Proteaceae	*Petrophile linearis*		Lower	<10	0.2
R4	Restionaceae	*Desmocladus flexuosus*		Lower	30_10	0.1

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R4	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	30_10	0.2
R4	Dilleniaceae	*Hibbertia vaginata*		Lower	<2N	0.3
R4	Asteraceae	*Hyalosperma cotula*		Lower	<2T10	0.1
R4	Iridaceae	*Patersonia occidentalis*		Lower	<10	0.3
R4 opp	Hemerocallidaceae	*Tricoryne elatior*		Lower	opp	0.1
R4 opp	Droseraceae	*Drosera* sp.		Lower	opp	0.1
R4 opp	Xanthorrhoeaceae	*Chamaescilla corymbosa*		Lower	opp	0.1
R4 opp	Orchidaceae	*Prasophyllum* sp.		Lower	opp	0.1
R4 opp	Stylidiaceae	*Stylidium* sp.		Lower	opp	0.1
R4 opp	Asteraceae	*Ursinia anthemoides*	*	Lower	opp	0.1
R4 opp	Colchicaceae	*Burchardia congesta*		Lower	opp	0.2
R4 opp	Proteaceae	*Xylomelum occidentale*		Upper	opp	8
R4 opp	Haemodoraceae	*Conostylis juncea*		Lower	opp	0.2
R4 opp	Asparagaceae	*Thysanotus ?arenarius*		Lower	opp	0.2
R4 opp	Restionaceae	*Desmocladus fasciculatus*		Lower	opp	0.1
R4 opp	Poaceae	*Austrostipa compressa*		Lower	opp	0.2
R4 opp	Polygalaceae	*Comesperma calymega*		Lower	opp	0.2
R5	Myrtaceae	*Corymbia calophylla*		Upper	<2T10	15
R5	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R5	Cyperaceae	*Lepidosperma* sp.		Lower	<10	0.5
R5	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<10	1.5
R5	Poaceae	*Briza maxima*	*	Lower	<2N	0.3
R5	Myrtaceae	*Kunzea glabrescens*		Upper	<2T10	5
R5	Poaceae	*Ehrharta calycina*	*	Lower	<2T10	0.3
R5	Poaceae	*Hordeum leporinum*	*	Lower	<2N	0.3
R5	Poaceae	*Lolium* sp.	*	Lower	<2N	0.3
R5	Restionaceae	*Dielsia stenostachya*		Lower	70_30	0.2

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R5	Asteraceae	*Ursinia anthemoides*	*	Lower	<2N	0.2
R5	Orobanchaceae	*Orobanche minor*	*	Lower	<2N	0.3
R5	Myrtaceae	*Astartea* sp.		Mid	30_10	1.5
R5	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.3
R6	Proteaceae	*Banksia attenuata*		Upper	<10	12
R6	Proteaceae	*Banksia ilicifolia*		Upper	30_10	10
R6	Myrtaceae	*Melaleuca preissiana*		Upper	<10	10
R6	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R6	Asteraceae	*Zantedeschia aethiopica*	*DP	Lower	<10	0.5
R6	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	30_10	0.3
R6	Poaceae	*Ehrharta calycina*	*	Lower	<2N	0.3
R6	Asteraceae	*Ursinia anthemoides*	*	Lower	<2N	0.2
R6	Poaceae	*Bromus diandrus*	*	Lower	<2N	0.2
R6	Hemerocallidaceae	*Tricoryne elatior*		Lower	<2T10	0.2
R6	Myrtaceae	*Eucalyptus marginata*		Upper	<2T10	10
R6	Restionaceae	*Desmocladus fasciculatus*		Lower	<2N	0.2
R7	Proteaceae	*Banksia ilicifolia*		Upper	<10	15
R7	Proteaceae	*Banksia menziesii*		Upper	<2N	10
R7	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R7	Poaceae	*Briza maxima*	*	Lower	<2N	0.2
R7	Asteraceae	*Ursinia anthemoides*	*	Lower	<2N	0.2
R7	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.3
R7	Restionaceae	*Desmocladus flexuosus*		Lower	30_10	0.2
R7	Proteaceae	*Banksia attenuata*		Upper	<2T10	10
R7	Araceae	*Zantedeschia aethiopica*	*DP	Lower	<2N	0.5
R8	Proteaceae	*Banksia ilicifolia*		Upper	30_10	12
R8	Proteaceae	*Banksia menziesii*		Upper	<10	10

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R8	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R8	Restionaceae	*Desmocladus flexuosus*		Lower	30_10	0.3
R8	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	30_10	0.3
R8	Araliaceae	*Trachymene pilosa*		Lower	<2N	0.1
R8	Myrtaceae	*Melaleuca thymoides*		Mid	<2N	1.5
R8	Proteaceae	*Banksia attenuata*		Upper	<2N	8
R8	Hemerocallidaceae	*Corynotheca micrantha*		Lower	30_10	0.2
R8	Violaceae	*Hybanthus calycinus*		Lower	<10	0.2
R9	Proteaceae	*Banksia menziesii*		Upper	<10	8
R9	Casuarinaceae	*Allocasuarina fraseriana*		Upper	30_10	10
R9	Myrtaceae	*Eucalyptus marginata*		Upper	30_10	20
R9	Proteaceae	*Banksia attenuata*		Upper	<10	10
R9	Myrtaceae	*Kunzea glabrescens*		Upper	30_10	4
R9	Proteaceae	*Adenanthos cygnorum*		Mid	<10	2
R9	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.5
R9	Iridaceae	*Patersonia occidentalis*		Lower	30_10	0.5
R9	Myrtaceae	*Calytrix angulata*		Lower	30_10	0.2
R9	Asparagaceae	*Thysanotus ?arenarius*		Lower	<10	0.1
R9	Restionaceae	*Desmocladus flexuosus*		Lower	30_10	0.2
R9	Fabaceae	*Gompholobium tomentosum*		Lower	30_10	0.2
R9	Xanthorrhoeaceae	*Chamaescilla corymbosa*		Lower	<10	0.1
R9	Dilleniaceae	*Hibbertia hypericoides*		Lower	<2N	0.5
R9	Proteaceae	*Petrophile linearis*		Lower	<2N	0.3
R9	Droseraceae	*Drosera* sp.		Lower	<2T10	0.1
R9	Ericaceae	Ericaceae sp.		Lower	<2T10	0.3
R9	Proteaceae	*Stirlingia latifolia*		Mid	<2T10	1
R9	Myrtaceae	*Melaleuca thymoides*		Mid	<2T10	1.5

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R9	Dilleniaceae	*Hibbertia vaginata*		Lower	<2T10	0.3
R9	Hemerocallidaceae	*Tricoryne elatior*		Lower	<2T10	0.1
R9	Haemodoraceae	*Conostylis aculeata*		Lower	<2T10	0.1
R10	Myrtaceae	*Eucalyptus rudis*		Upper	70_30	25
R10	Myrtaceae	*Astartea* sp.		Mid	30_10	2
R10	Cyperaceae	*Lepidosperma longitudinale*		Mid	<10	2
R10	Dennstaedtiaceae	*Pteridium esculentum*		Mid	100_70	1.5
R10	Papaveraceae	*Fumaria capreolata*	*	Lower	<10	0.3
R10	Fabaceae	*Acacia saligna*		Mid	<2T10	1.5
R10	Oxalidaceae	*Oxalis pes-caprae*	*	Lower	<2T10	0.1
R10	Juncaginaceae	*Triglochin* sp.		Lower	<10	0.3
R10 opp	Proteaceae	*Banksia grandis*		Upper	opp	10
R10 opp	Cyperaceae	*Ficinia nodosa*		Mid	opp	1.5
R11	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R11	Myrtaceae	*Kunzea glabrescens*		Upper	<2N	5
R11	Restionaceae	*Dielsia stenostachya*		Lower	100_70	0.2
R11	Restionaceae	*Hypolaena exsulca*		Lower	30_10	0.2
R11	Poaceae	*Bromus diandrus*	*	Lower	<10	0.2
R11	Poaceae	*Ehrharta calycina*	*	Lower	<10	0.2
R11	Asteraceae	*Hypochaeris glabra*	*	Lower	<10	0.1
R11	Poaceae	*Briza maxima*	*	Lower	<10	0.2
R11	Araceae	*Zantedeschia aethiopica*	*DP	Lower	<2T10	0.5
R11	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Lower	<2T10	0.5
R11	Poaceae	*Lolium* sp.		Lower	<2N	0.3
R11	Caryophyllaceae	*Cerastium glomeratum*	*	Lower	<2N	0.2
R11	Poaceae	*Briza minor*	*	Lower	<2N	0.2
R11	Iridaceae	*Patersonia occidentalis*		Lower	<2N	0.5

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R11	Asteraceae	*Arctotheca calendula*	*	Lower	<2N	0.2
R12	Myrtaceae	*Eucalyptus rudis*		Upper	30_10	20
R12	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R12	Myrtaceae	*Melaleuca rhaphiophylla*		Upper	30_10	8
R12	Restionaceae	*Dielsia stenostachya*		Lower	100_70	0.2
R12	Restionaceae	*Hypolaena exsulca*		Lower	30_10	0.2
R12	Cyperaceae	*Lepidosperma* sp.		Lower	<10	0.5
R12	Orchidaceae	Orchidaceae sp.		Lower	<10	0.5
R12	Araceae	*Zantedeschia aethiopica*	*DP	Lower	<2N	0.3
R12	Poaceae	*Lolium* sp.	*	Lower	<2N	0.3
R12	Poaceae	*Briza maxima*	*	Lower	<2N	0.3
R12	Poaceae	*Bromus diandrus*	*	Lower	<2N	0.5
R12	Asteraceae	*Conyza sumatrensis*	*	Lower	<2N	0.3
R12	Violaceae	*Hybanthus calycinus*		Lower	<2N	0.3
R12	Poaceae	*Briza minor*	*	Mid	<10	1.5
R12	Juncaceae	*Juncus pallidus*		Mid	<2T10	1.5
R12	Asparagaceae	*Thysanotus ?arenarius*		Lower	<2T10	0.3
R12	Hemerocallidaceae	*Caesia occidentalis/micrantha*		Lower	<2T10	0.3
R12	Myrtaceae	*Kunzea glabrescens*		Upper	<2T10	4
R13	Proteaceae	*Banksia ilicifolia*		Upper	30_10	15
R13	Proteaceae	*Banksia menziesii*		Upper	<10	12
R13	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R13	Dennstaedtiaceae	*Pteridium esculentum*		Mid	70_30	1.5
R13	Poaceae	*Briza maxima*	*	Lower	<2N	0.3
R13	Araceae	*Zantedeschia aethiopica*	*DP	Lower	<2N	0.5
R13	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<2N	0.5
R13	Proteaceae	*Banksia attenuata*		Upper	<10	8

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R14	Casuarinaceae	*Allocasuarina fraseriana*		Upper	<10	15
R14	Proteaceae	*Banksia attenuata*		Upper	30_10	10
R14	Proteaceae	*Banksia menziesii*		Upper	30_10	10
R14	Proteaceae	*Xylomelum occidentale*		Upper	<10	10
R14	Myrtaceae	*Eucalyptus marginata*		Upper	30_10	15
R14	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<10	1.5
R14	Proteaceae	*Stirlingia latifolia*		Lower	30_10	0.5
R14	Ericaceae	*Leucopogon propinquus*		Lower	<2T10	0.5
R14	Araceae	*Zantedeschia aethiopica*	*DP	Lower	<2N	0.5
R14	Asteraceae	*Hypochaeris glabra*	*	Lower	<10	0.1
R14	Asteraceae	*Ursinia anthemoides*	*	Lower	<10	0.2
R14	Poaceae	*Briza maxima*	*	Lower	<10	0.2
R14	Restionaceae	*Desmocladus flexuosus*		Lower	<10	0.2
R14	Hemerocallidaceae	*Tricoryne elatior*		Lower	<2T10	0.2
R14	Poaceae	*Ehrharta calycina*	*	Lower	<2N	0.3
R14	Asparagaceae	*Thysanotus patersonii/manglesianus*		Lower	<2T10	CR
R15	Proteaceae	*Banksia menziesii*		Upper	30_10	8
R15	Proteaceae	*Xylomelum occidentale*		Upper	30_10	8
R15	Myrtaceae	*Eucalyptus marginata*		Upper	30_10	20
R15	Proteaceae	*Banksia attenuata*		Upper	30_10	10
R15	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<10	1.5
R15	Casuarinaceae	*Allocasuarina fraseriana*		Upper	30_10	10
R15	Asteraceae	*Hypochaeris glabra*	*	Lower	<2N	0.1
R15	Araliaceae	*Trachymene pilosa*		Lower	<2N	0.1
R15	Asteraceae	*Ursinia anthemoides*	*	Lower	<2N	0.1
R15	Restionaceae	*Desmocladus fasciculatus*		Lower	<2N	0.2
R15	Iridaceae	*Romulea rosea*	*	Lower	<2N	0.1

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R15	Dilleniaceae	*Hibbertia hypericoides*		Lower	<2T10	0.3
R15	Asteraceae	*Hyalosperma cotula*		Lower	<2N	0.1
R15	Asteraceae	*Lagenophora huegelii*		Lower	<2T10	0.1
R15	Restionaceae	*Desmocladus flexuosus*		Lower	<2T10	0.2
R15	Proteaceae	*Briza maxima*	*	Lower	<2T10	0.1
R15	Fabaceae	*Kennedia prostrata*		Lower	<2T10	cr
R16	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R16	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	4
R16	Proteaceae	*Xylomelum occidentale*		Upper	<2T10	10
R16	Casuarinaceae	*Allocasuarina fraseriana*		Upper	<2T10	15
R16	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	30_10	0.5
R16	Myrtaceae	*Calytrix angulata*		Lower	30_10	0.2
R16	Anarthriaceae	*Lyginia imberbis*		Lower	30_10	0.3
R17	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	12
R17	Proteaceae	*Banksia menziesii*		Upper	30_10	10
R17	Proteaceae	*Banksia attenuata*		Upper	<10	10
R17	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R17	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.5
R17	Myrtaceae	*Astartea* sp.		Mid	<10	1
R17	Anarthriaceae	*Lyginia imberbis*		Lower	<2T10	0.5
R17	Loranthaceae	*Nuytsia floribunda*		Upper	<2T10	15
R18	Myrtaceae	*Corymbia calophylla*		Upper	<10	20
R18	Casuarinaceae	*Allocasuarina fraseriana*		Upper	<10	15
R18	Myrtaceae	*Eucalyptus marginata*		Upper	<2T10	20
R18	Proteaceae	*Banksia menziesii*		Upper	30_10	15
R18	Proteaceae	*Banksia attenuata*		Upper	30_10	15
R18	Proteaceae	*Xylomelum occidentale*		Upper	<10	10

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R18	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R18	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.3
R18	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<2T10	1.5
R18	Anarthriaceae	*Lyginia imberbis*		Lower	<2T10	0.3
R18	Proteaceae	*Banksia grandis*		Upper	<2T10	8
R18	Restionaceae	*Desmocladus flexuosus*		Lower	<2T10	0.3
R18	Iridaceae	*Patersonia occidentalis*		Lower	<2T10	0.3
R19	Casuarinaceae	*Allocasuarina fraseriana*		Upper	<10	15
R19	Proteaceae	*Banksia menziesii*		Upper	30_10	15
R19	Myrtaceae	*Eucalyptus marginata*		Upper	<10	20
R19	Proteaceae	*Banksia attenuata*		Upper	30_10	10
R19	Proteaceae	*Xylomelum occidentale*		Upper	<10	10
R19	Myrtaceae	*Kunzea glabrescens*		Upper	30_10	5
R19	Iridaceae	*Patersonia occidentalis*		Lower	70_30	0.5
R19	Proteaceae	*Stirlingia latifolia*		Lower	30_10	0.5
R19	Restionaceae	*Desmocladus flexuosus*		Lower	30_10	0.3
R19	Zamiaceae	*Macrozamia riedlei*		Lower	<10	0.3
R19	Violaceae	*Hybanthus calycinus*		Lower	<10	0.2
R19	Dasypogonaceae	*Dasypogon bromeliifolius*		Lower	<10	0.5
R19	Dilleniaceae	*Hibbertia hypericoides*		Lower	<10	0.5
R19	Proteaceae	*Petrophile linearis*		Lower	<2T10	0.2
R19	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Lower	<2T10	0.5
R20	Myrtaceae	*Corymbia calophylla*		Upper	30_10	20
R20	Myrtaceae	*Eucalyptus marginata*		Upper	30_10	20
R20	Myrtaceae	*Kunzea glabrescens*		Upper	70_30	5
R20	Fabaceae	*Acacia floribunda*	*	Upper	<2T10	5
R20	Proteaceae	*Banksia ilicifolia*		Upper	<2T10	10

ID	Family	Taxon	Status	Stratum	Cover (%)	Height (m)
R20	Poaceae	*Briza maxima*	*	Lower	30_10	0.2
R20	Fabaceae	*Hardenbergia comptoniana*		Lower	<2T10	CR
R21	Myrtaceae	*Melaleuca preissiana*		Upper	30_10	10
R21	Myrtaceae	*Eucalyptus marginata*		Upper	<2T10	20
R21	Myrtaceae	*Corymbia calophylla*		Upper	30_10	20
R21	Myrtaceae	*Kunzea glabrescens*		Upper	100_70	5
R21	Fabaceae	*Acacia saligna*		Upper	<10	3
R21	Dennstaedtiaceae	*Pteridium esculentum*		Lower	100_70	0.5
R21	Xanthorrhoeaceae	*Xanthorrhoea preissii*		Mid	<2T10	2

Appendix D – Fauna data

Black Cockatoo potential breeding tree and foraging data

Conservation significant fauna evidence

Black Cockatoo potential breeding tree and foraging data

Tree Density Plot No.	Tree species	DBH (cm)	Tree density (trees/ hectare)	Black Cockatoo Foraging value	Fauna habitat type	Easting	Northing
1	Jarrah	100	8	high	Mixed Eucalyptus Banksia Sheoak woodland	397199	6420593
	Jarrah	80					
2	Marri	65	4	moderate	Mixed Eucalyptus Banksia Sheoak woodland	397514	6420550
3	Marri	60	16	moderate	Mixed Eucalyptus Banksia Sheoak woodland	397545	6420466
	Marri	70					
	Marri	80					
	Marri	80					
4	nil		0	high	Mixed Eucalyptus Banksia Sheoak woodland	397770	6420480
5	Marri	55	8	moderate	Scattered native trees	398087	6420567
	Marri	80					
6	Jarrah	80	12	high	Mixed Eucalyptus Banksia Sheoak woodland	398251	6420797
	Jarrah	70					
	Jarrah	80					
7	Marri	80	8	high	Mixed Eucalyptus Banksia Sheoak woodland	398412	6420558
	Marri	90					
8	Marri	51	8	high	Mixed Eucalyptus Banksia Sheoak woodland	398575	6420641
	Marri	55					
9	nil		0	low	Scattered native trees	398618	6420436
10	Flooded Gum	60	4	low	Flooded Gum Melaleuca woodland	395936	6420373
11	nil		0	moderate	Flooded Gum Melaleuca woodland	395923	6420463
12	Jarrah	51	4	low	Mixed Eucalyptus Banksia Sheoak woodland	396077	6420601
13	Jarrah	90	12	moderate	Mixed Eucalyptus Banksia Sheoak woodland	396478	6420642
	Jarrah	60					
	Jarrah	65					

Tree Density Plot No.	Tree species	DBH (cm)	Tree density (trees/ hectare)	Black Cockatoo Foraging value	Fauna habitat type	Easting	Northing
15	Flooded Gum	51	76	low	Riparian	397143	6421690
	Flooded Gum	65					
	Flooded Gum	60					
	Flooded Gum	65					
	Flooded Gum	60					
	Flooded Gum	55					
	Flooded Gum	60					
	Flooded Gum	65					
	Flooded Gum	55					
	Flooded Gum	55					
	Flooded Gum	51					
	Flooded Gum	55					
	Flooded Gum	51					
	Flooded Gum	51					
	Flooded Gum	55					
	Flooded Gum	70					
	Flooded Gum	65					
	Flooded Gum	55					
	Flooded Gum	65					
16	Flooded Gum	75	56	low	Riparian	397523	6421709
	Flooded Gum	75					
	Flooded Gum	65					
	Flooded Gum	51					
	Flooded Gum	60					
	Flooded Gum	51					
	Flooded Gum	65					

Tree Density Plot No.	Tree species	DBH (cm)	Tree density (trees/ hectare)	Black Cockatoo Foraging value	Fauna habitat type	Easting	Northing
	Flooded Gum	70					
	Flooded Gum	51					
	Flooded Gum	65					
	Flooded Gum	60					
	Flooded Gum	65					
	Flooded Gum	51					
	Flooded Gum	51					
17	Tuart	65	32	moderate	Riparian	397615	6421774
	Tuart	85					
	Tuart	85					
	Tuart	90					
	Tuart	60					
	Tuart	65					
	Tuart	80					
	Tuart	65					
18	nil		0	high	Mixed Eucalyptus Banksia Sheoak woodland	397203	6423466
20	nil		0	high	Mixed Eucalyptus Banksia Sheoak woodland	396968	6423393
21	Flooded Gum	90	8	low	Flooded Gum Melaleuca woodland	396657	6423471
	Flooded Gum	60					
22	Marri	75	4	low	Flooded Gum Melaleuca woodland	396951	6423630
23	nil		0	high	Mixed Eucalyptus Banksia Sheoak woodland	397359	6423660
24	Jarrah	65	8	high	Mixed Eucalyptus Banksia Sheoak woodland	397609	6423551
	Jarrah	75					
25	nil		0	moderate	Mixed Eucalyptus Banksia Sheoak woodland	398074	6423458
26	Jarrah	70	12	high	Mixed Eucalyptus Banksia Sheoak woodland	397508	6423324

Tree Density Plot No.	Tree species	DBH (cm)	Tree density (trees/ hectare)	Black Cockatoo Foraging value	Fauna habitat type	Easting	Northing
	Jarrah	90					
	Jarrah	75					
27	Marri	150	4	moderate	Scattered native trees	397267	6424465
28	nil		0	nil	Scattered native trees	397155	6424517
29	Jarrah	65	8	high	Mixed Eucalyptus Banksia Sheoak woodland	397187	6424615
	Jarrah	51					
30	Jarrah	65	8	high	Mixed Eucalyptus Banksia Sheoak woodland	397400	6424740
	Jarrah	100					
31	Jarrah	55	4	high	Mixed Eucalyptus Banksia Sheoak woodland	397075	6424703
32	Jarrah	110	16	high	Mixed Eucalyptus Banksia Sheoak woodland	398743	6424313
	Jarrah	51					
	Jarrah	70					
	Jarrah	65					
33	Flooded Gum	51	4	low	Flooded Gum Melaleuca woodland	398728	6423013
34	Marri	100	8	high	Mixed Eucalyptus Banksia Sheoak woodland	398935	6423056
	Marri	90					
35	nil		0	nil	Scattered native trees	398953	6422505
36	nil		0	nil	Mixed Eucalyptus Banksia Sheoak woodland	398714	6422327
37	Flooded Gum	90	40	low	Riparian	398871	6422134
	Flooded Gum	85					
	Flooded Gum	65					
	Flooded Gum	70					
	Marri	65					
	Flooded Gum	70					
	Flooded Gum	60					
	Flooded Gum	80					

Tree Density Plot No.	Tree species	DBH (cm)	Tree density (trees/ hectare)	Black Cockatoo Foraging value	Fauna habitat type	Easting	Northing
	Flooded Gum	100					
	Flooded Gum	65					
38	Flooded Gum	51	40	low	Riparian	398815	6422153
	Flooded Gum	65					
	Flooded Gum	55					
	Flooded Gum	51					
	Flooded Gum	55					
	Flooded Gum	55					
	Flooded Gum	60					
	Flooded Gum	55					
	Flooded Gum	60					
	Flooded Gum	51					

Conservation significant fauna evidence

Chewed Jarrah - Forest Red-tailed Black Cockatoo

Chewed Allocasuarina fraseriana - Forest Red-tailed Black Cockatoo

Chewed Banksia attenuata – Carnaby's Cockatoo

Chewed Banksia ilicifolia – Carnaby's Cockatoo

Quenda diggings

Carter's Freshwater Mussel

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6138451-20209/https://projects.ghd.com/oc/WesternAustralia2/metronetyanchepraile/Delivery/Documents/6138451-REP_Lowlands Environmental Values Assessment.docx

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Revision	Author	Reviewer		Approved for Issue		
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2	A Benkovic	J Tindiglia		J Tindiglia		7/02/2020

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Appendix C – Lowlands Weed Survey Report

LOWLANDS RESERVE WEED SURVEY - 2019

FINAL

06 February 2020

PREPARED FOR

PREPARED BY

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Midge Richardson	Lowlands Homestead Resident (and former owner of reserve)
Mark Angeloni	Serpentine-Jarrahdale Shire Environmental Officer

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this report for succinctness:

DBCA	(Western Australian) Department of Biodiversity, Conservation and Attractions
ha	hectare
PTA	(Western Australian) Public Transport Authority

COVER PHOTO

Photo of *Gladiolus angustus* in Lowlands Reserve

EXECUTIVE SUMMARY

The Public Transport Authority requires offsets to counterbalance significant residual environmental impacts associated with the Yanchep Rail Extension and Thornlie-Cockburn Link projects. One of the offset sites is 'Lowlands Reserve', a 1138 ha Class 'A' Nature Reserve (R 51784) managed by the Department of Biodiversity, Conservation and Attractions for the purpose of 'Conservation of Flora and Fauna', approximately 15 kilometres east of Rockingham.

A weed baseline of Lowlands Reserve was required to inform on-ground management works that will constitute offsets. Field surveys were undertaken over 8 field days from 30 November to 10 December 2019 inclusive. Traverses covered approximately 90 km, with approximately 1,700 observations recorded. Despite the limitations of timing, the mapping appropriately reflects the distribution and abundance of 32 weed species likely to be subject to management (43 weeds recorded onsite were not mapped).

Weed maps were generated of:

- approximately 9 hectares of tree lot plantings, including local and non-local species
- 21 tree and shrub species
    - 1 abundant and widespread
    - 3 widespread
    - 14 in low abundance and/or restricted extent
    - 3 suspected of being weeds onsite as they naturally occur in the region but appear to have established in the reserve as a result of activities such as plantings in nearby areas.
- 9 herb species
    - 1 abundant and widespread
    - 3 widespread
    - 5 low abundance and/or restricted extent
- 2 grasses
    - 2 widespread

The most abundant and widespread weed was *Zantedeschia aethiopica* (Arum Lily), which occurs over more than 135 hectares based on combined data from 2019 low intensity traverses across the entire reserve and 2012 high intensity mapping of the portion of the reserve along the Serpentine River.

Following the 2019 reconnaissance survey, management objectives should be established. Future weed data collection should be developed in the context of these objectives and take the two discrete but complementary forms of surveillance (to detect new occurrences of weeds in an area), and monitoring (to measure changes in abundance and/or extents).

Other datasets should be used in conjunction with the weed mapping in developing a weed management program, and additional associated data collection is recommended.

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PHOTOGRAPHS

TABLES

FIGURES

1. INTRODUCTION

1.1. BACKGROUND

The Public Transport Authority (PTA) requires offsets to counterbalance the significant residual environmental impacts associated with the Yanchep Rail Extension and Thornlie-Cockburn Link projects that form part of the METRONET Program. One of the offset sites is Lot 301 Lowlands Road Mardella, referred to in this report as the 'Lowlands Reserve'.

A weed baseline of Lowlands Reserve was required to inform on-ground management works that will constitute offsets.

1.2. LOCATION

The Lowlands Reserve is a 1138 ha Class 'A' Nature Reserve (R 51784) managed by the Department of Biodiversity, Conservation and Attractions (DBCA) for the purpose of 'Conservation Of Flora And Fauna', approximately 15 kilometres east of Rockingham, as shown in Figure 1.

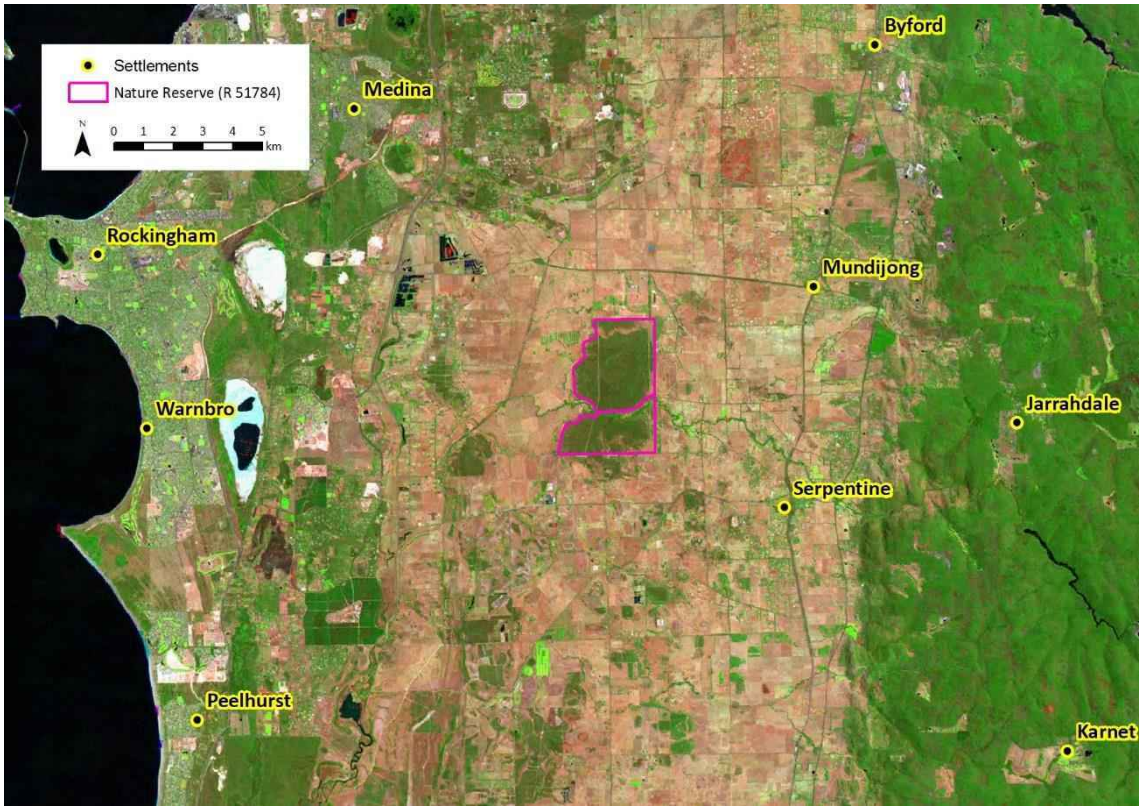

Figure 1: Location of Survey Area

Basemap © Geoscience Australia – National Mapping Division (2002)

The reserve was historically privately-owned freehold land. The majority of Lots 300 and 301 Lowlands Road were purchased by the Government of Western Australia in 2014, with the remainder (adjoining cleared areas) purchased in 2019 to consolidate and rationalise boundaries.

1.3. SCOPE

The scope of work was:

- Conduct a desktop assessment of background information including:
  - Lowlands Weed Action Calendar (2015-16-17).
  - Lowlands Arum Lily mapping (DEC, 2012).
  - Lowlands Blackberry and Bridal Creeper mapping (DEC, 2012)
  - Lowlands Castor Oil Cottonbush and Freesia mapping (DEC, 2012)
  - Lowlands Access and Dieback Interpretation Map (DPAW, 2016).
  - Scope of Work Guidelines for Weed Mapping Lowlands Nature Reserve 2019 (DBCA, 2019).
  - Lowlands Draft Hygiene Management Plan (DPAW, 2013)
  - Management of Phytophthora dieback in Lowlands Nature Reserve (Government of Western Australia, 2018).
  - Lowlands Nature Reserve Access Management Information (Government of Western Australia, no date).
- Conduct weed mapping of the entire Lowlands Site (refer to Figure 1, attached) in accordance with the following guidance documents:
  - Techniques for mapping weed distribution and cover in bushlands and wetlands Standard Operating Procedure (SOP) No: 22.1 (Department of Environment and Conservation, 2011).
  - Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (Government of Western Australia, 2016).
  - Site specific dieback management procedures including the Lowlands Access and Dieback Interpretation Map (DPAW, 2016), Lowlands Draft Hygiene Management Plan (DPAW, 2013) and Management of Phytophthora dieback in Lowlands Nature Reserve (Government of Western Australia, 2018).
- Prepare a short report summarising the results of the weed mapping with references to weed maps prepared in accordance with the Techniques for mapping weed distribution and cover in bushlands and wetlands Standard Operating Procedure (SOP) No: 22.1 (Department of Environment and Conservation, 2011)
- Liaison with officers from the DBCA as required.
- Provision of all spatial data (compatible with ArcGIS in MGA Zone 50).

The survey methodology, refined through consultation with, and approved by, DBCA and PTA, was a reconnaissance survey:

- focused on weeds likely to be subject to management, DBCA indicated Perennial Veldt Grass was the only grass to be targeted;
- based on traverses:
  - along tracks/firebreaks, clearings, reserve perimeter and the Serpentine River;
  - in the reserve's interior at approximately 500 metres spacing;
- with initial fieldwork (excluding woody weeds) completed by 30 December; and
- with fieldwork ceasing if wet soil conditions occurred, to limit spread of *Phytophthora cinnamomi* (Dieback).

2. METHODS

2.1. TIMING

Field surveys were undertaken over 8 field days from 30 November to 10 December 2019 inclusive. Whilst field surveys were commenced within 3 days of finalising contractual and access arrangements, the timing was sub-optimum given Perth experienced its earliest recorded 40-degree December day on December 3, after having its first ever 40-degree November day on record on 16 November (Ceranic, 2019).

Fieldwork was not interrupted by wet soil conditions, as would have been required if it had occurred, to limit spread of *Phytophthora cinnamomi* (Dieback).

During the survey, some species were only detectable of the basis of dead material (e.g. *Moraea flaccida* (One-Leaf Cape Tulip) shown in Photo 1).

Identification of *Ehrharta calycina* (Perennial Veldt Grass) was problematic given none of the terrestrial grasses retained seed or colour at the time of the survey, the similar *Ehrharta longiflora* (Annual Veldt Grass) was also present, where observed *Ehrharta* species tended to occur in very low density (Photo 2), grass species tended to intermingle. At the time of the survey, both *Ehrharta* species' inflorescences had shed seed, and were yellow. Height was not used diagnostically, although many plants appeared less robust than would usually be expected of *Ehrharta calycina* (Perennial Veldt Grass) on the Swan Coastal Plain.

The detectability of some weeds declined significant during the survey period (e.g. *Zantedeschia aethiopica* (Arum Lily) shown in Photo 3 and Photo 4).

To address detectability issues most traverses were walked, regardless of whether vehicle access was available, or tracks had already been driven. Additional walking was undertaken to limit fire risk associated with driving vehicles over dead grasses on very hot days.

Despite the limitations of timing, it is considered the weed mapping appropriately reflect the situation, and the scope was fulfilled in identifying key species and their broad distribution onsite.

Photo 1: Remnants of *Moraea flaccida* (One-Leaf Cape Tulip)

Photo 2: Remnants of *Ehrharta species* (Veldt Grass)

Photo 3: Dying Back of *Zantedeschia aethiopica* (Arum Lily)

Photo 4: Remnants of *Zantedeschia aethiopica* (Arum Lily)

2.1. TRAVERSES

Traverses, excluding multiple trips along tracks, covered approximately 90 km (Figure 2). Midge Richardson allowed traverses to extend into her adjacent property.

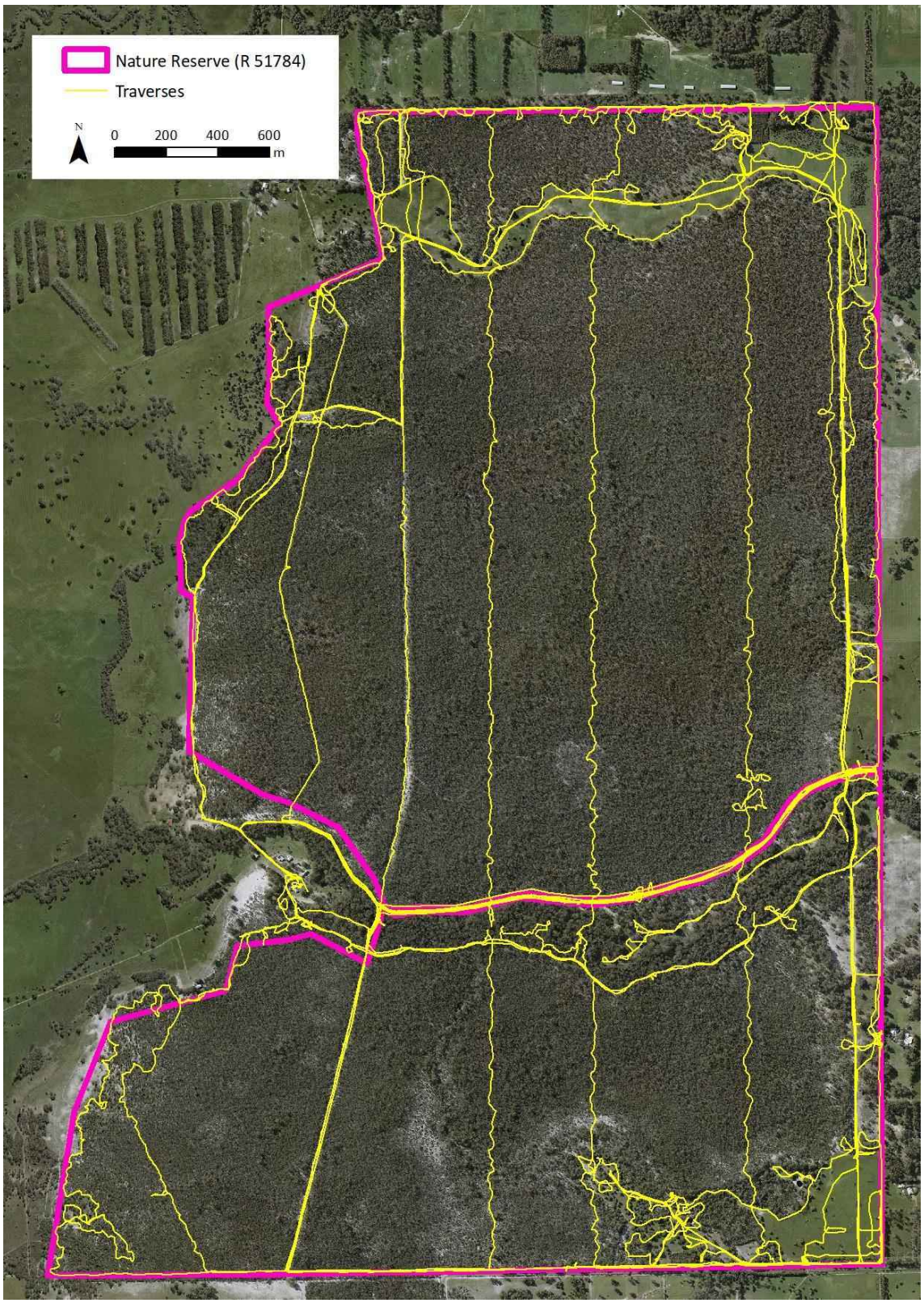

Figure 2: Survey Traverses

Approximately 1,700 observations with GPS locations were recorded. The objective of the reconnaissance to provide an indication of patterns across the reserve and whilst every record represents an observation of a plant, not every individual of every weed was recorded.

Visibility and access was highly variable across the reserve (Photo 5 to Photo 10).

Photo 5: Limited Access/Visibility in *Banksia attenuata/Banksia menziesii* Woodland

Photo 6: Limited Access/Visibility in *Kunzea ericifolia* Shrubland

Photo 7: Limited Access/Visibility in *Eucalyptus gomphocephala* Woodland

Photo 8: Extensive Access/Visibility in *Banksia attenuata/Banksia menziesii* Woodland

Photo 9: Extensive Access/Visibility in *Banksia ilicifolia* Woodland

Photo 10: Extensive Access/Visibility in *Melaleuca preissiana* Woodland

Most traverses were walked, regardless of whether vehicle access was available given the suboptimum timing for detecting weeds.

The length and intensity of traverses were considered sufficient to generate weed maps that appropriately reflect the situation, and the scope was fulfilled in identifying the broad distribution of key species onsite.

2.2. INCORPORATION OF PREVIOUS HISTORIC DATA

Previous high intensity weed surveys of the portion of the reserve along the Serpentine River undertaken by DBCA (as the then Department of Environment and Conservation) included:

- *Asparagus asparagoides* (Bridal Creeper) 2007 and 2015
- *Freesia alba* × *leichtlinii* (Freesia) 2012 and 2015
- *Gomphocarpus fruticosus* (Narrow-Leaf Cottonbush) 2012
- *Leptospermum laevigatum* (Coast Teatree) 2016
- *Pinus species* (Pine Trees) 2015
- *Ricinus communis* (Castor Oil Plant) 2012
- *Rubus* species (Blackberry) 2007 and 2017
- *Zantedeschia aethiopica* (Arum Lily) 2005 and 2012

Previous weed data collected just outside the reserve by DBCA (as the then Department of Environment and Conservation) included:

- *Agapanthus species* (Agapanthus) 2015
- *Carpobrotus edulis* (Pigface) 2015
- *Ehrharta calycina* (Perennial Veldt Grass) 2015
- *Ferraria crispa* (Black Flag) 2015

These earlier datasets should not be compared with the 2019 data to measure change due to differences in survey method and boundaries. The multiple datasets are shown in figures where they provide an indication of a broader distribution than that shown by the 2019 dataset alone (where data largely overlaps only the 2019 is shown for clarity).

2.3. PERSONNEL

Andrew Waters, who undertook all parts of the fieldwork and report writing, is appropriately qualified as a Certified Environmental Practitioner with the Environment Institute of Australia and New Zealand and holding:

- Graduate Certificate GIS (with distinction), Curtin University;
- Bachelor of Science (Environmental Science), Murdoch University;
- Advanced Certificate of Horticulture, Challenger TAFE;
- *Phytophthora* Interpretation, Glevan Consulting; and
- *Phytophthora* Management, CALM, 1999.

Since 1997, Andrew has worked in the following 10 bioregions:

- Avon Wheatbelt
- Esperance Plains
- Geraldton Sandplains
- Great Sandy Desert
- Jarrah Forest
- Little Sandy Desert
- Mallee
- Murchison
- Pilbara
- Swan Coastal Plain

3. RESULTS

3.1. WEEDS

3.1.1. PLANTINGS

A number of formerly cleared sites within the reserve have been planted as tree lots, as indicated in Table 1 and Figure 3, and shown in Photo 11 and Photo 12:

- Prior to 2014, Lots 300 and 301 Lowlands Road were privately owned and mixed plantings of local and non-local Australian trees was undertaken; and
- DBCA subsequently planted lots of only *Corymbia calophylla* (Marri).

Table 1: Tree Lot Plantings

Site	Area (ha)	Species include but not limited to (Angeloni, 2019)	Recorded in Native Flora Inventory (Keighery, Keighery, & Gibson, 1995)
1 + 2	0.3 + 0.2	*Casuarina obesa* (Swamp Sheoak)	Yes
		Eucalyptus rudis (Flooded Gum)	Yes
		Melaleuca lateritia (Robin Redbreast Bush)	Yes
		Melaleuca cuticularis (Saltwater Paperbark)	No
		Melaleuca viminea (Mohan)	No
3	1.3	*Eucalyptus gomphocephala* (Tuart)	Yes
		Eucalyptus dundasii (Dundas Blackbutt)	No
		Eucalyptus melliodora (Yellow Box)	No
		Eucalyptus sideroxylon (Red Ironbark)	No
		Eucalyptus platypus (Moort)	No
4	1.5	*Eucalyptus marginata* (Jarrah) – dieback resistant variety	Yes
		Eucalyptus patens (Swan River Blackbutt)	No
		Eucalyptus melliodora (Yellow Box)	No
		Eucalyptus lane-poolei (Salmon White Gum)	No
		Eucalyptus occidentalis (Flat-topped Yate)	No
5	1.2	*Eucalyptus marginata* (Jarrah) – dieback resistant variety	Yes
		Eucalyptus patens (Swan River Blackbutt)	No
		Eucalyptus melliodora (Yellow Box)	No
6	0.9	*Corymbia calophylla* (Marri)	Yes
7	1.6	*Corymbia calophylla* (Marri)	Yes
8	0.6	*Corymbia calophylla* (Marri)	Yes
9	1.4	*Corymbia calophylla* (Marri)	Yes

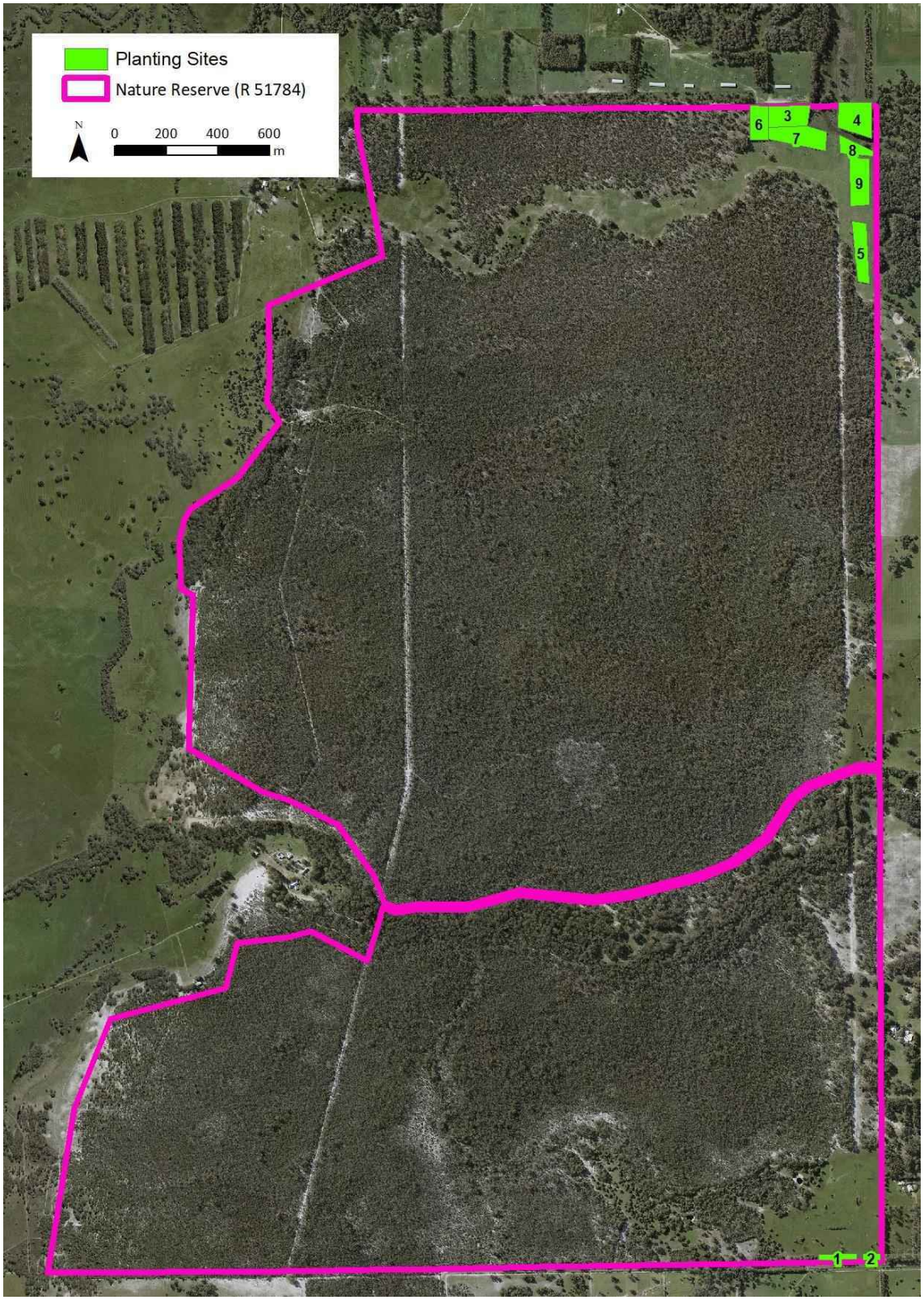

Figure 3: Location of Tree Lot Planting Sites

Photo 11: Plantings at Site 3

Photo 12: Plantings at Site 5

3.1.2. SUSPECTED WEEDS

The three species in Table 2 (with photos included in Appendix 1) are suspected of being weeds onsite as they naturally occur in the Perth Metropolitan Region but have been recorded as having the potential to become 'weedy' outside their natural distribution by Keighery (2013) and:

- do not appear to be naturally occurring onsite, although Keighery, Keighery, & Gibson (1995) noted several species onsite more typical of other parts of the Swan Coastal Plain/Ridge Hill Shelf;
- were only observed around periphery of reserve (and on nearby properties/roads);
- have not been planted in the reserve (Richardson, 2019);
- appear to have established in the reserve as a result of activities such as plantings in nearby areas.

Table 2: Suspected Weeds

Weed	Comments
Agonis flexuosa (Peppermint)	• 9 plants recorded – not initially targeted and likely more plants • Grows on a variety of soils, but restricted in the Perth Region to calcareous dunes (Dixon, 2011). • Naturally occur along the Swan Estuary downstream from Freshwater Bay (Powell, 2009) with Blackwall Reach possibly being one of the most easterly occurrences (Government of Western Australia, 2000). • May become weedy if fire and soil disturbance is not controlled (Dixon, 2011). • Has the ability to completely alter the structure of communities it invades, and it is currently being removed from Kings Park (Keighery G. , 2013)
Callistemon phoeniceus (Lesser Bottlebrush)	• 9 plants recorded – not initially targeted and likely more plants • Perth Metropolitan Region is at the western edge of its distribution (Powell, 2009) • In the Perth Metropolitan Region, it grows in the Helena and Avon Valleys (Powell, 2009)
Calothamnus rupestris (Mouse Ears)	• 9 plants recorded – not initially targeted and likely more plants • In reserve not growing in typical habitat (usually associated with granite, and to a lesser degree laterite) (Powell, 2009)

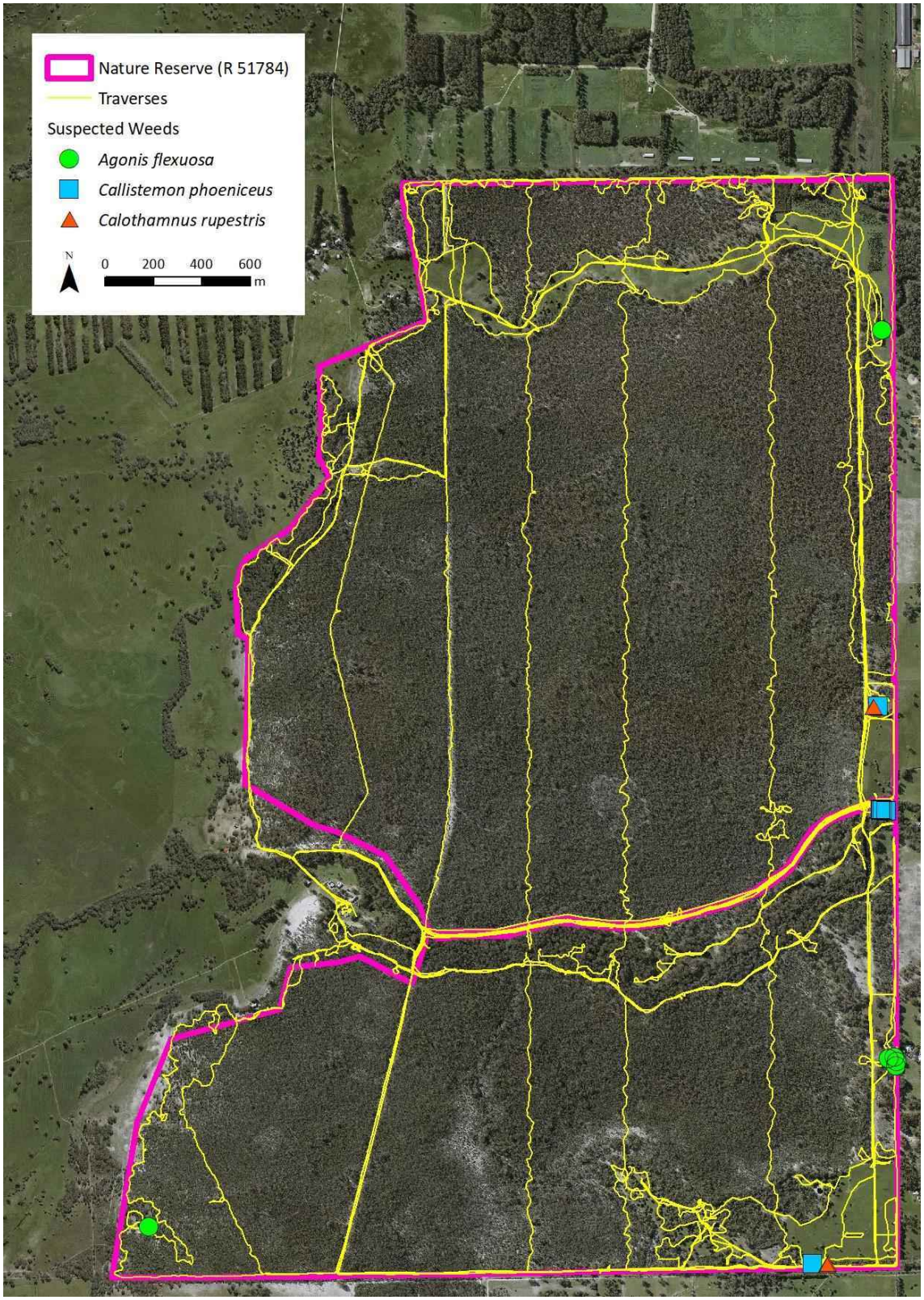

Figure 4: Location of Suspected Weeds

3.1.1. TREE AND SHRUB WEEDS MAPPED

The 21 tree/shrub weed species mapped are listed in Table 3, with photos included in Appendix 2.

Table 3: Tree/Shrub Observations

Abundance / Extent	Weed	Comments (counts and areas* limited to reserve)
Abundant and Widespread Figure 5	*Gomphocarpus fruticosus* (Narrow-Leaf Cottonbush)	20.5 ha based on 206 observations on traverses 39.5 ha based on traverses and 2012 map
Widespread Figure 6	*Corymbia* and *Eucalyptus* species (Gum Trees)	114 plants excluding tree lots All very tall trees with smooth white trunks, no species naturally occurring onsite have these characteristics. At least 4 species, predominately: • *Corymbia citriodora* (eastern boundary) • *Eucalyptus saligna* (northern boundary)
	Ricinus communis (Castor Oil Plant)	2.25 ha based on 23 observations on traverses 11.25 ha based on traverses and 2012 map
Low Abundance and/or Restricted Extent Figure 7 Figure 8	*Acacia longifolia* (Sydney Golden Wattle)	2 plants
	Brachychiton populneus (Kurrajong)	1 plant near Serpentine River
	Casuarina cunninghamiana (River Sheoak)	1 site on eastern fenceline estimated less than 10 plants
	Chamaecytisus palmensis (Tagasate)	6 plants on eastern fenceline
	Ficus carica (Edible Fig)	5 plants
	Lavandula stoechas (Italian Lavender)	1 site near Serpentine River estimated less than 10 plants
	Leptospermum laevigatum (Coast Teatree)	18 seedlings in vicinity of parent plant which has been cut-down, near Lowlands private road • 17 seedlings north of road (around parent) • 1 seedling nearby just south of road
	Melaleuca quinquenervia (Broad-leaved Paperbark)	1 plant on eastern fenceline
	Pelargonium capitatum (Rose Pelargonium)	3 sites estimated less than 10 plants
	Phytolacca octandra (Red Ink Plant)	2 plants
	Pinus pinea (Stone Pine)	8 plants Leaves in pairs – consistent with identification of *Pinus pinea* supplied by Midge Richardson (2019)
	Salix matsunda (Chinese Willow)	1 plant
	Schinus terebinthifolia (Brazilian Pepper)	5 plants
	Solanum linnaeanum (Apple of Sodom)	19 plants

***Area based on 50 m x 50 m squares in grid intersected by records**

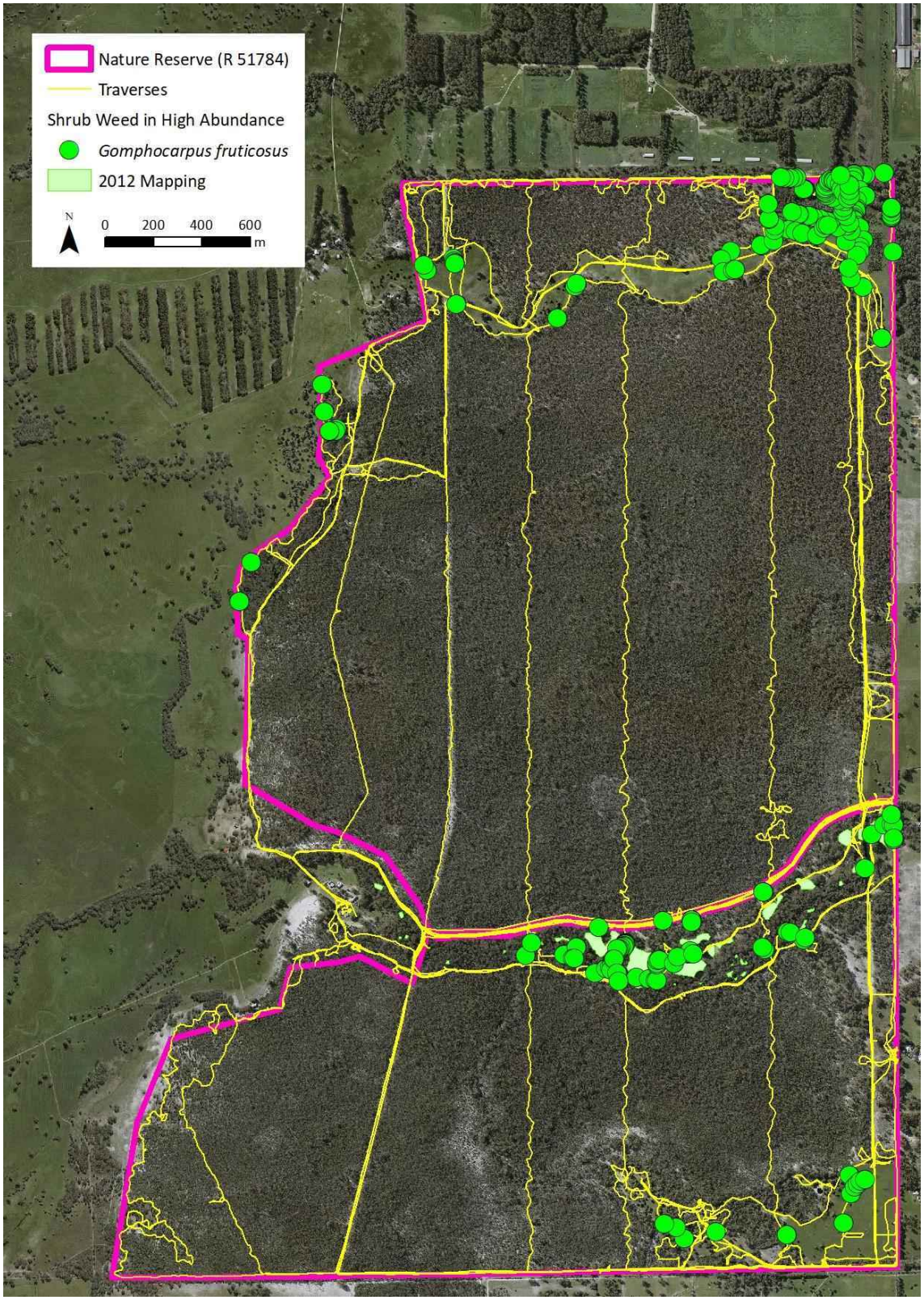

Figure 5: Location of Shrub (*Gomphocarpus fruticosus*) in High Abundance

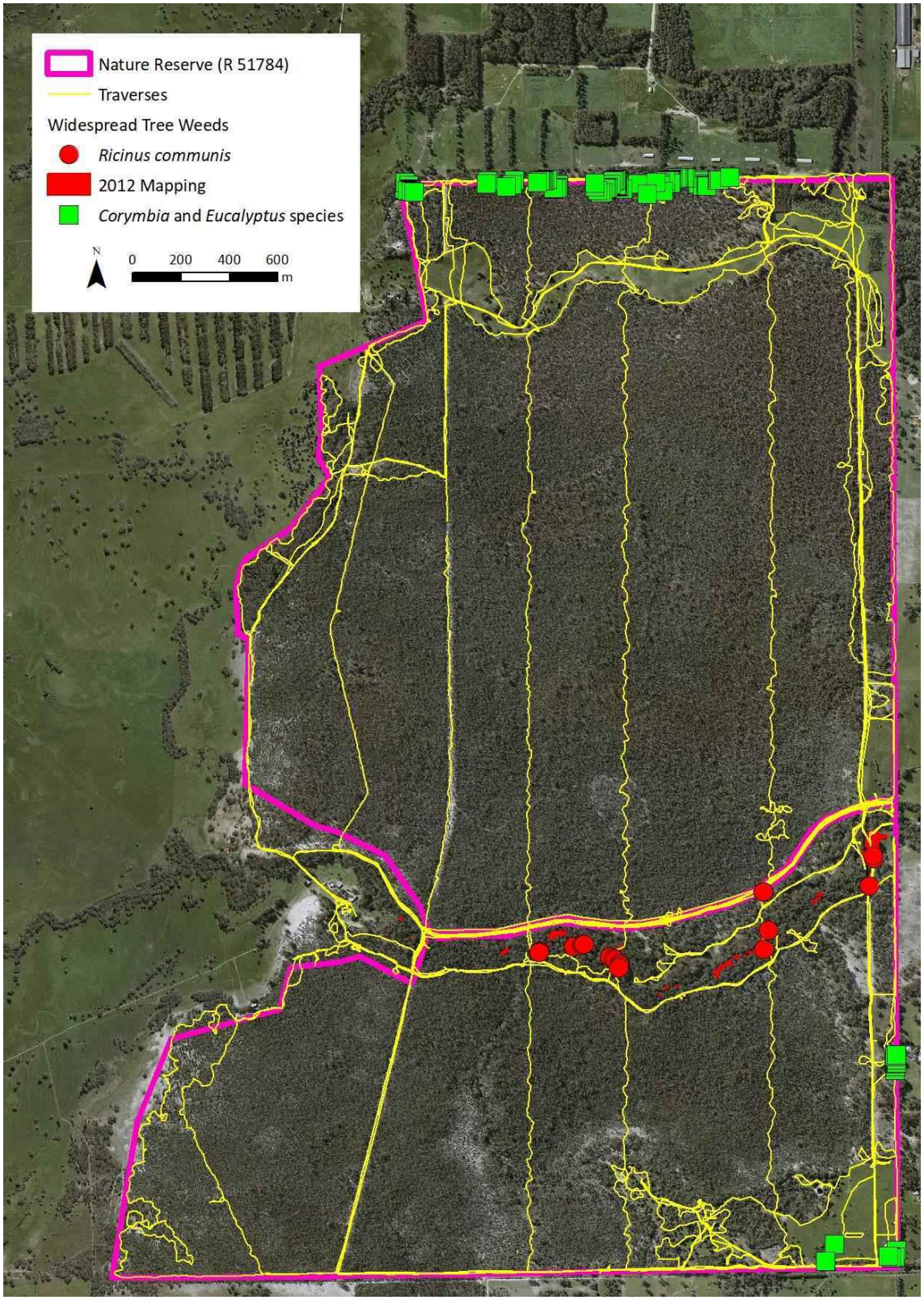

Figure 6: Location of Widespread (*Ricinus communis* and *Corymbia/Eucalyptus*) Trees

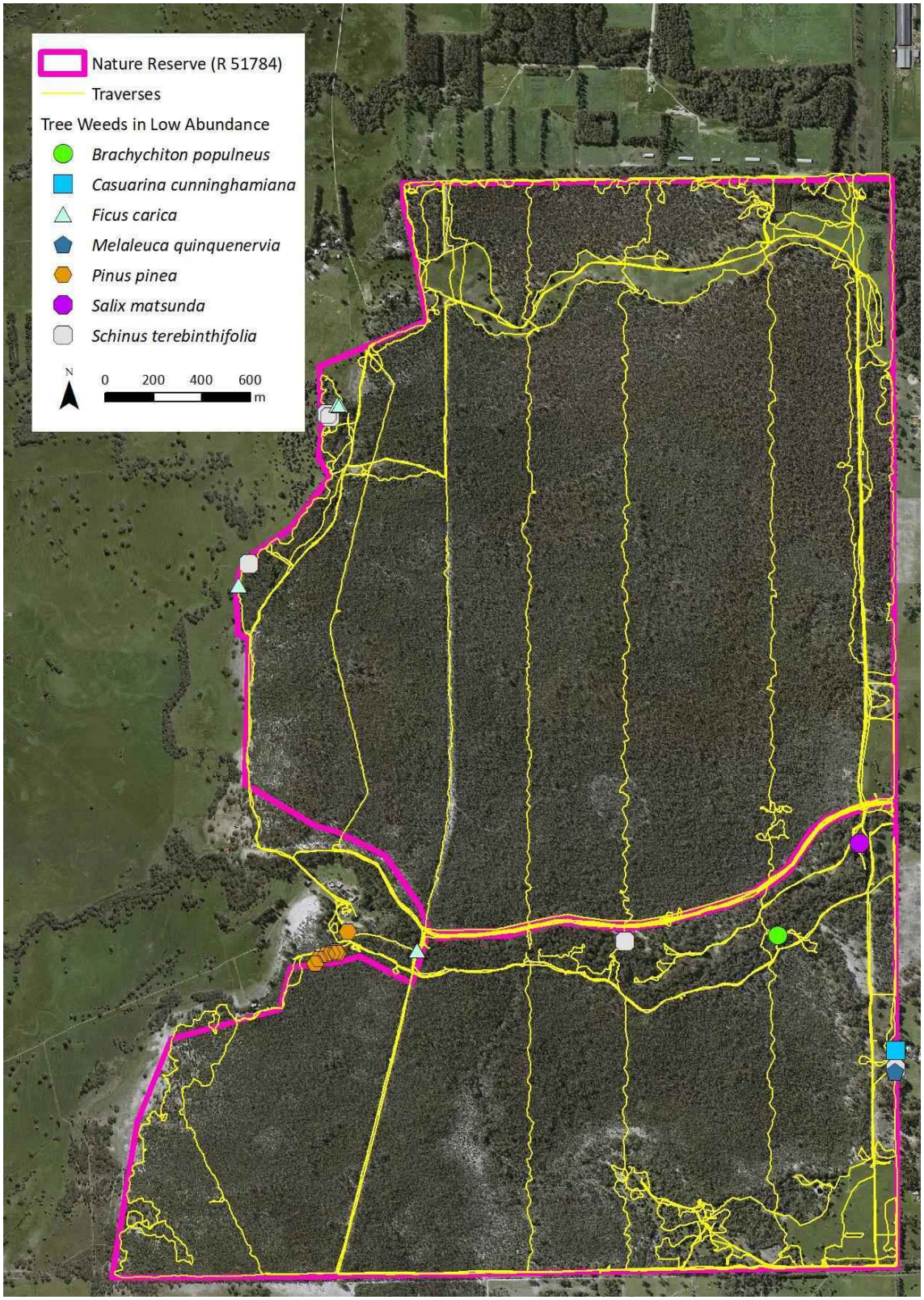

Figure 7: Location of Trees in Low Abundance

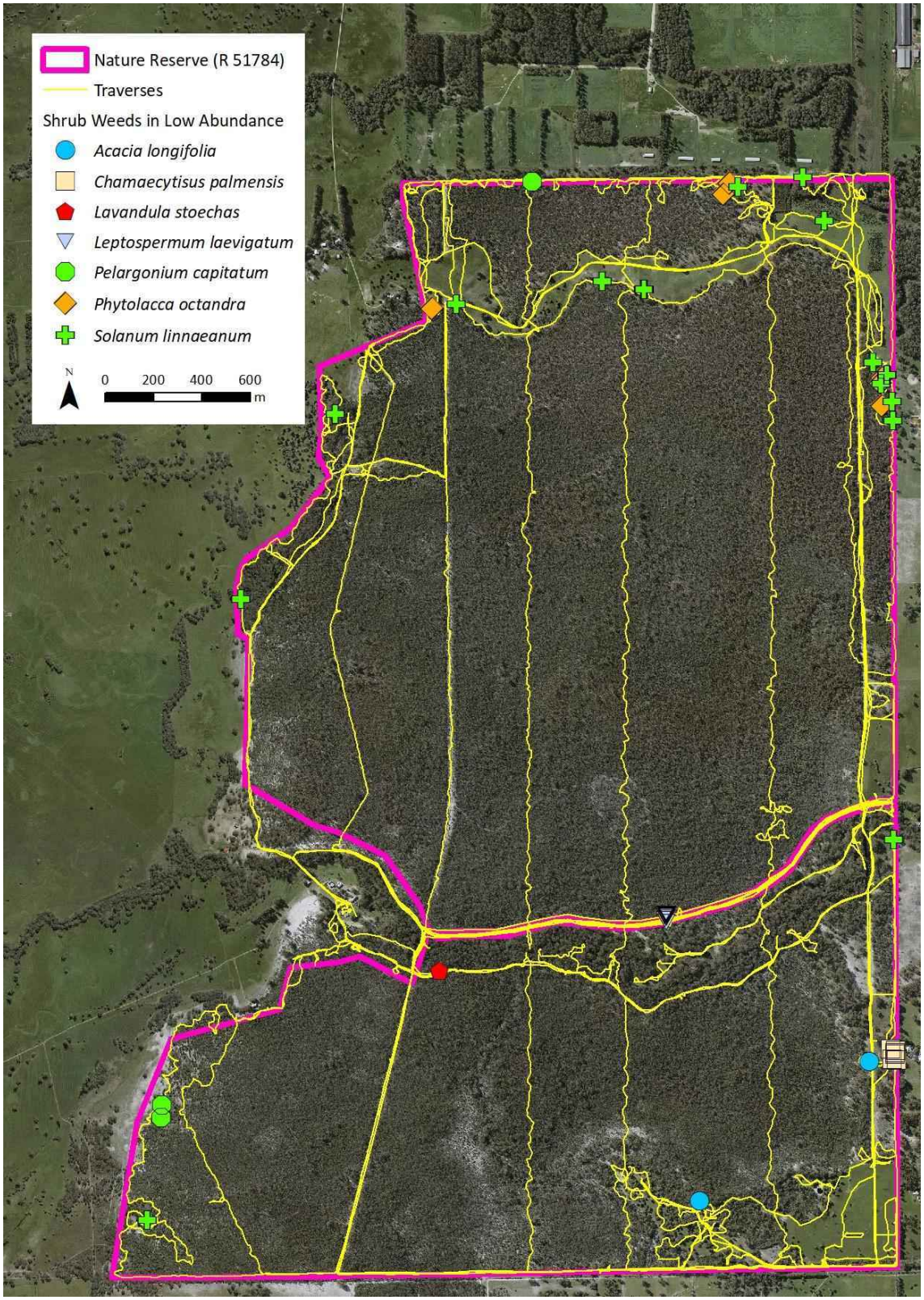

Figure 8: Location of Shrubs in Low Abundance

3.1.2. OTHER WEEDS MAPPED

The 9 herb/climbing weed species mapped are listed in Table 4Table 3, with photos included in Appendix 3.

Table 4: Herb/Climber Observations

Abundance / Extent	Weed	Comments (counts and areas* limited to reserve)
Abundant and Widespread Figure 9	*Zantedeschia aethiopica* (Arum Lily)	47.25 ha based on 703 observations on traverses 135 ha based on traverses and 2012 map
Widespread Figure 10	*Echium plantagineum* (Paterson's Curse)	1.75 ha based on 9 observations on traverses
	Gladiolus angustus (Long Tubed Painted Lady)	120 plants on traverses
	Moraea flaccida (One-leaf Cape Tulip)	4.5 ha based on 50 observations on traverses
Low Abundance and/or Restricted Extent Figure 11	*Asparagus asparagoides* (Bridal Creeper)	1 ha based on 6 observations on traverses 1 ha based on traverses and 2015 map 13.75 ha based on traverses and 2007 map
	Euphorbia terracina (Geraldton Carnation Weed)	1 site on pile of limestone next to private road estimated less than 10 plants
	Freesia alba × *leichtlinii* (Freesia)	0.5 ha based on 6 observations on traverses (all observations on reserve boundary) 2 ha based on traverses and 2015 map 1.25 ha based on traverses and 2012 map
	Rubus species (Blackberry)	0.25 ha based on 2 observations on traverses 1.75 ha based on traverses and 2017 map 0.75 ha based on traverses and 2017 map
	Watsonia meriana var. *bulbillifera* (Bugle Lily)	0.25 ha based on 6 observations on traverses (most observations just outside reserve)

***Area based on 50 m x 50 m squares in grid intersected by records**

The 2 grass weed species mapped are listed in Table 5, with photos included in Appendix 4.

Table 5: Grass Observations

Abundance / Extent	Weed	Comments (counts and areas* limited to reserve)
Widespread Figure 12	*Ehrharta calycina* (Perennial Veldt Grass) *Ehrharta longiflora* (Annual Veldt Grass)	Data combined for *Ehrharta* species (Veldt Grasses) 37.75 ha based on 703 observations on traverses

***Area based on 50 m x 50 m squares in grid intersected by records**

DBCA indicated *Ehrharta calycina* (Perennial Veldt Grass) was the only grass to be recorded, but it was not differentiated from the similar *Ehrharta longiflora* (Annual Veldt Grass) due to identification issues arising from weather and low density of plants. At the time of the survey, both *Ehrharta* species' inflorescences had shed seed, and were yellow. Height was not used diagnostically, although many plants appeared less robust than would usually be expected of *Ehrharta calycina* (Perennial Veldt Grass) on the Swan Coastal Plain.

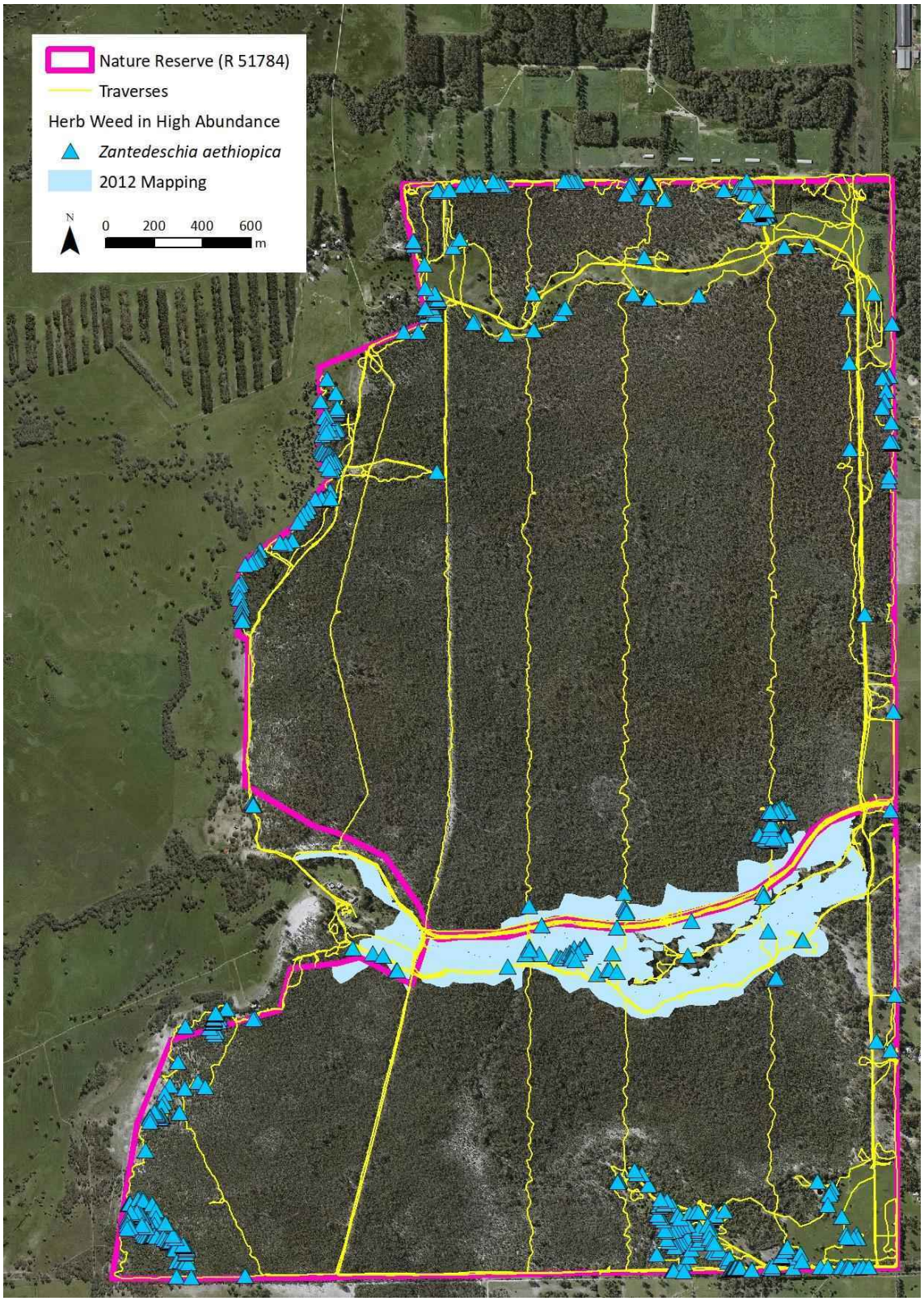

Figure 9: Location of Herb (*Zantedeschia aethiopica*) in High Abundance

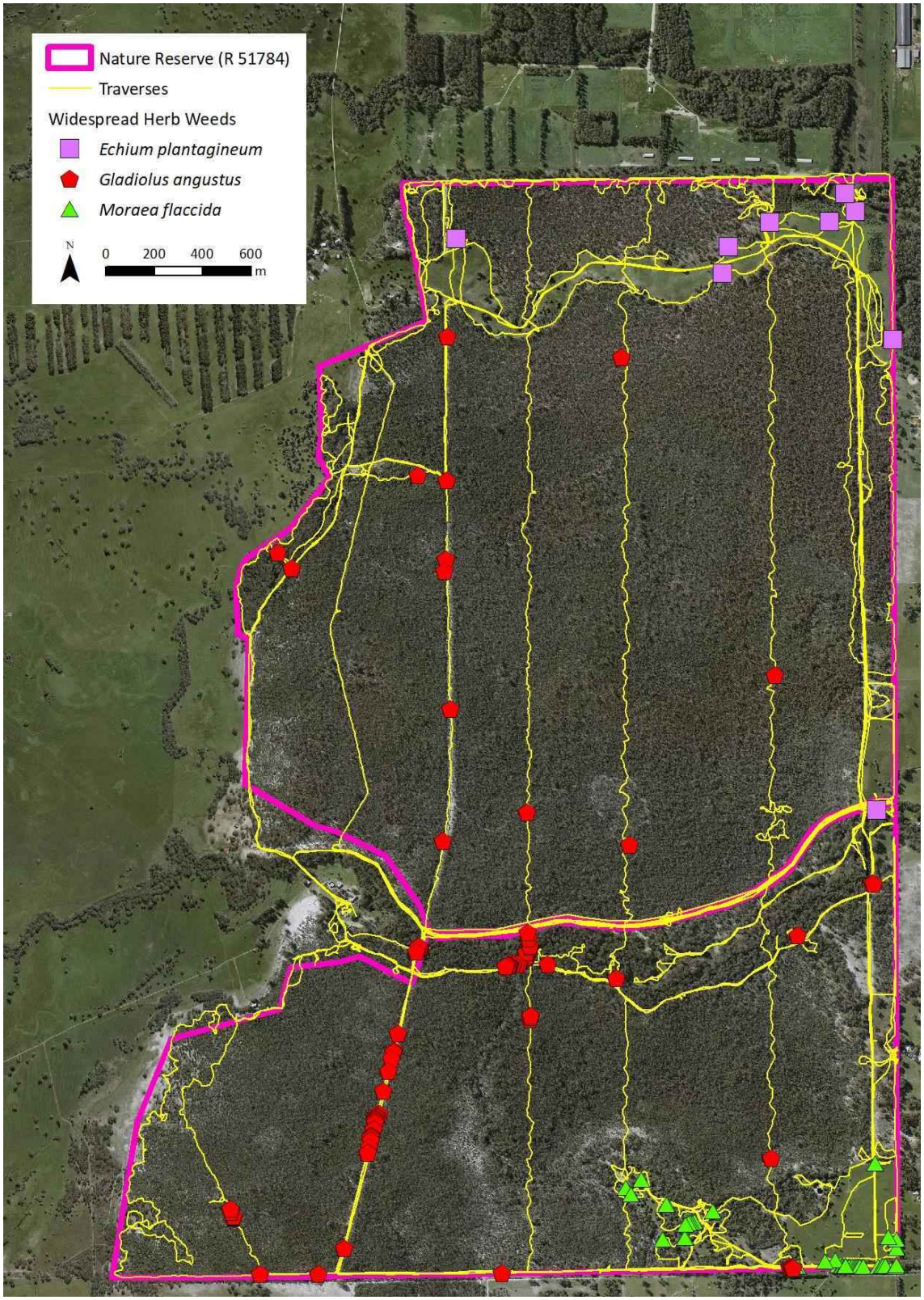

Figure 10: Location of Widespread Herbs

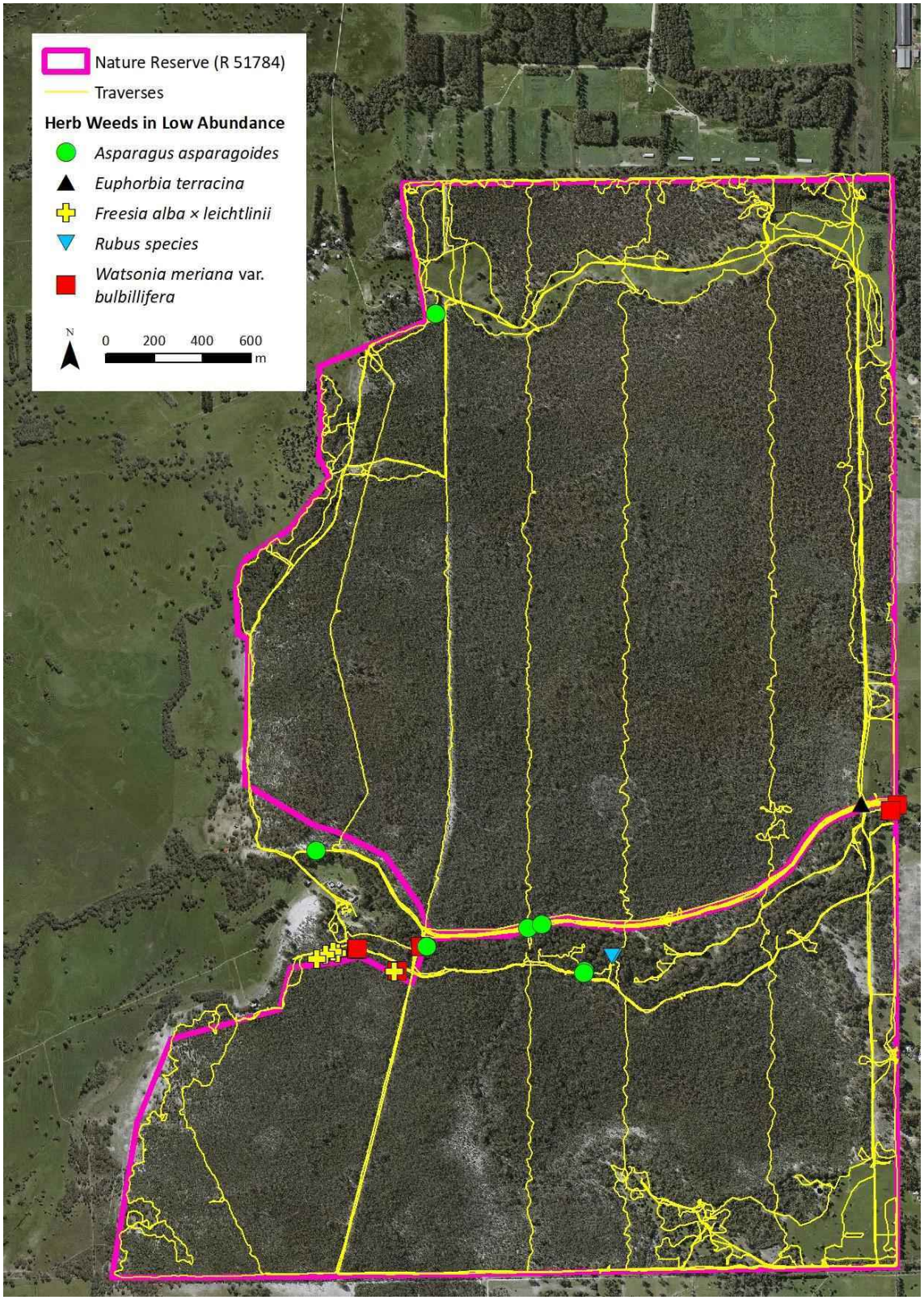

Figure 11: Location of Herbs in Low Abundance

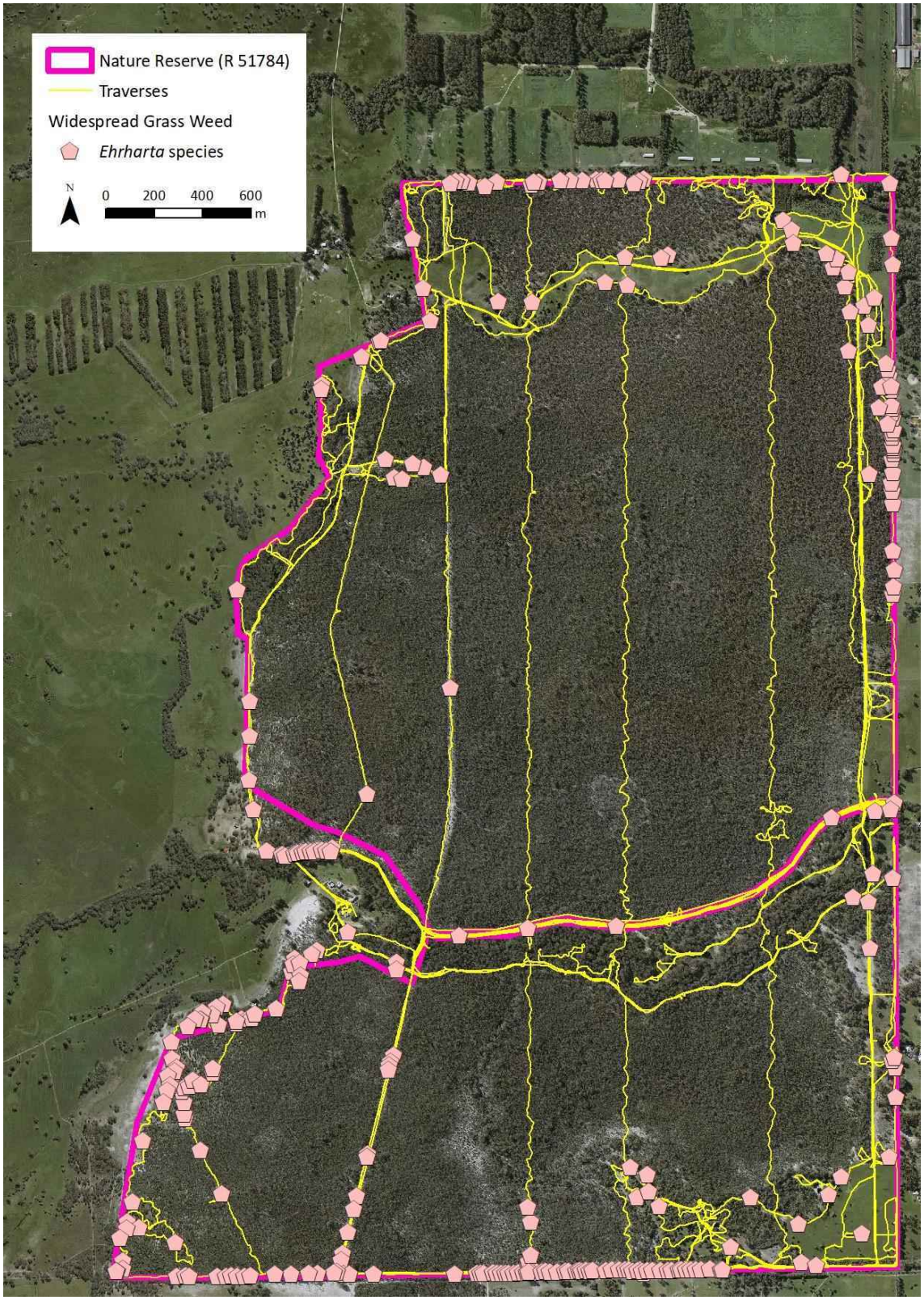

Figure 12: Location of Widespread Grasses (*Ehrharta* species)

3.1.3. WEEDS IN RESERVE NOT MAPPED

The 41 weed species previously recorded in the reserve by Keighery, Keighery, & Gibson (1995) but not mapped were:

- *Aira caryophyllea* (Silvery Hairgrass)
- *Aira cupaniana* (Silvery Hairgrass)
- *Anthoxanthum odoratum* (Sweet Vernal Grass)
- *Briza maxima* (Blowfly Grass)
- *Briza minor* (Shivery Grass)
- *Bromus diandrus* (Great Brome)
- *Cerastium glomeratum* (Mouse Ear Chickweed)
- *Conyza sumatrensis*
- *Cynodon dactylon* (Couch)
- *Disa bracteata*
- *Echinochloa crus-galli* (Barnyard Grass)
- *Hordeum leporinum* (Barley Grass)
- *Hypochaeris glabra* (Smooth Catsear)
- *Isolepis marginata* (Coarse Club-rush)
- *Juncus capitatus* (Capitate Rush)
- *Juncus polyanthemus*
- *Lagurus ovatus* (Hare's Tail Grass)
- *Lolium multiflorum* (Italian Ryegrass)
- *Lotus angustissimus* (Narrowleaf Trefoil)
- *Lotus subbiflorus*
- *Lysimachia arvensis* (Pimpernel)
- *Ornithopus compressus* (Yellow Serradella)
- *Ornithopus pinnatus* (Slender Serradella)
- *Oxalis glabra*
- *Oxalis pes-caprae* (Soursob)
- *Oxalis purpurea* (Largeflower Wood Sorrel)
- *Parentucellia viscosa* (Sticky Bartsia)
- *Petrorhagia dubia*
- *Poa annua* (Winter Grass)
- *Romulea rosea* var. *australis* (Guildford Grass)
- *Rumex acetosella* (Sorrel)
- *Rumex pulcher* (Fiddle Dock)
- *Solanum americanum* (Glossy Nightshade)
- *Sonchus asper* subsp. *asper*
- *Sonchus oleraceus* (Common Sowthistle)
- *Stellaria media* (Chickweed)
- *Trifolium campestre var. campestre* (Hop Clover)
- *Ursinia anthemoides* (Ursinia)
- *Vicia sativa* subsp. *sativa*
- *Vulpia bromoides* (Squirrel Tail Fescue)
- *Vulpia myuros* (Rat's Tail Fescue)

It was outside the scope to record additional weeds not likely to be subject to management, but *Lupinus* species (Lupins) and *Cucumis myriocarpus* (Prickly Paddy Melon) were opportunistically observed.

3.1.4. WEEDS ADJACENT RESERVE

Weeds previously mapped by DBCA around the Lowlands Homestead (adjacent to the reserve) but not detected in the reserve in the 2019 reconnaissance survey, included:

- *Agapanthus species* (Agapanthus)
- *Carpobrotus edulis* (Pigface)
- *Ferraria crispa* (Black Flag)

Midge Richardson allowed traverses to extend into her adjacent property in the 2019 reconnaissance survey for logistical reasons, but the gardens of the Lowlands Homestead were not surveyed. *Olea europaea* (Olive) trees were opportunistically observed at the entrance to the private road at the western end of Lowlands Road.

3.1. NON-NATIVE FAUNA

The PTA requested opportunistic observations of non-native animals be recorded.

Evidence of non-native fauna is shown in Figure 13, with photos included in Appendix 5. Rabbit droppings were observed but no active rabbit warrens were observed.

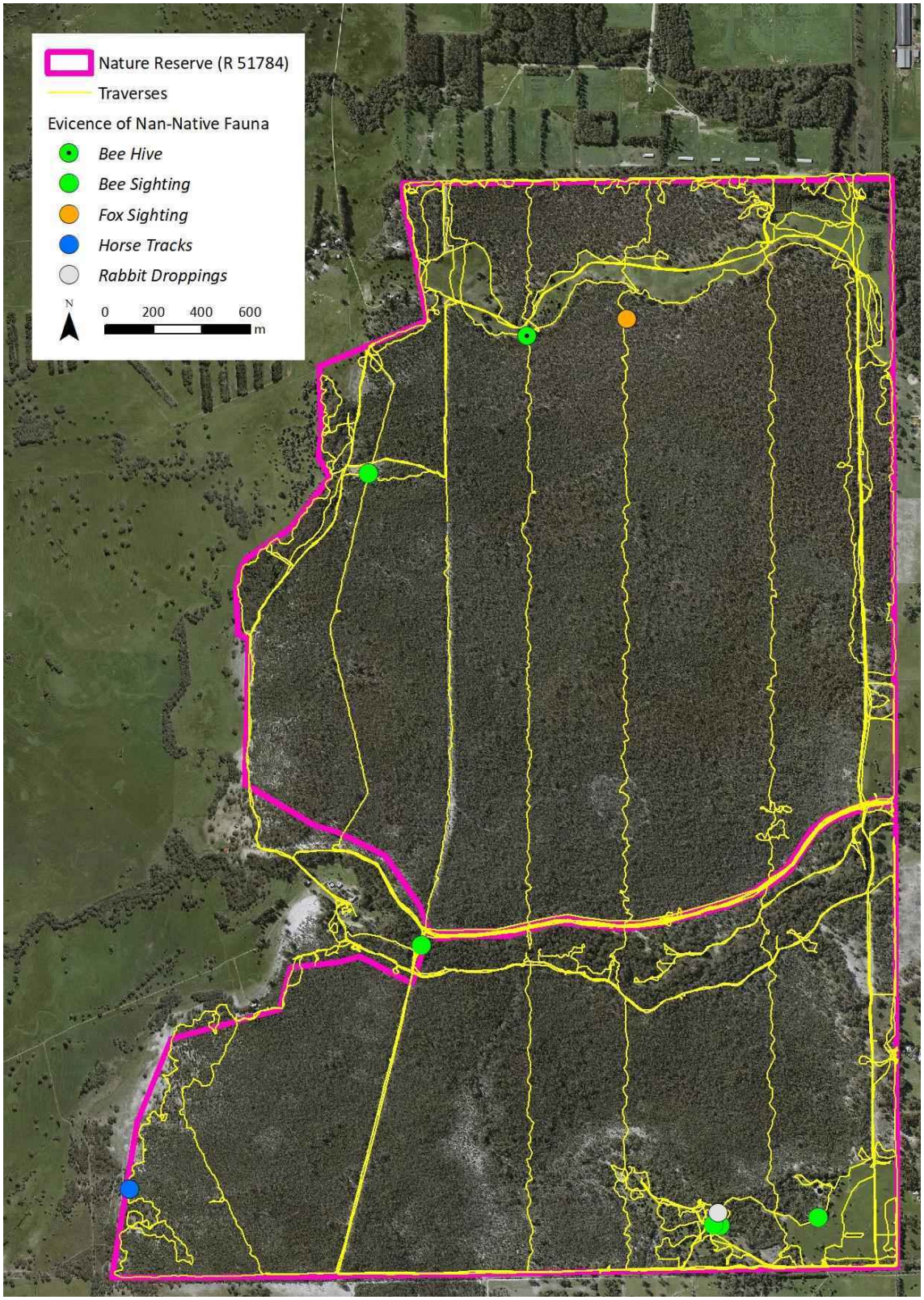

Figure 13: Opportunistic Observations of Non-native Fauna Activity

4. RECOMMENDATIONS

4.1. WEED DATASETS

Weed data collection needs to be fit for purpose, and should take the two discrete but complementary forms of:

- Surveillance to detect new occurrences of weeds in an area; and
- Monitoring to measure changes in abundance and/or extents.

Surveillance is intended to confirm species presence and not to generate quantitative measures for weeds (e.g. extents). Surveillance should be relatively rapid and focused on high-risk areas (such as the reserve's boundaries, tracks, and in proximity of previously recorded weeds outside the reserve (e.g. around the *Olea europaea* (Olive) trees at the western end of Lowlands Road). Surveillance can be passive (conducted whilst undertaking other tasks) or active (undertaken in a more formal targeted manner).

Monitoring is intended to quantitively measure the effectiveness of management. Given the size of the reserve and issues around access, the most rapid method for measuring changes in extents of weed infestations over time would be to record the number grid squares (e.g. 50 metres x 50 metres) intersected by GPS records of plants (with records being taken at least every 10 metres where infestations are relatively continuous). Reporting can be in this form even if every individual plant (e.g. for shrubs and trees in low abundance, or geophyte herbs in low abundance in proximity to the threatened orchids *Drakaea elastica and Caladenia huegelii*) or cover data (e.g. for abundant herbs) was collected to provide more nuanced information for prioritising on-ground management within infestations.

Whilst the 2019 reconnaissance survey has generated minimum counts/extents of weeds it should be considered a surveillance survey as:

- the scope was to conduct a reconnaissance survey to identify key species and their broad distribution onsite;
- the survey was not comprehensive;
- traverses were not all along 'fixed' lines and therefore not intended to be replicable; and
- the detectability of some weeds in some areas was suboptimal as a result of the weather.

Tiered objectives of prevention, elimination, containment and management are summarised in Table 6, adapted from the Model for Management and Monitoring of Invasive Species developed by the Department of Agriculture and Food and shown in Figure 14.

Table 6: Framework for Weed Objectives

Objective	Scenario	Targets
Prevention	• Weed absent from area	• No introductions • No germinants reach maturity (set seed)
Eradication	• Small localised populations • Large discrepancy between current and potential impact • Elimination feasible and potential high impact	• No seed set in reserve • Removal of mature plants (timeframe may vary with short to medium term reduction in density/abundance and/or extent)
Containment	• Rapidly increasing extent and/or density • Moderate discrepancy between current and potential impact • Elimination not feasible	• No increase in extent • No increase in density/abundance
Management	• Low discrepancy between current and potential impact • Elimination not feasible and containment irrelevant as threat "naturalised" at or near its potential extent	• Minimise negative impacts (e.g. in vicinity of threatened flora) • Often considered in terms of total weed cover (e.g. fuel load for fire)

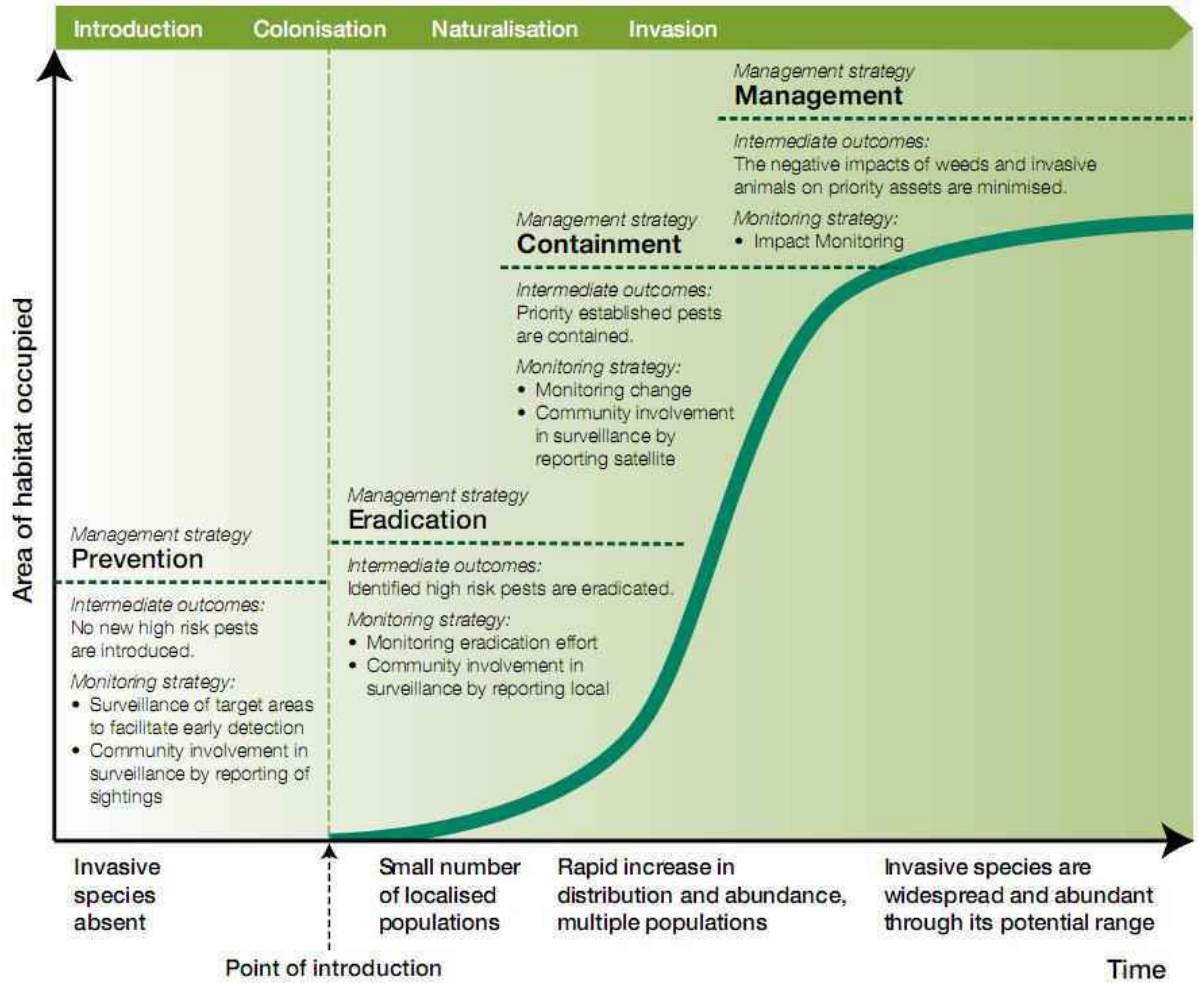

Figure 14 Model for Management and Monitoring of Invasive Species
(De Milliano, Woolnough, Reeves, & Shepherd, 2010)

Weed data collection needs to be fit for purpose as, for example mature and juvenile plants need to differentiated in records if the objective is to stop seed set within the reserve (i.e. eradicate all mature plants) for a species that could be eradicated for a short period but for which there is a constant seed source for re-invasion (e.g. from gum trees just outside the reserve boundary).

The scope of this report was focused on weed species likely to be subject to management. It is noted that data may need to be collected for some weed species not yet mapped (see Section 3.1.3) in some portions of the reserve where site(asset)-based rather than species(threat)-based priorities are established. For example, the South African weed orchid *Disa bracteata* maybe targeted for control (and therefore monitoring) where it currently appears to occur in low abundance in the vicinity/habitat of the threatened orchids *Drakaea elastica* and *Caladenia huegelii.*

The scope of this report was focused on weed species likely to be subject to management. There are previously cleared areas within the reserve, as shown in Photo 13, in which there are only weeds (even if these are not highly invasive weeds) which could at least in part be displaced by native flora plantings, which could also increase fauna habitat values. Weed objectives and monitoring in these areas could be based on total weed cover or conversely by native plant cover.

Photo 13: Example of Previously Cleared Area

4.1.1. COMPLIMENTARY DATASETS

Other datasets that should be used in conjunction with the weed mapping in developing a weed management program include inputs into a risk assessment that addresses potential incidental damage to fauna habitat and off-target damage to native flora:

- *Phytophthora cinnamomi* (Dieback) is already considered in terms of access in Lowlands Nature Reserve Access Management Information and DBCA has equipment sterilization procedures.
- In addition to the threatened and priority fauna species recorded onsite, it is noted that there appears to be habitat for *Petalura hesperia,* Western Petalura. This is the largest dragonfly in Western Australia, with body length of 10 cm and a wingspan of 13 cm (Barrett, 1998). It is restricted to boggy marshes or seepages beside freshly oxygenated water, and dense vegetation appears to be critical to its habitat requirements of moist soils with roots and vegetation to burrow amongst (Barrett, 1998). This species is known from only 19 locations, with few individuals recorded at each site (Barrett, 1998). The species can be considered threatened and it is believed to be extinct at its only known location on the Swan Coastal Plain, at Bull Creek (Sutcliffe, 2003). Detection is difficult as it is only effectively surveyed when adults are in flight (typically December-January) and it has a 5-6 year larval stage (Barrett, 1998).
- Additional priority and threatened flora surveys may need to be undertaken to create a comprehensive species and location inventory. *Jacksonia gracillima* P3 (Photo 14) was opportunistically observed in the reserve. A specimen was not taken for confirmation as no permission had been sought for taking native flora from the reserve and as it was not targeted its distribution will be more extensive than shown in Figure 15. It is a dense groundcover (Photo 15) that could be planted to capture windblown seed and reduce the establishment of weeds along some sections of fencelines, and increase the viability of the priority flora population, and increase cover for fauna by re-establishing it in previously cleared portions of the reserve.
- More detailed vegetation mapping may need to be undertaken to provide more detailed weed habitat mapping (i.e. areas at risk of invasion by specific weeds), and better delineate values of the reserve. It is noted that several occurrences of vegetation types do not appear to have previously been mapped, including:
  - *Baumea articulata* sumpland shown in Photo 16 on the western boundary in the north of reserve.
  - *Eucalyptus rudis* woodland shown in Photo 17 on the western boundary in the south of reserve.

Objectives need to be prioritised and this can be based on datasets relating to:

- values impacted by weeds (e.g. threatened and priority flora species in competition with weeds, small lizards with burrowing habitat displaced by dense weed root systems etc);
- the difference between current and potential impacts (e.g. the potential to change hydrology, vegetation structure, fire regimes etc); and
- weed status (e.g. Biosecurity and Agriculture Management Act 2007 requirements).

Photo 14: Flower of *Jacksonia gracillima* P3

Photo 15: Habit of *Jacksonia gracillima* P3

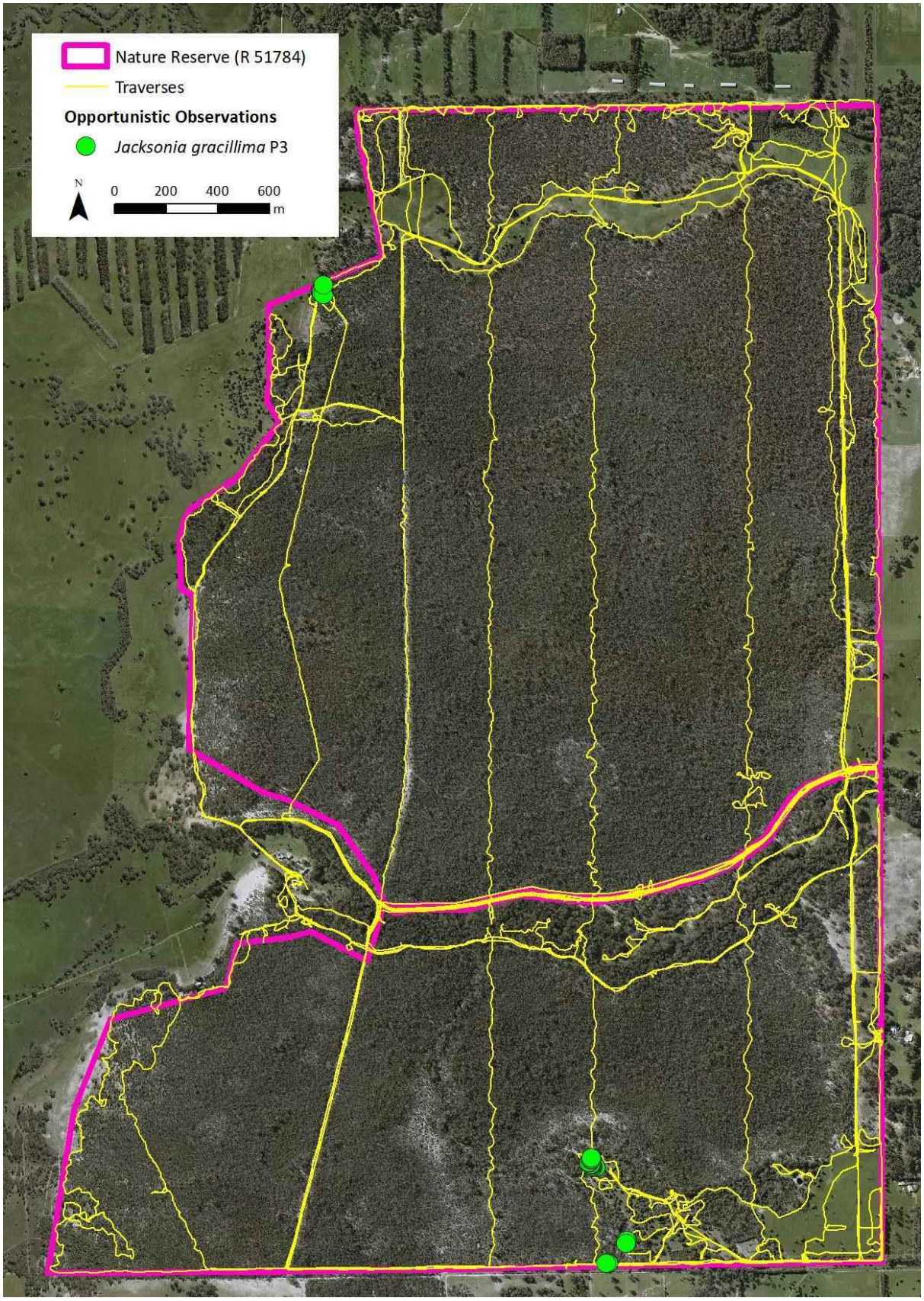

Figure 15: Opportunistic Observations of *Jacksonia gracillima* P3
NB: Not targeted and lack of observations along traverses not indicative of absence

Photo 16: *Baumea articulata* sumpland

Photo 17: *Eucalyptus rudis* woodland

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APPENDIX 1: PHOTOS OF SUSPECTED WEEDS

Photo 18: *Agonis flexuosa* (Peppermint)

Photo 19: *Callistemon phoeniceus* (Lesser Bottlebrush)

Photo 20: *Calothamnus rupestris* (Mouse-Ears)

APPENDIX 2: PHOTOS OF TREE AND SHRUB WEEDS

Photo 21: *Acacia longifolia* (Sydney Golden Wattle)

Photo 22: *Brachychiton populneus* (Kurrajong)

Photo 23: *Casuarina cunninghamiana* (River Sheoak)

Photo 24: *Corymbia citriodora* (Lemon Scented Gum)

Photo 25: *Chamaecytisus palmensis* (Tagasate)

Photo 26: *Eucalyptus saligna* (Sydney Blue Gum)

Photo 27: *Ficus carica* (Edible Fig)

Photo 28: *Gomphocarpus fruticosus* (Narrow-Leaf Cottonbush)

Photo 29: *Leptospermum laevigatum* (Coast Teatree)

Photo 30: *Lavandula stoechas* (Italian Lavender)

Photo 31: *Melaleuca quinquenervia* (Broad-leaved Paperbark)

Photo 32: *Pelargonium capitatum* (Rose Pelargonium)

Photo 33: *Phytolacca octandra* (Red Ink Plant)

Photo 34: *Pinus pinea* (Stone Pine)

Photo 35: *Ricinus communis* (Castor Oil Plant)

Photo 36: *Salix matsunda* (Chinese Willow)

Photo 37: *Schinus terebinthifolia* (Brazilian Pepper)

Photo 38: *Solanum linnaeanum* (Apple of Sodom)

APPENDIX 3: PHOTOS OF HERB AND CLIMBING WEEDS

Photo 39: *Asparagus asparagoides* (Bridal Creeper)

Photo 40: *Echium plantagineum* (Paterson's Curse)

Photo 41: *Euphorbia terracina* (Geraldton Carnation Weed)

Photo 42: *Freesia alba* × *leichtlinii* (Freesia)

Photo 43: *Gladiolus angustus* (Long Tubed Painted Lady)

Photo 44: *Moraea flaccida* (One-Leaf Cape Tulip)

Photo 45: *Rubus* species (Blackberry)

Photo 46: *Watsonia meriana var. bulbillifera* (Bugle Lily)

Photo 47: *Zantedeschia aethiopica* (Arum Lily)

APPENDIX 4: PHOTOS OF GRASS WEEDS

Photo 48: *Ehrharta species* (Veldt Grass)

APPENDIX 5: PHOTOS OF FERAL/NON-NATIVE FAUNA ACTIVITY

Photo 49: Bee Hive

Photo 50: Horse Tracks

Photo 51: Rabbit Droppings

Appendix D – Lowlands Black Cockatoo habitat Assessment

Memorandum

5 October 2020

To	Public Transport Authority		
From	GHD Pty Ltd		
Subject	Lowlands black cockatoo habitat Assessment against 2017 revised draft guidelines	Job no.	6138451

1 Introduction and background

METRONET is the State government's program of projects to increase the size of Perth's railway network, whilst also supporting the planning of integrated station precincts, to support growth of the Perth metropolitan region. Where required, METRONET projects are and/or will be assessed under the *Environmental Protection Act 1986* and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As part of the environmental approvals processes, the Public Transport Authority (PTA) is required to offset significant residual environmental impacts of assessed projects.

A number of sites have been identified to offset potential residual impacts. GHD Pty Ltd (GHD) was engaged by the PTA to undertake Environmental Values Assessments (EVAs) of potential offset sites, including Lot 301 Lowlands Road in the suburb of Mardella within the Shire of Serpentine-Jarrahdale (Lowlands site). GHD performed an environmental values assessment at Lowlands site in June and November 2019 and provided PTA with a final report *METRONET Potential Offset Sites Lowlands Environmental Values Assessment* issued in February (GHD 2020).

1.1 EVA scope and results

The EVA scope of works involved a desktop black cockatoo habitat assessment and included an evaluation of presence and approximate extent of foraging, breeding and roosting habitat within the site. Habitat suitability was based on the mapping from Keighery *et al.* (1995) and DBCA (2017), and broad fauna habitats described by GHD. Foraging, breeding and roosting habitat was defined as per the EPBC Act referral guidelines for three threatened black cockatoo species (Department of Sustainability, Environment, Water, Populations, and Communities (DSEWPaC) 2012).

Four broad fauna habitats were described within the survey area based on the mapped vegetation types, including Mixed Eucalyptus Banksia woodland, Flooded Gum Melaleuca woodlands, Riparian and pasture with scattered trees. The survey area is an intact area of native vegetation mostly surrounded by cleared land with low density semi-rural residential properties and has limited connectivity to other areas of bushland. The Serpentine River intersects the central part of the survey area and there is some connectivity along this river.

During the one day field visit, Carnaby's Cockatoos were seen and heard calling over the survey area. Forest Red-tailed Black Cockatoos were also observed feeding at two locations during the subsequent two day field assessment. Foraging evidence (chewed Marri, Jarrah, Banksia and

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Allocasuarina nuts) was recorded extensively throughout the Mixed Eucalyptus Banksia and Scattered native tree habitat types with both Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo distinctive mandible marks evident. The survey area contains suitable foraging and potential breeding habitat for both Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo. No foraging evidence of Baudin's Cockatoo was located within the survey area, however the survey area is considered to contain suitable foraging and potential roosting habitat.

From tree density plots the potential breeding trees were recorded within all four of the major habitat types. Potential breeding trees were recorded at greatest density within the Riparian habitat and lowest density recorded in the Scattered native tree habitat. The presence of extensive and high quality foraging resource throughout the survey area enhances the value potential breeding trees. The survey area does not support any known roosts, however the 2018 Great Cocky Count (Peck et al. 2018) reports a confirmed roost for Carnaby's Cockatoo in the Lowlands area.

1.2 Purpose of memorandum

PTA have requested GHD complete a supplementary desktop assessment of the Lowlands site EVA results (GHD 2020) by applying the foraging habitat scoring tool in the revised draft referral guideline for three threatened black cockatoo species (Department of the Environment and Energy (DEE) 2017) to further quantify the quality and extent of foraging habitat present.

The limitations and assumptions in the GHD (2020) Lowlands EVA report also apply to the opinions conclusions and recommendations in this memorandum.

2 Method

The DEE 2017 draft revised referral guidelines provide a foraging habitat scoring tool to assist with the EPBC Act Environmental Offsets Policy, and determine 'habitat quality' referred to in the offset calculator. The draft revised referral guidelines state the tool "*can also be used to calculate the starting quality of a proposed offset site and to estimate the future quality, with and without the proposed offset/management intervention*".

The foraging habitat scoring tool from DEE (2017) used to quantify the quality and extent of foraging habitat present is provided in Attachment 1. The final habitat quality score description is based on the scale provided in Plate 1, as reproduced from DEE (2017).

Plate 1 Habitat quality score

The original EVA scope of works has meant not all of the information considered in the scoring tool (i.e. no information on presence of hollows at the site) was recorded in the field and therefore not available to inform this current assessment. Where available, government databases were accessed (e.g. breeding and roosting records for a 12 km buffer of the Lowlands site as per the revised draft guideline criteria) to supplement the results from GHD (2020). Where a gap remains for the context adjusters, a conservative approach has been applied, with either no additions applied even if the attributes improving functionality are considered likely, whereas attributes reducing functionality have been subtracted.

3 Assessment

The foraging habitat assessment for the fauna habitat mapped from the Lowland site for the Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo is outlined in Table 1, Table 2 and Table 3, respectively.

The outcome of this assessment is summarised in Table 4.

Table 1 Carnaby's Cockatoo habitat score

Starting Score	Mixed Eucalyptus Banksia Sheoak woodland (940.3 ha)	Flooded Gum Melaleuca woodland (24.5 ha)	Riparian (36.6 ha)	Pasture with scattered trees (120.6 ha)
+1 to +10	This habitat comprises emergent Marri and Jarrah trees over a mature canopy of *Banksia* with Sheoaks and Paperbarks in lower lying areas. (+7) (high quality).	This habitat comprises occasional emergent Marri trees (+1) (low quality)	This habitat does not contain foraging species suitable for Carnaby's Cockatoo.	This habitat comprises scattered Jarrah, Marri and occasional Flooded gum and or Banksia species. (+1) (low quality).
Context adjustor - attributes improving functionality of foraging habitat				
+3	The Lowlands site is within the Swan Coastal Plain. (+3)	The Lowlands site is within the Swan Coastal Plain. (+3)	The Lowlands site is within the Swan Coastal Plain. (+3)	The Lowlands site is within the Swan Coastal Plain. (+3)
+3	Presence of suitable nest hollows is uncertain.	Presence of suitable nest hollows is uncertain.	Presence of suitable nest hollows is uncertain.	Presence of suitable nest hollows is uncertain.
+2	Does not primarily comprise Marri.	Does not primarily comprise Marri.	Does not primarily comprise Marri.	Does not primarily comprise Marri.
+2	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)
+1	Although the Lowlands site intersects the buffer of recorded roosting site, it is uncertain the Lowlands site is a roosting site.	Although the Lowlands site intersects the buffer of recorded roosting site, it is uncertain the Lowlands site is a roosting site.	Although the Lowlands site intersects the buffer of recorded roosting site, it is uncertain the Lowlands site is a roosting site.	Although the Lowlands site intersects the buffer of recorded roosting site, it is uncertain the Lowlands site is a roosting site.
Context adjustor - attributes reducing functionality of foraging habitat				
-2	Extensive evidence of foraging/debris.	No clear foraging evidence/ debris. (-2)	No clear foraging evidence/ debris. (-2)	Extensive evidence of foraging/debris.

-2	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site
-1	The Lowlands site is > 12 km from a known breeding location. (-1)	The Lowlands site is > 12 km from a known breeding location. (-1)	The Lowlands site is > 12 km from a known breeding location. (-1)	The Lowlands site is > 12 km from a known breeding location. (-1)
-1	The Lowlands site is < 12 km from a known roosting site.	The Lowlands site is < 12 km from a known roosting site.	The Lowlands site is < 12 km from a known roosting site.	The Lowlands site is < 12 km from a known roosting site.
-1	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.
-1	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)
Final Score	**10**	**2**	**-**	**4**

Table 2 Baudin's Cockatoo habitat score

Starting Score	**Mixed Eucalyptus Banksia Sheoak woodland (940.3 ha)**	**Flooded Gum Melaleuca woodland (24.5 ha)**	**Riparian (36.6 ha)**	**Pasture with scattered trees (120.6 ha)**
+1 to +10	This habitat comprises emergent Marri and Jarrah trees over a mature canopy of *Banksia* with Sheoaks and Paperbarks in lower lying areas. (+7) (high quality).	This habitat comprises occasional emergent Marri trees (+1) (low quality)	This habitat does not contain foraging species suitable for Baudin's Cockatoo.	This habitat comprises scattered Jarrah, Marri and occasional Flooded gum and or Banksia species. (+1) (low quality).
Context adjustor - attributes improving functionality of foraging habitat				
+3	The northern and east portion of the Lowland site is located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines. (+3).	The northern and east portion of the Lowland site is located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines. (+3).	The northern and east portion of the Lowland site is located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines. (+3).	The northern and east portion of the Lowland site is located within the known foraging area, based on Appendix A,

				Map 2 of the draft revised guidelines. (+3).
+3	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.
+2	Does not primarily comprise Marri.	Does not primarily comprise Marri.	Does not primarily comprise Marri.	Does not primarily comprise Marri.
+2	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)
+1	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.
Context adjustor - attributes reducing functionality of foraging habitat				
-2	No clear evidence of feeding debris. (-2)	No clear evidence of feeding debris. (-2)	No clear evidence of feeding debris. (-2)	No clear evidence of feeding debris. (-2)
-2	Foraging habitat occurs within 6 km of the Lowlands site; with the northern and east portion of the site located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines.	Foraging habitat occurs within 6 km of the Lowlands site; with the northern and east portion of the site located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines.	Foraging habitat occurs within 6 km of the Lowlands site; with the northern and east portion of the site located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines.	Foraging habitat occurs within 6 km of the Lowlands site; with the northern and east portion of the site located within the known foraging area, based on Appendix A, Map 2 of the draft revised guidelines.
-1	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)
-1	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)
-1	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.

-1	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)
Final Score	**7**	**1**	**-**	**1**

Table 3 Forest Red-tailed Black Cockatoo habitat score

Starting Score	**Mixed Eucalyptus Banksia Sheoak woodland (940.3 ha)**	**Flooded Gum Melaleuca woodland (24.5 ha)**	**Riparian (36.6 ha)**	**Pasture with scattered trees (120.6 ha)**
+1 to +10	This habitat comprises emergent Marri and Jarrah trees over a mature canopy of *Banksia* with Sheoaks and Paperbarks in lower lying areas. (+7) (high quality).	This habitat comprises occasional emergent Marri trees (+1) (low quality)	This habitat does not contain foraging species suitable for Forest Red-tailed Black Cockatoo.	This habitat comprises scattered Jarrah, Marri and occasional Flooded gum and or Banksia species. (+1) (low quality).
Context adjustor - attributes improving functionality of foraging habitat				
+3	No good Jarrah and/or marri recruitment observed (i.e. evidence of young trees).	No good Jarrah and/or marri recruitment observed (i.e. evidence of young trees).	No good Jarrah and/or marri recruitment observed (i.e. evidence of young trees).	No good Jarrah and/or marri recruitment observed (i.e. evidence of young trees).
+3	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.	Presence of suitable nest hollows was not recorded.
+2	Does not primarily comprise Marri or Jarrah.	Does not primarily comprise Marri or Jarrah.	Does not primarily comprise Marri or Jarrah.	Does not primarily comprise Marri or Jarrah.
+2	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)	Contains trees with potential to be used for breeding. (+2)
+1	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.	The Lowlands site is not known to be a roosting site.
Context adjustor - attributes reducing functionality of foraging habitat				

-2	Extensive evidence of foraging/debris.	No clear foraging evidence/ debris. (-2)	No clear foraging evidence/ debris. (-2)	Extensive evidence of foraging/debris.
-2	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site	There is foraging habitat within 6 km of the Lowlands site
-1	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)	It is unknown if the Lowlands site is > 12 km from a known breeding location. (-1)
-1	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)	It is unknown if the Lowlands site is > 12 km from a known roosting site. (-1)
-1	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.	The Serpentine River intersects the Lowlands site.
-1	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)	Dieback is present within the Lowlands site. (-1)
Final Score	**6**	**0**	**-**	**0**

Table 4 Foraging habitat quality score for the three listed Black Cockatoos by vegetation type

Species	Mixed Eucalyptus Banksia Sheoak woodland (940.3 ha)	Flooded Gum Melaleuca woodland (24.5 ha)	Riparian (36.6 ha)	Pasture with scattered trees (120.6 ha)
Carnaby's Cockatoo	10 (very high quality)	2 (low quality)	-	4 (quality)
Baudin's Cockatoo	7 (high quality)	1 (low quality)	-	1 (low quality)
Forest Red-tailed Black Cockatoo	6 (high quality)	0	-	0

4 References

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Lowlands vegetation association, condition and known threatened flora and ecological communities mapping*, Government of Western Australia

Department of Sustainability, Environment, Water, Populations, and Communities (DSEWPaC) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Canberra, Australia, Department of Sustainability, Environment, Water, Population and Communities

Department of the Environment and Energy (DEE) 2017, *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*, Commonwealth of Australia

GHD 2020, *METRONET Potential Offset Sites Lowlands Environmental Values Assessment*, Unpublished report for Public Transport Authority

Keighery B, Keighery G and Gibson N 1995, *Floristics of Lowlands, Part X in the series Floristics of Reserves and Bushland Areas of the Perth Region (System 6)*, Wildflower Society of WA (Inc.), Nedlands

Peck, A, Barrett G and Williams, M 2018, *The 2018 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (Calyptorhynchus latirostris) and Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso)*, BirdLife Australia, Floreat, Western Australia.

Attachment 1 Foraging habitat scoring tool (DEE 2017)

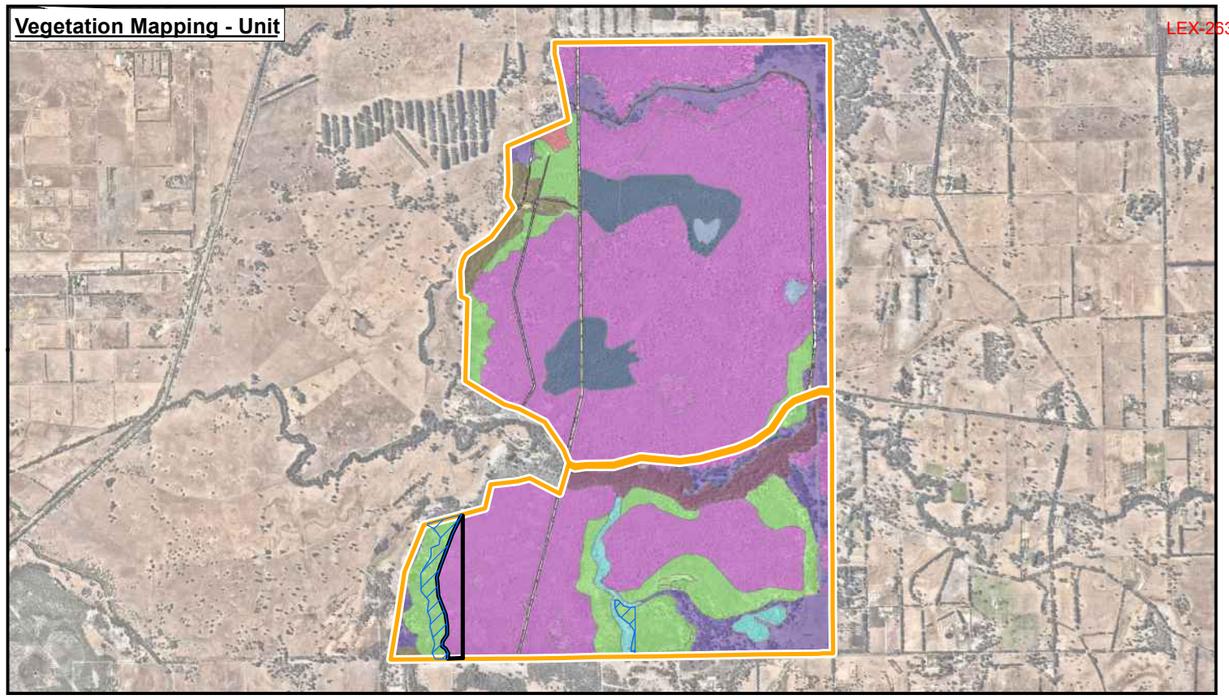
Starting Score	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for Forest Red-tailed Black cockatoo
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful **rehabilitation**, and/or has some level of **protection** from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10.
7 (High quality)	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA.	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. 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, including along roadsides. Does not include areas under a RFA.
5 (Quality)	Pine plantation or introduced eucalypts.	Pine plantation or introduced eucalypts.	Introduced eucalypts as well as the introduced Cape lilac (*Melia azedarach*).
1 (Low quality)	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants.
Additions	**Context adjustor - attributes improving functionality of foraging habitat**	**Context adjustor - attributes improving functionality of foraging habitat**	**Context adjustor - attributes improving functionality of foraging habitat**
+3	Is within the Swan Coastal Plain (important foraging area).	Is within the known foraging area (see map).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.
+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 dbh for salmon gum and wandoo).	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).
+1	Is known to be a roosting site.	Is known to be a roosting site.	Is known to be a roosting site.
Subtractions	**Context adjustor - attributes reducing functionality of foraging habitat**	**Context adjustor - attributes reducing functionality of foraging habitat**	**Context adjustor - attributes reducing functionality of foraging habitat quality**
-2	No clear evidence of feeding debris.	No clear evidence of feeding debris.	No clear evidence of feeding debris.
-2	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.
-1	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.
-1	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.
-1	Is > 2 km from a watering point.	Is > 2 km from a watering point.	Is > 2 km from a watering point.
-1	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).	Disease present (e.g. *Phytophthora cinnamomi* or marri canker).

Appendix E – TCL and Malaga to Ellenbrook Rail Works Offsets Quantification Table

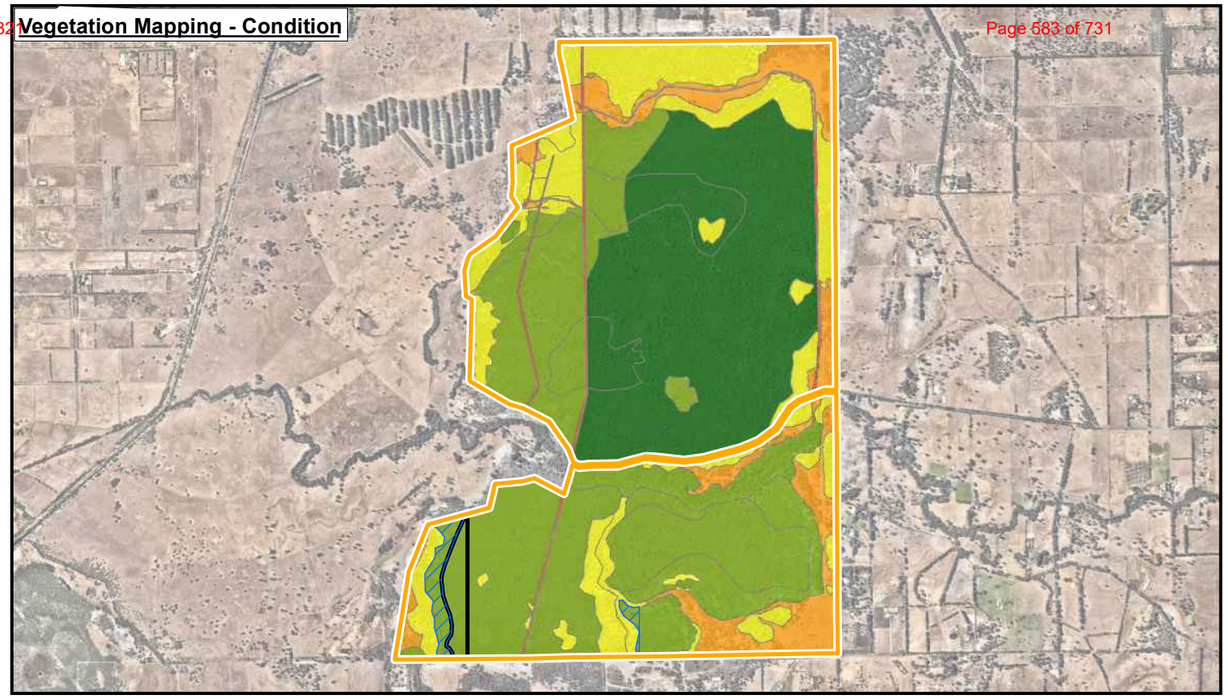
Table A: TCL Proposal and Malaga to Ellenbrook Rail Works Proposal Offsets Quantification Table for the Lowlands offset site

Environmental value (MNES)	Proposal	Footprint - estimated impact (ha)	Footprint - estimated required offset (ha)	Total attributed to offset sites (ha)	Total available at offset site (ha)	Quantity remaining at offset site (ha)	Figure
Banksia Woodlands of the Swan Coastal Plain (SCP) Threatened Ecological Community (TEC)	TCL	2.9	13.59	90.62	937.24	846.62	1
	Malaga to Ellenbrook Rail Works (this Proposal)	11.96	77.03				
Carnaby's Cockatoo foraging habitat (including Forest Red-tailed Black Cockatoo for MEL Part 1 NVCP)	TCL	23	129.32	491.14	1,063.72	572.6	2
	Malaga to Ellenbrook Rail Works Part 2 (this Proposal)	81.4	358.7				
	Malaga to Ellenbrook Rail Works Part 1 Native Vegetation Clearing Permit	0.803	3.12				
Forest Red-tailed Black Cockatoos foraging habitat (including Baudin's for TCL)	TCL	16.2	96.7	360			2
	Malaga to Ellenbrook Rail Works (this Proposal)	68.1	263.3				
Baudin's Black Cockatoos foraging habitat	Malaga to Ellenbrook Rail Works (this Proposal)	81.4	337.9	337.9			2
Black Cockatoo potential breeding trees	TCL	48 trees	144 trees	1,413 trees	8,096 trees	6,683 trees	2
	Malaga to Ellenbrook Rail Works (this Proposal)	423 trees	1,269 trees				

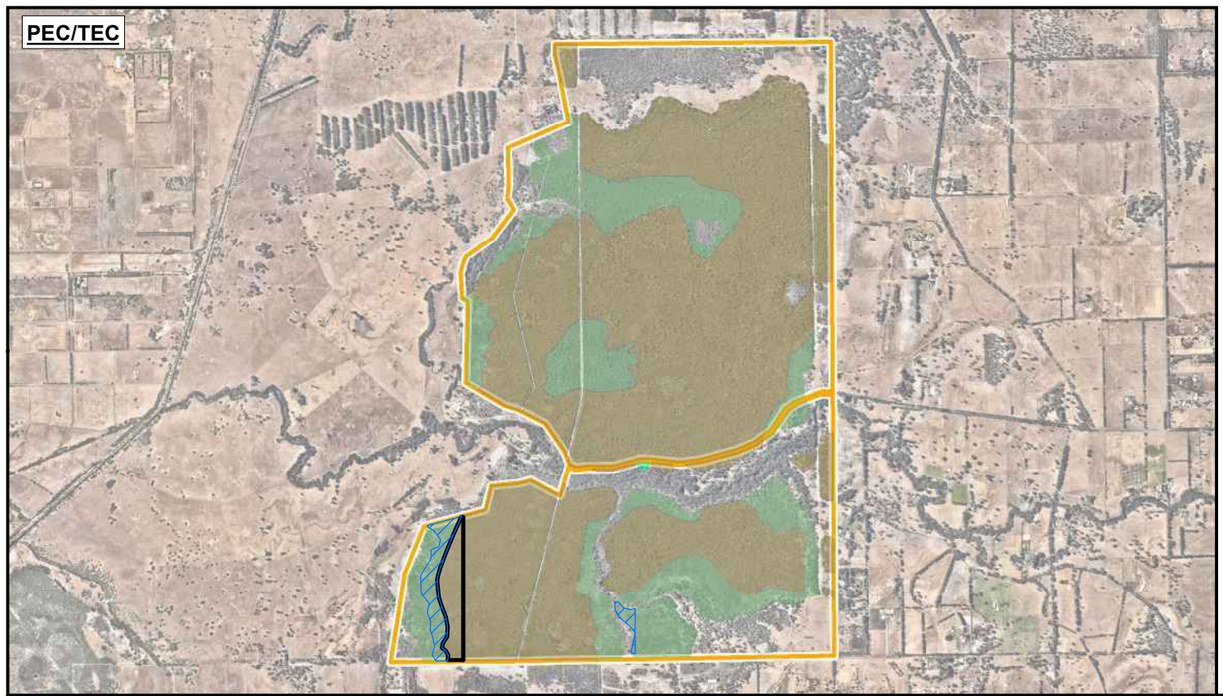
Vegetation Mapping - Unit



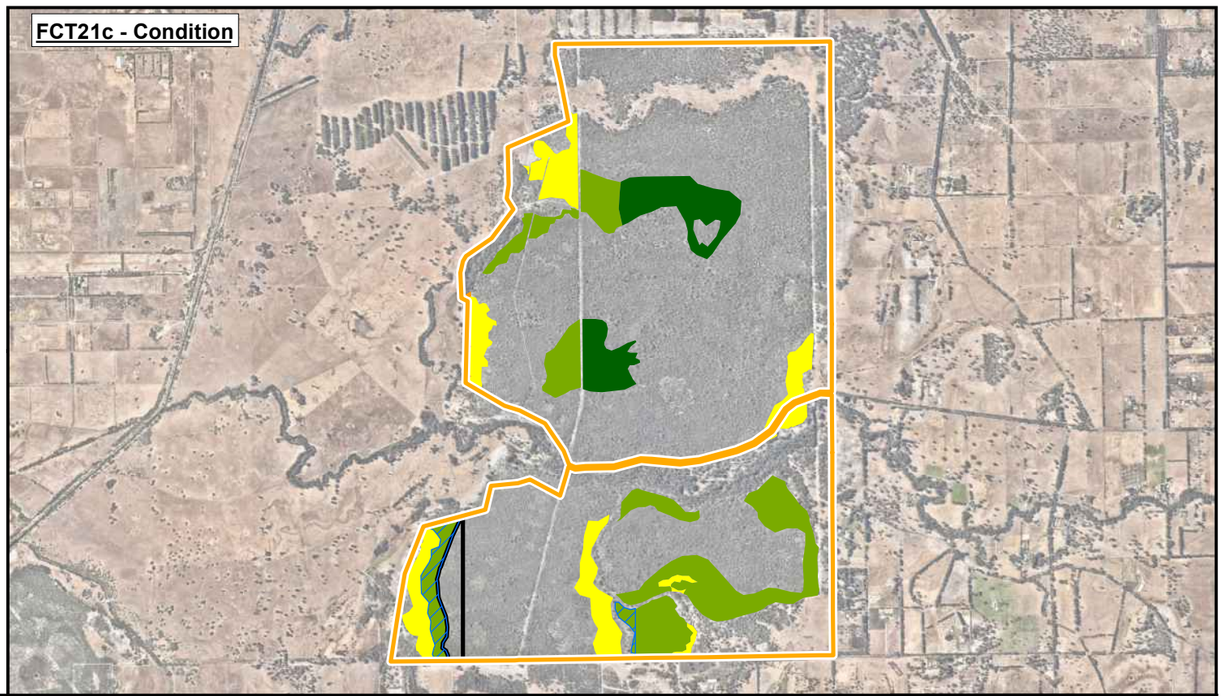
Vegetation Mapping - Condition



PEC/TEC



FCT21c - Condition



Lowlands Offset Site Banksia Woodlands TEC Offset Allocation

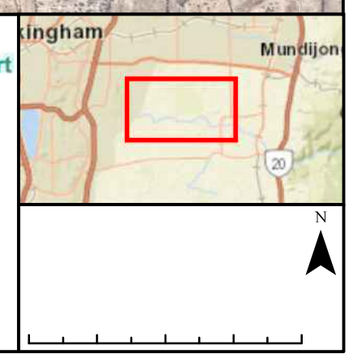
Public Transport Authority

Legend

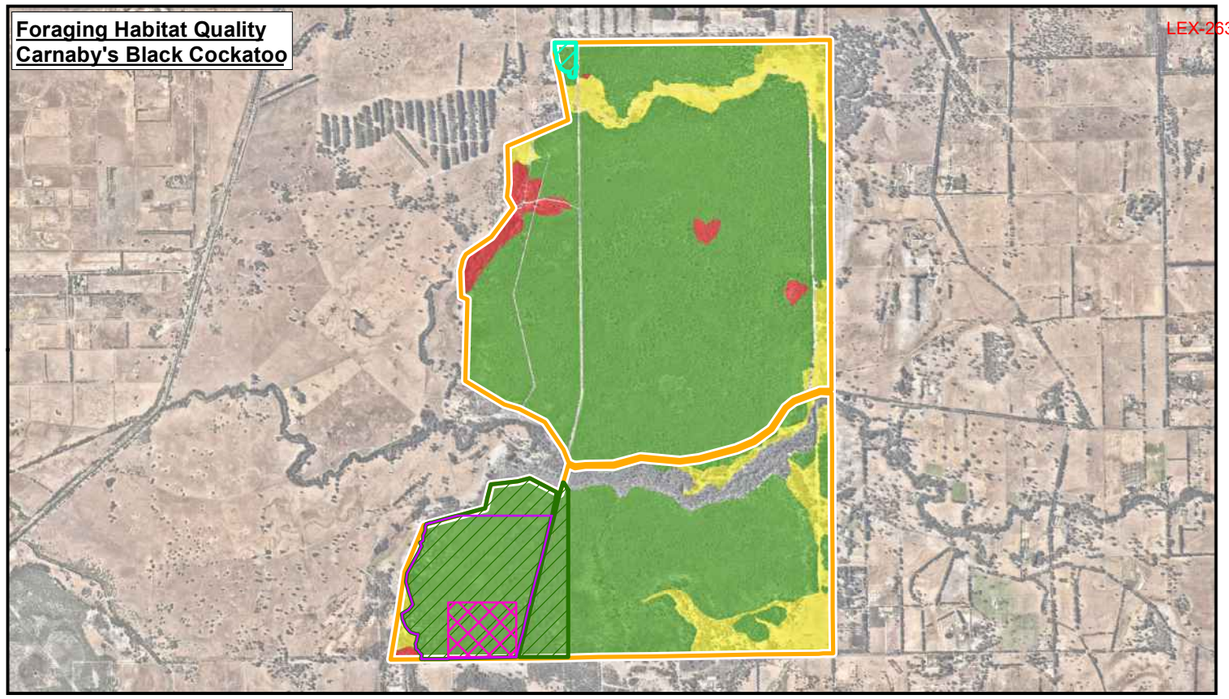
Vegetation Mapping - Unit (GHD, 2020)

Vegetation Mapping - Condition (GHD, 2020)

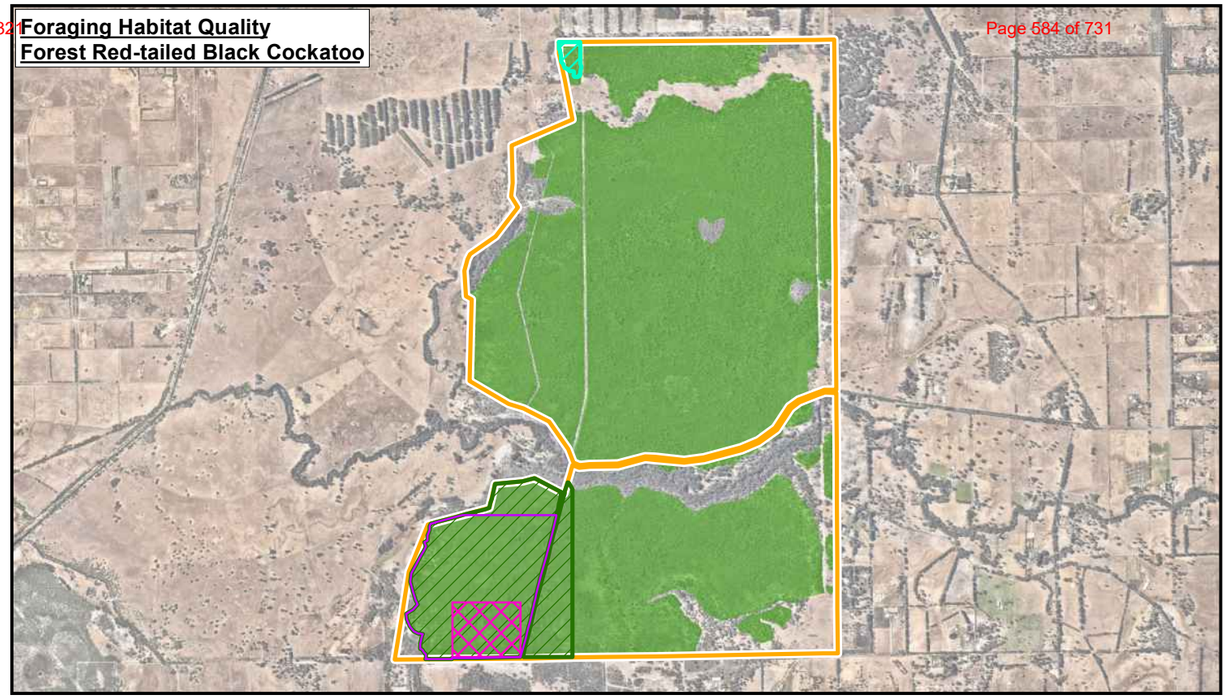
PEC/TEC (GHD Vegetation Mapping, 2020)



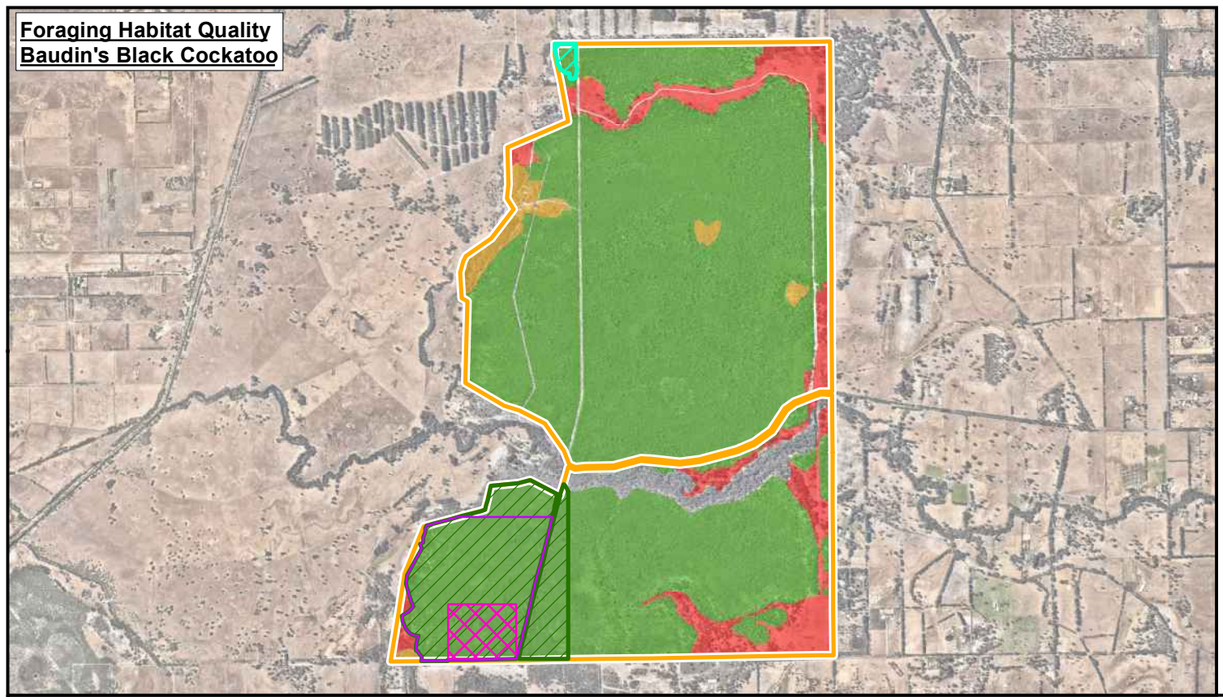
Foraging Habitat Quality
Carnaby's Black Cockatoo



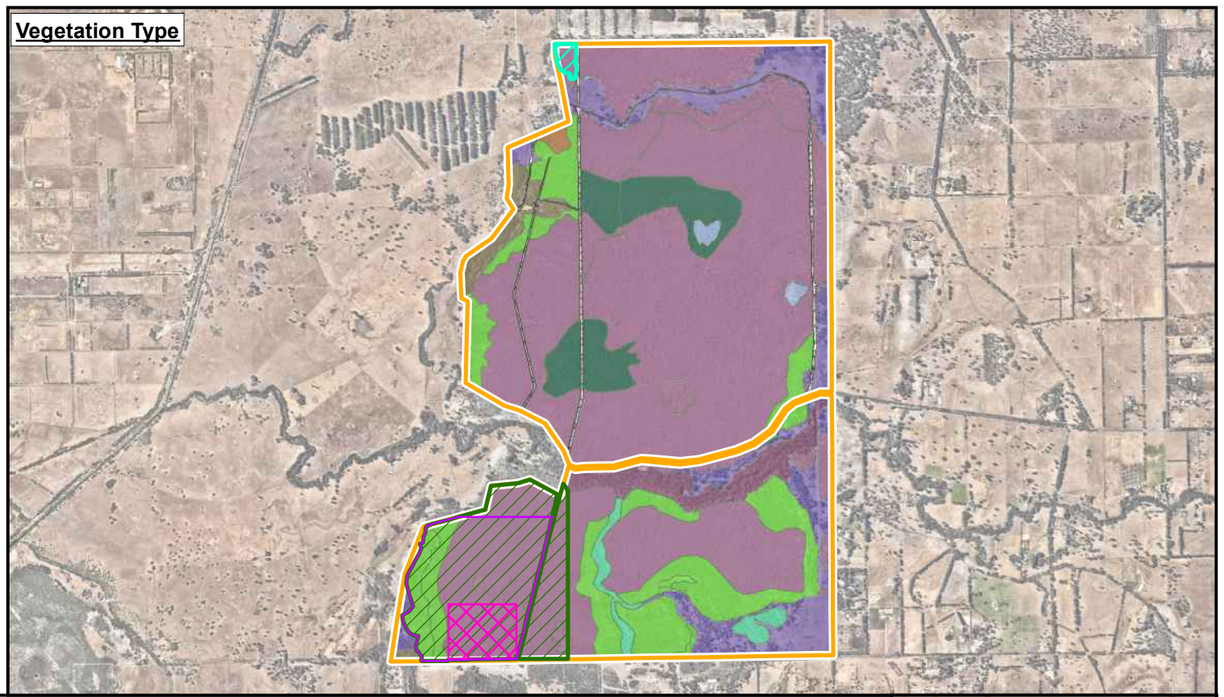
Foraging Habitat Quality
Forest Red-tailed Black Cockatoo



Foraging Habitat Quality
Baudin's Black Cockatoo



Vegetation Type



Lowlands Offset Site Carnaby's (CBC), Forest Red-tailed (FRT) and Baudin's (BBC) Black Cockatoo and Black Cockatoo Potential Breeding Trees Offset Allocation

Public Transport Authority

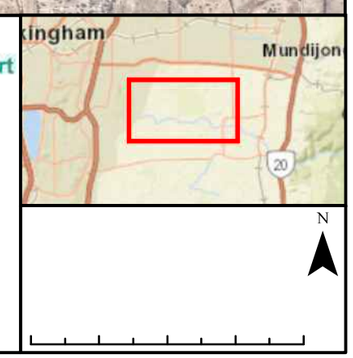
Legend

FRT - Foraging Habitat Quality (GHD, 2020b)

CBC - Foraging Habitat Quality (GHD, 2020b)

BCB - Foraging Habitat Quality (GHD, 2020b)

Vegetation Mapping - Unit (GHD, 2020)



Appendix F – Commonwealth Offset Calculators

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	
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

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes	Clearing of up to 10.05 ha of Banksia Woodland SCP TEC and 1.81 ha of TEC buffer	**Area**	11.86	Hectares	PTA (2020) indicates up to 7.01 ha in Very Good, 2.31 ha in Good condition, and 0.73 ha in Degraded condition and 1.81 ha of native vegetation may be cleared
			Quality	**8**	Scale 0-10	
			Total quantum of impact	9.49	Adjusted hectares	
Threatened species habitat						
Area of habitat	Yes	Clearing of up to 81.4 ha of Carnaby's foraging habitat	**Area**	81.4	Hectares	PTA (2020) indicates up to 42.8 ha of High quality habitat, 11.3 ha of Moderate quality and 27.3 of Low quality habitat within the Footprint may be cleared
			Quality	**6**	Scale 0-10	
			Total quantum of impact	48.84	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					
Threatened species						
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

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
Ecological Communities																					
Area of community	Yes	9.49	Adjusted hectares	Land acquisition and management at Lowlands	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	77.03	**Risk of loss (%) without offset**	15%	**Risk of loss (%) with offset**	5%	7.70	90%	6.93	5.46	9.49	100.01%	Yes		
									Future area without offset (adjusted hectares)	65.5	**Future area with offset (adjusted hectares)**	73.2									
					Time until ecological benefit	7	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**8**	1.00	85%	0.85	0.78					
Threatened species habitat																					
Area of habitat	Yes	48.84	Adjusted hectares	Land acquisition and management at Lowlands	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	358.7	**Risk of loss (%) without offset**	15%	**Risk of loss (%) with offset**	5%	35.87	90%	32.28	25.43	44.18	90.47%	Yes		
									Future area without offset (adjusted hectares)	304.9	**Future area with offset (adjusted hectares)**	340.8									
					Time until ecological benefit	7	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**8**	1.00	85%	0.85	0.78					
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																				
Threatened species																					
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

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				$0.00		$0.00
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	48.84	44.18	90.47%	**Yes**	$0.00	#DIV/0!	#DIV/0!
Area of community	9.488	9.49	100.01%	**Yes**	$0.00	N/A	$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

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	
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

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
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Clearing of up to 68.1 ha of FRTBC habitat	**Area**	68.1	Hectares	PTA (2020) indicates up to 33.6 ha of High quality habitat, 4.3 ha of Moderate quality and 30.2 ha of Low quality habitat within the Footprint may be cleared
			Quality	**6**	Scale 0-10	
			Total quantum of impact	40.86	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					
Threatened species						
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
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	40.86	Adjusted hectares	Land acquisition and management of the Lowlands site.	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	263.3	**Risk of loss (%) without offset**	15%	**Risk of loss (%) with offset**	5%	26.33	90%	23.70	22.77	36.97	90.49%	Yes	
									Future area without offset (adjusted hectares)	223.8	**Future area with offset (adjusted hectares)**	250.1								
					Time until ecological benefit	7	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**8**	1.00	85%	0.85	0.84				
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																			
Threatened species																				
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				$0.00		$0.00
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	40.86	36.97	90.49%	**Yes**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

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	Baudin's
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

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Clearing of up to 81.4 ha of Baudin's foraging habitat	**Area**	81.4	Hectares	PTA (2020) indicates up to 42.8 ha of Moderate quality and 38.6 ha of Low quality habitat within the Footprint may be cleared
			Quality	**5**	Scale 0-10	
			Total quantum of impact	40.70	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					
Threatened species						
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

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
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	40.70	Adjusted hectares	Land acquisition and management of lowlands site.	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	337.9	**Risk of loss (%) without offset**	15%	**Risk of loss (%) with offset**	5%	33.79	90%	30.41	23.96	36.83	90.49%	Yes	
									Future area without offset (adjusted hectares)	287.2	**Future area with offset (adjusted hectares)**	321.0								
					Time until ecological benefit	7	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**6**	1.00	85%	0.85	0.78				
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																			
Threatened species																				
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

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				$0.00		$0.00
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	40.7	36.83	90.49%	**Yes**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Appendix G – Lowlands Site Management Plan

Lowlands Site Management - Objectives and Targets						
Activity	**Objective**	**Recovery/Management Plan alignment**	**Timing**	**Target**	**Completion Criteria**	**Tangible Improvements**
Installation of 16.0km of electrified fencing material (including 4 gates)	Install 16 km of electrified fencing material (including 4 gates) at the Lowlands site to minimise and/or prevent unauthorised site access to: * Reduce litter disposal in the area * Reduce the risk of weed and dieback spread * Reduce the risk of unlawful damage to environmental values through unauthorised activities such as 4WDing, illegal dumping, fires etc. * Reduce the risk of stock entering the site to graze	The activities align with the following sections within each of the relevant respective recovery/management plans: **Carnaby's Black Cockatoo Recovery Plan** Section 14 - Recovery Actions Action 1 - Protect and Manage Important Habitat Tasks include: Implement management to protect and improve the condition of breeding habitat and associated feeding habitat, including activities that: • Control grazing (e.g. fencing to exclude stock) • Manage fire regimes • Prevent further degradation of habitat **EPA Technical Report: Carnaby's Black Cockatoo in Environmental Impact Assessment in the Perth and Peel Region** Recovery Management and Protection Table 5, Page 20 Habitat management to include the following actions: • Feral animal and nest competitor control • Disease and pest control (e.g. Phytophthora and Marri Canker) • Fire management • Fencing • Weed control **Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia naso*) Recovery Plan** Action 1 - Protect and Manage Important Habitat Tasks include: Implement management to protect and improve the condition of breeding habitat and associated feeding habitat, including activities that: • Control grazing (e.g. fencing) • Manage fire regimes, weeds and dieback • Prevent further degradation of habitat • Maintain natural and artificial water sources used by cockatoos **Grand Spider Orchid (*Caladenia huegelii*) Recovery Plan** Section 3 - Recovery Actions: • A range of operational tasks have been carried out to protect populations of C. huegelii, including weed control, application of phosphate and general management of reserves and bushland • Manage access - There is a need to manage both recreational and managerial access at several populations. This management may take the form of fencing, track closure and rehabilitation, and/or interpretive signage. Fenced areas will ideally include a buffer of surrounding habitat • Undertake Weed Control - Weeds are a threat to several populations of Caladenia huegelii. High levels of weeds impact on C. huegelii by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire • Develop and implement a fire management strategy - Caladenia huegelii plants are killed by fire during the above-ground phase of their lifecycle (late April to early November). Fire should therefore be prevented from occurring in populations during these months. Fire also promotes the introduction and proliferation of weed species, and can affect the health of mycorrhizal fungi by removing necessary leaf litter **Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community** Section 5.2 Priority Protection and Restoration Actions RESTORE the ecological community within its original range by active abatement of threats, re-vegetation and other conservation initiatives; • Prevent weed invasion by minimising any soil disturbance • Detect and control weeds early. Small infestations should be a priority for removal • Prevent further introduction of feral animals and contain domestic animals within new residential areas. • Implement appropriate fire management regimes for the ecological community taking into account results from research • Manage populations of feral grazing animals that damage native vegetation	To be completed by the end of the 2nd year of funding	Install 16km of electrified fencing (including 4 gates) by the completion of the 2nd year of funding.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That 16km of electrified fencing has been installed at the Lowlands site in accordance with the objective by the end of the 2nd year of funding.	The installation of fencing will: 1. Reduce weed incursion 2. unauthorised dumping/littering which will degrade vegetation, contaminate soil and/or harm fauna. 3. Reduce unauthorised access including 4WDing that will degrade flora habitat and condition, cause erosion, harm or kill fauna, cause potential contamination and dust etc. 4. Allow the DBCA to enforce penalties to those accessing the site without proper authority. 5. Reduce spread of dieback. 6. Reduce impacts to flora and fauna caused by stock. 7. Reduce unauthorised clearing. Reducing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate.
Management and maintenance to existing access tracks. Complete upgrade works where required	Manage and maintain all tracks within the Lowlands site to allow site entry and access for authorised vehicles, where required. Tracks within the site to have the following benefits/purpose: * Act as firebreaks - allowing fast access to fire fighting requirements * Minimise damage to surrounding habitat as vehicle movement will be limited to tracks *Allow access to areas to carry out other management actions		Years 1, 3, 5 and 7	Manage and maintain tracks to a standard to allow required vehicles to transverse the site	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That all Lowlands site tracks allow access to required vehicles and upgrade works have been completed in accordance with the objective during years 1, 3, 5 and 7.	The maintenance of tracks will: 1. Reduce weed incursion 2. Isolate vehicle and pedestrian access to restricted tracks, allowing redundant tracks to revegetate naturally. 3. Reduce spread of dieback. 4. Reduce impacts to flora and fauna caused by vehicles. 5. Reduce unauthorised clearing. Reducing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate.
Reserve Management Officer Salary and associated costs	To engage a Reserve Management Officer to manage the implementation of the Lowlands site management activities administered under the PTA offsets strategy site management funding.		Annually over seven years	Engage an appropriately qualified person for the position of a Reserve Management Officer	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That a Reserve Management Officer has been hired and occupies the Reserve Management Officer role for the Lowlands Site over the seven years, in accordance with the objective.	A dedicated Lowlands site Reserve Management Officer will provide continual site management and monitoring of the site to: 1. Ensure all activities are being implemented as stated. 2. 100% of their chargeable time is dedicated to the Lowlands site. 3. Identify issues promptly and develop appropriate management actions. 4. Streamline site access. 5. Provide one source of information. 6. Directly undertake site actions. 7. Provided updated information as required. 8. Reduce the risks of environmental impacts/unauthorised access. 9. Assist in the natural regeneration of the site. 10. Be available to respond to site as required. 11. Provide tangible improvement to the site and may allow the site's environment values to regenerate.
Signage - Materials and installation	To erect suitable signage on the Lowlands site which includes site details (conservation status), access details and restrictions.		The funding will be provided over the first four years to allow signage to be relocated if required due to fencing installation.	Erect suitable signage at access points across the Lowlands site to restrict unauthorised access	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That appropriate signage has been erected on the Lowlands site, in accordance with the objective and within the scheduled timeframe.	The installation of signage will minimise or reduce unauthorised site access which will: 1. Reduce weed incursion 2. Minimise unauthorised dumping/littering which will degrade vegetation, contaminate soil and/or harm fauna. 3. Reduce unauthorised access including 4WDing that will degrade flora habitat and condition, cause erosion, harm or kill fauna, cause potential contamination and dust etc. 4. Allow the DBCA to enforce penalties to those accessing the site without proper authority. 5. Reduce spread of dieback. 6. Reduce impacts to flora and fauna caused by stock. 7. Reduce unauthorised clearing. Reducing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate.
Phytophthora cinnamomi (dieback) mapping (years 3 and 7) and management plan	To map, manage and monitor the spread of dieback within the Lowlands site. Mapping is to inform the development of a dieback management plan and assess if management measures are sufficient/require revision, monitor management progress.		Maintenance of wash-down facilities throughout the seven years. Dieback mapping to be completed in years 3 and 7.	Minimise, track and manage the spread of dieback throughout the site	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That Dieback mapping has been conducted at the Lowlands site in years 3 and 7 and results are provided to the PTA. 3. That a Lowlands site specific dieback management plan has been developed and is revised according to the most recent dieback mapping data. 4. That the Lowlands site specific dieback management plan is being implemented at the site.	Mapping, monitoring and managing dieback at the Lowlands site will: 1. Provide better understanding of the current impacts and extent 2. Provide improved site management. 3. Actively reduce the spread of dieback throughout the site. 4. Minimise dieback impacts to vegetation. Understanding and managing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate/prevent further impacts.
Weed mapping	Map weeds within the Lowlands site to identify the distribution of weeds throughout the site and prepare targeted weed management plans. Weed mapping will also monitor management progress.		Weed mapping to be completed in years 3 and 7	Conduct weed mapping to develop and update site specific weed management plans and monitor weed management.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That weed mapping has been completed in years 3 and 7 in accordance with the objective. 3. That a Lowlands site specific weed management plan has been developed and is revised according to the most recent weed mapping data. 4. That the Lowlands site specific weed management plan is being implemented at the site.	Mapping, monitoring and managing dieback at the Lowlands site will: 1. Provide better understanding of the current impacts and extent. 2. Provide improved site management. 3. Actively reduce the spread of weeds throughout the site. 4. Minimise weed impacts to vegetation and fauna. Understanding and managing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate/prevent further impacts.

Weed control- materials and program implementation	Conduct weed control at the Lowlands site to reduce the spread of targeted weeds in targeted locations.	Weed control to be carried out annually over 7 years	Control/reduce the spread of targeted weeds across the site within designated areas.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That appropriate weed control measures have been implemented each year of funding to control Lowlands site targeted weeds and environmental values areas in accordance with the objectives.	Weed control at the Lowlands site will: 1. Provide improved site management. 2. Actively remove and reduce the spread of weeds throughout the site. 3. Minimise weed impacts to vegetation and fauna. Understanding and controlling these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate/prevent further impacts.
Flora and vegetation survey	District flora officer staff to undertake Lowlands site specific pre-disturbance flora assessments required as part of the DBCA's internal approvals (via the Disturbance Approval System(DAS)) for activities such as fence line clearing, prescribed burns and other activities which have the potential to disturb vegetation.	Annually over seven years	Identify additional management actions that need to be implemented throughout the seven years of management.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. The results of the flora and vegetation surveys conducted at the Lowlands site over the seven years in accordance with the objective to be included within the annual compliance reports.	Site specific pre-disturbance flora assessments required as part of the DBCA's internal approvals provide a baseline to assess future management and impacts.
Rubbish Removal	Remove and dispose rubbish/unauthorised dumping throughout the Lowlands site.	Annually over seven years	Remove and dispose of rubbish/unauthorised dumping from the Lowlands site.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That rubbish located within the Lowlands site has been removed and disposed correctly over the seven years.	Removing rubbish from the site will: 1. Minimise and manage impacts to flora and fauna from rubbish and contamination. 2. Minimise and manage contamination. Reducing and removing these impacts and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate.
Fire Management - prescribed burn	Conduct a prescribed/hazard reduction burn at the Lowlands site to reduce the risks associated with and/or likelihood of wildfires/arson etc.	To be carried out during years 3, 5 and 7. *Note this may be altered in the event of wildfires or unplanned burns occurring on the site	Conduct prescribed burns to reduce the risk of an wildfire at the Lowlands site	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That prescribed burns were conducted at the Lowlands site in accordance with the objectives annually over the seven years.	A hot uncontrolled burn or wildfire can cause: 1. Major safety implications to people, infrastructure, flora and fauna. 2. Destroy fauna food sources and habitat. 3. Require reallocation of site management funding for rehabilitation. 4. Destroy TEC/PEC threatened flora and fauna. Reducing this risk will assist in protecting the site's environmental values and reduce the risks associated with fire.
Feral animal monitoring and control (cat, fox, rabbit, kangaroos and pigs)	Conduct feral animal mapping and control at the Lowlands site to reduce the presence of feral animals on the site and minimise associated impacts.	Annually over seven years	Monitor and reduce the presence of feral animals on the Lowlands site	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That feral animal monitoring and control activities have been undertaken at the Lowlands site in accordance with the objectives annually over the seven years.	Controlling feral animals will: 1. Reduce competition for resources with native animals. 2. Reduce pressure on native animals which are feral animal prey. 3. Reduce grazing. Reducing and controlling this impact and pressures will provide tangible improvement to the site and may allow the site's environment values to regenerate.
Carnaby's Cockatoo watering point establishment	Establish a watering point at the Lowlands site to encourage Carnaby's Cockatoo to roost within the Lowlands site.	To be completed within the 3rd year of funding	Enhance the likelihood of Carnaby's Black Cockatoos roosting in the site.	The DBCA to provide evidence to the PTA within the annual compliance reports of the following: 1. Annual progress of task and funding spent. 2. That a Carnaby's Cockatoo watering point has been established at the Lowlands site in accordance with the objectives within the 3rd year of funding.	Providing water will increase the likelihood of Carnaby's Cockatoo roosting within the site and may assist in the recovery of the population of Carnaby's Black Cockatoos.

Recovery Plans

Carnaby's Black Cockatoo Recovery Plan
EPA Technical Report: Carnaby's Black Cockatoo in Environmental Impact Assessment in the Perth and Peel Region
Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksia naso) Recovery Plan
Grand Spider Orchid (Caladenia huegelii) Recovery Plan
Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community

Appendix H – Murdoch University Black Cockatoo Research Proposal

Conservation management for the long-term survivorship of black cockatoos endemic to the south-west of Western Australia: the application of telemetry to determine spatial ecology on the Perth-Peel Coastal Plain, south-west forest region and key breeding sites in response to a changing environment

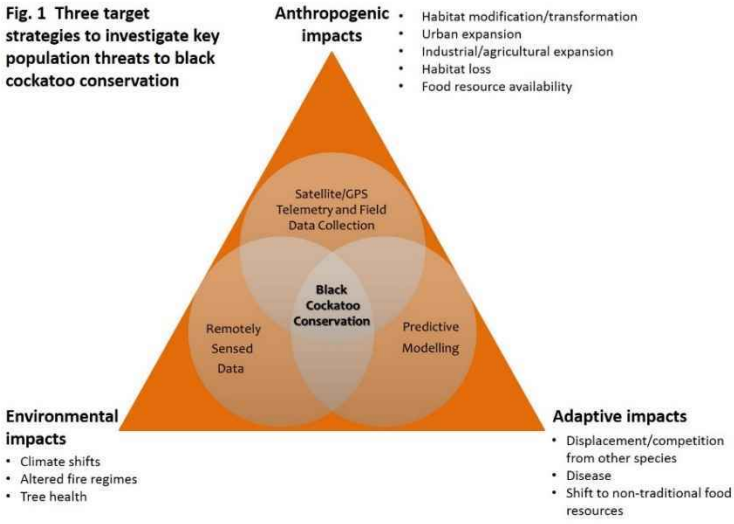
A/Professor Kristin Warren[1], Dr Jill Shephard[1], Dr Lian Yeap[1], Dr Bethany Jackson[1], Dr Rebecca Vaughan-Higgins[1], Rebecca Donaldson[1], Dr David Mitchell[2], Dr Geoff Barrett[2], Rick Dawson[2], Dr Peter Mawson[2], Dr Denis Saunders[3], Professor Willem Bouten[4]

[1] Harry Butler Institute, Murdoch University, [2] Department of Biodiversity, Conservation and Attractions, [3] CSIRO, [4] University of Amsterdam.

Summary

Western Australia's three endemic black cockatoo species, Carnaby's cockatoos (*Calyptorhynchus latirostris*), Baudin's cockatoos (*Calyptorhynchus baudinii*) and forest red-tailed black cockatoos (*Calyptorhynchus banksii naso*) are threatened and receive special protection as Matters of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act (1999) [1-7]. Threats to species survivorship for these black cockatoos are well documented, and include habitat loss and modification, urban and industrial expansion, disease, displacement by competing species, and climate shifts[1-2](Figure 1). Despite significant research to date[8-13], key information required to address the National Recovery Plan remains outstanding[14].

Fig. 1 Three target strategies to investigate key population threats to black cockatoo conservation



Background and Significance

Black cockatoos are iconic species in the Western Australian landscape. People hold strong cultural associations with them, and they are well placed to function as flagship species for habitat conservation. All three species occupy a large area of habitat in the south-west of Western Australia, including populations that inhabit the Perth-Peel Coastal Plain; with Carnaby's cockatoos typically migrating from inland breeding areas to coastal habitat during the non-breeding season, Baudin's cockatoos migrating from wintering sites in the Darling Ranges to southern breeding sites, and forest red-tailed black cockatoos moving between the Perth-Peel Coastal Plain and the Darling Ranges. All three species also have populations that inhabit the south-west forests in the southern part of their distribution range, which do not migrate to the Perth-Peel Coastal Plain.

Carnaby's cockatoos are listed as Endangered under Australian Federal law (*Environment Protection and Biodiversity Conservation Act 1999)* and internationally by the IUCN[1,4]. At the state level they are listed as Endangered under the Western Australia *Biodiversity Conservation Act 2016*[5]. The species has undergone an estimated 50% decline over the last 5 decades[1], including an estimated average decline of 5% per annum across the Perth-Peel Coastal Plain over the last nine years[13]. Overall this has contributed to a suggested 30% range contraction[1], and significant loss of breeding populations[1,13].

Forest red-tailed black cockatoos have declined in range by 30% as a result of habitat loss and have suffered a marked decline in population numbers since the 1950s[2,9,10]. The species is listed as Vulnerable under Australian Federal law (*Environment Protection and Biodiversity Conservation Act 1999)* and under the Western Australia *Biodiversity Conservation Act 2016*[5]. The forest red-tailed black cockatoo fits the IUCN Red List Criteria for Vulnerable due to a projected or suspected decline in the population of more than 30% within the next 10 years or three generations[2].

Baudin's cockatoos are listed as Endangered at the Federal Level (*Environment Protection and Biodiversity Conservation Act 1999),* and at the State Level (*Biodiversity Conservation Act* 2016)[5]. The population has been in decline over the last 50 years, however in the last eleven years there has been a dramatic decline (over 90%) in the numbers recorded at traditional autumn-winter roost sites in the northern Darling Range[15]. Additionally, in 2017 there were unexpectedly few records of large flocks of this species in the south-west[15].

The Carnaby's Cockatoo Recovery Plan[1] lists six priority Actions that must be undertaken to meet the Plan's objectives; and the Forest Black Cockatoo Recovery Plan[2] lists 13 Actions. The Actions listed in both these Recovery Plans have remained largely out of reach, as they have required information about the species' ecology, movement patterns and habitat use/selection which can only be obtained by large-scale tracking of wild flocks. Our team has developed and tested an approach enabling us to track wild flocks using satellite and GPS tags at both local population and landscape scales; allowing us to collect a suite of hitherto unknown ecological information. Accordingly, this proposed project will address and inform all six priority Actions from the Carnaby's Cockatoo Recovery Plan, and seven of the priority Actions in the Forest Black Cockatoo Recovery Plan.

Threatening processes for Western Australia's black cockatoos are exacerbated by the rapidly increasing urban and industrial development in the Perth-Peel region and the south-west of Western Australia[3]. Perth's human population is projected to nearly double to 3.5 million by 2050[3], emphasising the need to understand flock movements and habitat use, and identify critical feeding and breeding sites; which still remain largely unknown despite early attempts using direct observation[8-13,16-20]. There is an apparent mismatch between legislative intent and management action as insufficient knowledge exists about basic behavioural ecology across spatial scales, and which habitats are integral to long-term retention of black cockatoos.

Development and biodiversity conservation are not mutually exclusive. Perth is undergoing rapid and extensive development, and could be a strong model for how development and conservation can be managed synergistically. A large part of what makes Perth special is its unique and endemic biodiversity, which we are fortunate to have in our urban areas; including endangered and iconic black cockatoos. As Perth develops, it will be important to implement effective efforts to ensure the conservation management of our threatened species. For black cockatoos, this will mean identifying and protecting important habitat on the Perth-Peel Coastal Plain, alongside creation of replacement habitat, to ensure no net habitat loss across their distribution range.

Our tracking research, which identifies habitat use and flock movements through the landscape, can assist with identifying key habitats and areas for conservation/revegetation. Our research team is in a strong position to work alongside government to identify areas of habitat that are high-use, and to inform decisions regarding which areas are most appropriate to conserve and manage to halt black cockatoo population declines.

Our research team at Murdoch University has developed a novel tracking methodology for black cockatoos using GPS and satellite telemetry[21-22]. Together this will enable researchers to obtain movement, behavioural and ecological data at both the extent and spatial scale (local population and landscape scales) required to inform conservation and land management planning.

Funding Partnerships

Three industry partners have proposed funding for this project in relation to their offset packages – Main Roads Western Australia, the Public Transport Authority of Western Australia (PTA) and Talison Lithium.

Main Roads WA are responsible for the building and provision of road infrastructure and operations in relation to improvement in road efficiency, as well as maintenance of the State's major government roads, bridges and road verges. *It is proposed that Main Roads WA would provide funding for Year 1 of this research project.*

The Government of Western Australia has embarked on the delivery of METRONET, considered to be Perth's most ambitious public transport program, which aims to address sustainability issues in the city through the optimisation of existing rail capacity and building new rail systems. *The funding component from the PTA is for Years 2-5 and is linked to proposed METRONET projects.*

Talison Lithium Australia Pty Ltd has been operating the Greenbushes Lithium mine, in the Greenbushes region in south-west WA, for over 30 years. Talison Lithium is proposing to expand its operations at this mine site to increase the production of spodumene ore and lithium mineral concentrate. *The funding component from Talison Lithium in Year 2-5 is linked to the proposed expansion of the Greenbushes Lithium mine.*

These industry partners have indicated that they are committed to sustainable development; they aim to minimise and manage potential environmental impacts and work with the Western Australian Environmental Protection Authority and Department of Water and Environmental Regulations, and the Federal Department of Environment and Energy in relation to environmental approval and offset requirements.

Proposed Research

This project aims to utilise innovative tracking methodologies to undertake a movement ecology study of Carnaby's cockatoos, Baudin's cockatoos and forest red-tailed black cockatoos, to determine habitat use and threatening processes in modified landscapes. We will track the three species of black cockatoos on the Perth-Peel Coastal Plain and in the south-west

forest region of Greenbushes, and additionally – given the importance of the Perth-Peel Coastal Plain for Carnaby's cockatoos during the non-breeding season – we will track Carnaby's cockatoos at key breeding sites to better understand migratory movement dynamics of this species across its distribution range. We will also undertake health research on Carnaby's cockatoos at key breeding sites, to better understand the potential role of disease as a threatening process for this species. Several potential pathogens associated with avian disease have been found in wild Carnaby's cockatoo nestlings in south-western Australia, including: (1) psittacine beak and feather disease (a listed Key Threatening Process for endangered parrots, Commonwealth EPBC Act 1999); (2) polyoma virus; and, (3) *Chlamydia* sp. The clinical significance of these diseases for species survival remains unknown[23]. The Murdoch team has also been involved in the investigation of Carnaby's cockatoo Hindlimb Paralysis Syndrome (CHiPs) in adult Carnaby's cockatoos, likely associated with toxicity events involving birds exposed to agricultural chemicals at breeding sites. Each year a number of Carnaby's cockatoos that have migrated back to the Perth-Peel Coastal Plain following the breeding season, are observed with clinical symptoms suggestive of delayed organophosphate neuropathy. This disease is also suspected to have caused two mass mortality events at a key Wheatbelt breeding site (2009, 2012), resulting in a population crash at this site of > 90% of breeding birds, and functional extirpation of this important breeding population[24].

This research will use remote sensing to produce predictive modelling of black cockatoo population movements and habitat use, in association with existing and emerging threats across key range areas. The project offers a novel approach: it combines (a) satellite/GPS derived movement data from our innovative tracking system; (b) other remotely sensed landscape data (e.g. vegetation, water); and (c) existing fire and climate models, to identify crucial habitat characteristics and regions most resilient to impacts of threatening processes (fire, climate shifts, habitat modification, tree health, disease, urban expansion). The data and information they generate will allow collaborators to develop policies and take action to manage land changes, and build resilience into modified landscapes to address black cockatoo declines.

Objectives of the Study

In this study we adopt a multidisciplinary approach (Fig. 1) to meet the following five objectives: **1)** Characterise black cockatoo movement and habitat use across the Perth-Peel Coastal Plain and in the south-west forest region of Greenbushes for all three black cockatoo species; **2)** Study known Carnaby's cockatoo breeding sites, focussing on characterising habitat suitability, food resource availability and selection, nestling health, specific threatening processes and fledgling dispersal routes; **3)** Identify new breeding sites in inland or southern areas for all three species based on migratory movement of birds to breeding grounds; **4)** Apply new ecotoxicology methods to investigate CHiPs toxicity cases, particularly in the agricultural zone; and **5)** predictively model survivorship scenarios for all three species of black cockatoo using movement, habitat use and threats.

Methods and Analytical Framework to meet Objectives

Obj 1 and Obj 3 – *Flock Movements and Habitat Use across the PPCP; south-west forest region of Greenbushes; New Breeding Sites (Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo)*

- Double mounted Satellite and GPS tracking – 16 black cockatoos tracked on the Perth-Peel Coastal Plain per annum for four years - 8 Carnaby's cockatoos (4 individuals released into two different resident flocks), 4 Baudin's cockatoos and 4 forest red-tailed black cockatoos released into resident wild flocks on the Perth-Peel Coastal Plain and in south-west forest region of Greenbushes* – use of Switching State-Space Models [25], First-Passage Time Analysis [26] and GIS to model movement behaviour, habitat selection and foraging strategies. *The number of releases of black cockatoos equates to a total of 10 releases on the Perth-Peel Coastal Plain i.e. 6 for Carnaby's cockatoos, 2 for forest red-tailed black cockatoos, 2 for Baudin's cockatoos) and 6 releases in the south-west forest region of Greenbushes i.e. 2 for Carnaby's cockatoos, 2 for forest red-tailed black cockatoos, 2 for Baudin's cockatoos; fewer Baudin's cockatoos present for rehabilitation and whilst it is likely there will be birds from this species undergoing rehabilitation that will enable a number of release groups, in the event that there are insufficient Baudin's cockatoos to have four release groups over the duration of the project, additional Carnaby's cockatoos or forest red-tailed black cockatoos will be released instead based on discussion with the industry partners and DBCA.

Obj 2 – *Known Breeding Sites and Dispersal Routes (Carnaby's cockatoo)*

- GPS tracking and Satellite tracking – 9 breeding sites across the distribution range – 3 sites per annum for three years, with each site monitored in the subsequent year through field observations by research staff. Numbers of birds tracked: 4 adult breeding birds per site per year (i.e. 12 birds per year), each double mounted (UvA-BiTS and Telonics tags). This will include sites currently monitored by DBCA and Birdlife Australia (e.g. Coomallo Creek, Borden, Lake King, Stennetts Lake), and new sites (e.g. Kojonup and 4 additional sites identified by the tracking work) – Use of Switching State-Space Models, Calculation of Utilisation Distributions and associated Home Range estimators to identify and quantify high use habitat for feeding and watering; Examination of ecological linkages across identified habitat parameters using spatially explicit models (e.g. GLMs, GAMs, Maxent, Random Forests) to assess linkages between bird movement and specific habitat features (including travel distances to foraging and watering sites). These data will also be used in comparative studies between sites/regions and to inform predictive modeling.
- Energetics – combined analysis using GPS accelerometer derived activity budgets and caloric benefit of identified food species determined by Bomb Calorimetry.

- Nestling health - 20 nestlings per site - 60 nestlings per year. Screening for: i) psittacine beak and feather disease (key threatening process), ii) polyoma virus, iii) *Chlamydia* sp. (present in nestlings in south-western Australia).
- Ground surveys – identification of new nest hollows, assessment of hollow condition, inventory of current and potential future threats at each site.

Obj 3 – *Identify new breeding sites* – see Obj 1 above

Obj 4 – *CHiPs toxicity (Carnaby's cockatoo)*

- Application of new ecotoxicology methods to investigate CHiPs toxicity – catastrophic mass mortality events in 2009 and 2012 led to functional extirpation of a key breeding site in the Wheatbelt[24]. Separation Science (e.g. GC-MS) targeting agricultural pesticides undertaken. Samples will include environmental samples, eggshells and cadavers (in the event of further mortality events; CHiPs clinical cases).

Obj 5 – *Predictive modelling of perturbation scenarios (Carnaby's cockatoo, forest red-tailed black cockatoo and Baudin's cockatoo)*

- Realised movement, habitat use, food and water resources will be modelled in a predictive framework (e.g. using Ensemble Species Distribution Modelling[27] against various perturbation scenarios including: habitat loss, habitat modification due to climate shifts, fire impacts, and forecast land-use transformation through urban and industrial expansion to identify landscape critical for supporting species survivorship in the long-term [modelled in 10yr increments for 50-100yrs]). Existing fire and climate models exist. Ensemble modelling allows the prioritisation of habitat according to competing ecological hypotheses and is an excellent tool for guiding conservation management under large-scale disturbance scenarios.

Projected Conservation Management Outcomes

This project will deliver major new flock movement and habitat use information and conservation outcomes. Since 2015, our research team has successfully deployed 84 tags and generated over 140,000 GPS location fixes, 33,000 km of track movement and over 2.8M accelerometer records. The methodology is proven, and facilitates black cockatoo flock movement characterisation at spatial and temporal scales previously unattainable. The proposed research builds on this existing success, with a clear focus on conservation and management of all three black cockatoo species on the Perth-Peel Coastal Plain and the south-west forest region of Greenbushes, as well as at key Carnaby's cockatoo breeding sites across the species distribution range.

<u>We envisage the following direct conservation management outcomes:</u>

1. Identification and prioritisation of key habitat resources, including food, water and vegetation corridors, to maximise the retention of critical conservation value habitat for the long-term retention of Carnaby's cockatoos, Baudin's cockatoos and forest red-tailed black cockatoos across their distribution range.
2. Characterisation of appropriate roosting habitat for all three species of black cockatoo, particularly on the Perth-Peel Coastal Plain – this is important as it is not necessarily synonymous with appropriate feeding or nesting habitat.
3. Characterisation of optimal provisioning distances based on energetics work to inform future offset purchases.
4. Identification of new breeding sites (and nest hollow identification) for all three species of black cockatoo, facilitating additional long-term monitoring and protection of stronghold populations, and informing the purchase of off-set land.
5. Additional knowledge about key threatening processes (disease, displacement species, pesticide exposure etc) on Perth-Peel Coastal Plain, in the south-west forest region and at breeding sites.
6. Additional knowledge about critical habitat resources and the overall health of breeding populations at key Carnaby's cockatoo breeding sites, which is required to ensure appropriate long-term conservation management of these sites.
7. Correlation of realised species movement ecology with existing PVA models.
8. Facilitation of consultation with local, State and Federal governments to maximise future urban and peri-urban design to retain birds on the Perth-Peel Coastal Plain and maximise conservation management.
9. Continued liaison with stakeholder groups which consult with private landowners and industry, to manage properties and to maximise landscape and habitat integrity suitable to sustain black cockatoo populations over the long-term.

This project has been developed in collaboration with DBCA to meet the requirements of the EPBC Act Referral Guidelines for the three black cockatoo species[4], as well as priority Actions and recommendations from the national Carnaby's Cockatoo Recovery Plan[1]; Forest Black Cockatoo Recovery Plan[2]; Matters of National Environmental Significance (MNES) Significant Impact Guidelines[4-7]; and the Consideration of MNES by the WA land use planning system Discussion Paper[7].

<u>In addition, this project will meet the following recommendations from the MNES Paper:</u>

- Will address the Government of Western Australia's MNES Discussion Paper recommendations[4-7] to identify key areas within a region to sustain threatened populations, including collecting sufficient spatial information to inform assessments and provide clarification on aspects of MNES guidelines with respect to Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo conservation.

• Will contribute substantially towards the Government of Western Australia's preferred option for addressing Carnaby's cockatoo, Baudin's Cockatoo and forest red-tailed black cockatoo conservation in line with the EPBC Act, through identification of critical habitat, areas under threat and areas for potential offsets[4].

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Malaga to Ellenbrook Part 2 - Offset Value Calcuations - October 2020 - Based on DAWE Requirements

Offset site	Environmental value to be offset	Current land value ($)[1]	DBCA management cost for Lowlands for 7 years ($)[2]	Total value of Lowlands for 7 years[3]	Land size (ha)	Cost of offset site per ha[4]	Offset requirement as 100% land acquisition (ha)[5]	Offset required as Land Allocation	100% value of the offset[6]	90.45% of offset cost to be allocated to Lowlands[7]	9.55% of offset cost to be allocated to Black Cockatoo Research indirect offset ($)[8]
Lot 301 Lowlands Road Mardella (Lowlands)	TEC	$10,820,000.00	$2,103,924.00	$12,923,924.00	1,138	$ 11,356.70	77.03	77.03	$ 874,806.56	NA	NA
Lot 301 Lowlands Road Mardella (Lowlands)	Black Cockatoo Foraging Habitat	$10,820,000.00	$2,103,924.00	$12,923,924.00	1,138	$ 11,356.70	396.50	358.70	$ 4,502,931.34	$ 4,072,853.34	$ 430,078.00
								90.47%		90.45%	9.55%

1 Based on current land value: Lowlands based on valuation November 2019.

2 Cost to manage the Lowlands site for a period of 7 years provided by DBCA and as per the executed Memorandum of Understanding.

3 Land value + cost of management for 7 years. Note that these costs do no include the PTA costs or compliance reporting, estimated at $10,000 per annum per site for a period of seven years for Lowlands.

4 Value of offset site divide by number of ha

5 This is based on the application of the Commonwealth Offset Calculator to offset 100% of the impacts from the Proposal.

6 The PTA intends to offset the TEC, black cockatoo foraging habitat and potential breeding trees within the same offset allocation area i.e. within the same 358.70 ha area within the Lowlands offset site, therefore the costs are only expected to be of the largest required offset area.

7 Only 90.45% of the the offset will be land (i.e. 358.70 ha offset at Lowlands).

No more than 10% of the offset value can be applied to an indirect offset (ie the Murdoch University Research Project). The Grant Agreement for MEL stipulates the amount of $430,078.21 to be provided as funding, based on prior calculations of offset alloction areas. This value of the funding now constitutes 9.55% of the offset value and therefore the remainder of the offset (90.45%) will be provided as a direct land offset.

8 Calculations as follows

The revised value of the offset is $4,502,931.34

The funding to be provided to Murdoch University as an indirect offset from the MEL Proposal is $430,078.21, therefore the indirect offset funding is now 9.55% of the value of the offset.

The remaining 9.45% will be provided as a land offset, noting that 358.70 ha is actually 90.47% and therefore the PTA is providing an offset of 100.02%

Environmental Offset Third Party Delivery Arrangement

Memorandum of Understanding

Third Party Delivery Arrangements

for Environmental Offset Implementation

at the Lowlands Nature Reserve Offset Site

Proponent land management contribution

for the maintenance of environmental values

THIS MEMORANDUM OF UNDERSTANDING (MOU) is executed on the

10th day of September 2020

BETWEEN

DEPARTMENT OF BIODIVERSITY, CONSERVATION AND ATTRACTIONS (ABN 38 052 249 024) (Department) acting through its Director General, of 17 Dick Perry Avenue, Technology Park West, Kensington, Western Australia 6151

AND

PUBLIC TRANSPORT AUTHORITY OF WESTERN AUSTRALIA (ABN 61 850 109 576) a body corporate constituted pursuant to the provisions of the Public Transport Authority Act 2003, Western Australia, and having its office at Public Transport Centre, West Parade, Perth, Western Australia (**Public Transport Authority**)

BACKGROUND

A. The **Lowlands Nature Reserve** has been allocated to the Public Transport Authority as an advanced offset site for the purposes of environmental offsets for **METRONET** proposals.

B. To comply with **Ministerial Statements** issued by the Minister for Environment (Western Australia) and **EPBC Approvals** issued by the Minister for the Environment (Australia), and as a requirement of State and Commonwealth environmental approvals, project specific **Offset Strategies** will be prepared and submitted to the requirements of the **CEO** and/or the Department of Agriculture Water and Environment to demonstrate how the Public Transport Authority will counterbalance significant residual impacts on environmental values resulting from the construction and operation of METRONET proposals.

C. This MOU is applicable where Offset Strategies propose the contribution of funds to the **Department** for on-ground management activities within the Lowlands Nature Reserve.

D. On-ground management activities form part of the advanced offset package for the Lowlands Nature Reserve.

E. The Department will establish one or more **Specific Purpose Accounts** (Interest Bearing Trust Account) to accommodate payment contributions provided by the Public Transport Authority. The Department will use the funds in the Specific Purpose Accounts, and any accruing interest, for the sole purpose of undertaking the on-ground management activities identified in Annexure A.

F. This MOU sets out how the Public Transport Authority will satisfy the contribution commitments identified in Offset Strategies and how the Department will manage that contribution, as documented in Annexure A.

The Parties to this MOU agree:

1. INTERPRETATION

1.1 Definitions

Action means implementation of the relevant proposal.

Department means the Department of Biodiversity, Conservation and Attractions.

CEO means the Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or his delegate.

EP Act means the *Environmental Protection Act 1986* (State of Western Australia).

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia).

EPBC Approval means the approval notice issued by the Department of Agriculture, Water and the Environment for the relevant proposal in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia).

GST and Tax Invoice have the same meanings as in the GST Act.

GST Act means *A New Tax System (Goods and Services Tax) Act 1999* (Commonwealth of Australia) and, where the context permits, includes the Commissioner of Taxation's goods and services tax rulings and determinations and any other written law dealing with GST applying for the time being in Western Australia.

Lowlands Nature Reserve means the cadastral parcel identified as Lot 301 Lowlands Road, Mardella, (Lot 301 on Deposited Plan 77559, volume LR3164, folio 969) managed by the Department as an A-Class nature reserve (R51784) in accordance with the *Conservation and Land Management Act 1984*.

METRONET means a portfolio of projects undertaken by the METRONET taskforce to deliver public transport infrastructure in the Perth-Peel Region.

Ministerial Statement means the Statement approving the implementation of a proposal issued by the Minister for the Environment made under the *Environmental Protection Act 1986*.

Approved Offset Strategies means offset strategies approved by the CEO that are required under a Ministerial Statement and/or EPBC Approval.

Payment Date is the date on which payment of contributions for the management of Lowlands Nature Reserve are due pursuant as per clause 5.1 of this document.

Specific Purpose Account means the Specific Purpose Account referred to in BACKGROUND (E) of this MOU.

2. NO LEGAL RELATIONSHIP CREATED

Nothing in this MOU is intended to create a relationship of employment, partnership, joint venture or agency between the Department and the Public Transport Authority and nothing in this MOU will be deemed to have created any such relationship.

3. OTHER OBLIGATIONS NOT AFFECTED

The MOU cannot restrict the Department or the Public Transport Authority in the performance of their functions or exercise of their legal powers and it has no authority in law. Nothing in this MOU affects the Department's or the Public Transport Authority obligations under or pursuant to:

(a) any written or other law; or

(b) any contact.

4. TERM

Unless an extension to the MOU is agreed by the Department or the Public Transport Authority and executed, this MOU is valid commencing on the date it is executed until 29 February 2028.

5. OBLIGATIONS OF THE PUBLIC TRANSPORT AUTHORITY

In accordance with Approved Offset Strategies the Public Transport Authority agrees to:

5.1 pay to the Department $ 2,103,924 (GST exclusive) to undertake the on-ground management activities identified in Annexure A as either one lump sum payment on 25 September 2020 or by seven (7) instalments with the first instalment due on 25 September 2020 and subsequent instalments due on the anniversary of the first payment date for the following six (6) years.

5.2 provide to the CEO responsible for the administration of section 48 of the EP Act, documentary evidence showing that the payment has been made to the Department within 30 days of the Payment Date.

5.3 provide the Department with information relevant to the on-ground management at the Lowlands Nature Reserve.

5.4 provide compliance reports to the CEO, Department of Water and Environmental Regulation and/or Department of Agriculture, Water and Environment in accordance with the relevant Ministerial Statement and/or EPBC Approval.

6. OBLIGATIONS OF THE DEPARTMENT

6.1 The Department, represented by the Swan Regional Manager, will be responsible for undertaking the on-ground management activities identified in Annexure A and establishing and operating the Specific Purpose Account(s) in accordance with applicable legislation, including but not limited to the *Financial Management Act 2006* and relevant WA Treasurer's Instructions, and will:

a) use the payments made by the Public Transport Authority and interest accruing in the Specific Purpose Account established under this MOU for the sole purpose of undertaking the on-ground management activities identified in Annexure A.

b) prepare an operational works plan for the Lowlands Nature Reserve.

c) the operational works plan identified in clause 6.1(b) must:

(i) detail the on-ground management activities proposed in Annexure A,

(ii) outline the allocation of funds provided by the Public Transport Authority to agreed activities over an agreed timeframe,

(iii) outline contingencies in the event of any deviation from the delivery of agreed activities, budgeted expenditure and timeframes, as identified in Annexure A.

d) commence on-ground management activities as per Annexure A and the operational works plan on 1 January 2021.

e) provide an annual update of the on-ground management activities completed, expenditure incurred, outstanding activities or unspent funds based on a calendar year (1 January to 31 December), to the Public Transport Authority, no later than the first week of February the following calendar year.

f) the annual report identified in clause e) should be provided in accordance with the framework provided in Annexure B.

g) keep the Public Transport Authority informed of progress of the operational works plan pursuant to this MOU that might affect or have implications for the Public Transport Authority's projects, including the METRONET projects, proposals and compliance with Approved Offset Strategies.

h) ensure that any unspent funds remaining at the completion of specific on-ground management activities, are either re-allocated to associated on-ground management activities at the Lowlands Nature Reserve or carried forward to future operational years at the Lowlands Nature Reserve.

i) ensure any residual funds (including interest accrued) at the cessation of the term of this MOU are allocated to the ongoing management of the Lowlands Nature Reserve.

j) invoice the Public Transport Authority for the funds due pursuant to clause 5.1 of this MOU.

k) provide the Public Transport Authority a receipt for, or a statement showing, the payment referred to in clause 5.1 of this MOU within 30 days of the payment date.

l) provide the Public Transport Authority with any other information that the Public Transport Authority reasonably requires and requests the Department to provide to fulfil its obligations under a Ministerial Statement or Offset Strategy.

6.2 The Department will consult with the Public Transport Authority to investigate how activities implemented under the Specific Purpose Account, and any separate survey, monitoring and management programs undertaken by the Public Transport Authority, may be structured so as to optimise overall efficiency and benefits to each Party, subject to the provisions of this MOU.

7. ADVANCED OFFSET

The payment specified in clause 5.1 is the total cost, as provided by the Public Transport Authority to the Department, to manage the entire Lowlands Nature Reserve for seven (7) years. By providing the payment specified in clause 5.1, the Department understands that the Public Transport Authority has initiated an advanced offset arrangement, whereby use of the Lowlands Nature Reserve as an offset for future METRONET projects may be proposed, at no additional cost to the Public Transport Authority, unless otherwise agreed by both parties.

8. GOOD AND SERVICES TAX (GST)

All amounts payable under or in connection with this MOU, including by way of reimbursement, indemnity, damages or otherwise, are exclusive of GST, unless expressed otherwise. If GST is payable on a supply made under or in connection with this MOU and if the Party making that supply (supplier) is liable, under the applicable law, to pay or collect and remit, GST to the appropriate government agency, the Party receiving that supply (recipient) shall pay to the supplier an additional amount equal to the GST payable by the supplier in respect of the supply. The recipient must pay the additional amount to the supplier on the date

when the price (or part thereof) is provided to the supplier (subject to a Tax Invoice being received prior to Payment Date). This paragraph does not apply to the extent that the consideration for the supply is expressed to be inclusive of GST.

9. AMENDMENT

This MOU shall not be altered except with the prior written consent of Managing Director of the Office of Major Transport Infrastructure Development and the Director General of the Department.

EXECUTED as a Memorandum of Understanding

Signed for and on behalf of the **DEPARTMENT OF BIODIVERSITY, CONSERVATION AND ATTRACTIONS**

s. 47F(1) .....

MARK WEBB, DIRECTOR GENERAL

Date: 10/9/2020

Signed for and on behalf of the **PUBLIC TRANSPORT AUTHORITY OF WESTERN AUSTRALIA**

s. 47F(1) .....

s. 47F(1) **PUBLIC TRANSPORT AUTHORITY OF WESTERN AUSTRALIA,** an officer of the Authority duly authorised by the Authority pursuant to section 51(5) of the Public Transport Authority Act 2003 for that purpose

Date: 8/9/2020

ANNEXURE A – Public Transport Authority Land management contributions provided to the Department for on-ground management activities at the Lowlands Nature Reserve 2021-2027.

Management activity	Contribution Total over seven (7) years	Year 1 2021	Year 2 2022	Year 3 2023	Year 4 2024	Year 5 2025	Year 6 2026	Year 7 2027
16.0km electrified fencing material (including 4 gates) and installation	**$478,676**	$239,338	$239,338					
Management access tracks upgrade and maintenance	**$4,341**	$1,680		$887		$887		$887
Reserve Management Officer salary and associated costs	**$897,089**	$121,300	$122,300	$125,007	$127,782	$130,627	$133,542	$136,531
Signage (materials and installation)	**$15,928**	$15,928						
Phytophthora cinnamomi (dieback) mapping (years 3 and 7) and implementation of management plan	**$49,228**	$23,538		$5,000	$15,690			$5,000
Weed mapping	**$19,050**			$9,525				$9,525
Weed control (materials and program implementation)	**$99,236**	$23,031	$18,425	$11,556	$11,556	$11,556	$11,556	$11,556
Flora and vegetation survey	**$10,626**	$1,518	$1,518	$1,518	$1,518	$1,518	$1,518	$1,518
Rubbish removal	**$10,500**	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Fire management (prescribed burn)	**$75,000**			$25,000		$25,000		$25,000
Feral animal monitoring and control (including but not limited to cat, fox, rabbit, kangaroos and pigs)	**$434,250**	$71,625	$60,525	$60,525	$60,525	$60,525	$60,525	$60,000
Carnaby's Cockatoo watering point establishment	**$10,000**			$10,000				
Total	**$2,103,924**	**$499,458**	**$443,606**	**$250,518**	**$218,571**	**$231,613**	**$208,641**	**$251,517**

ANNEXURE B – Department Annual Report to the Public Transport Authority Framework for Lowlands Nature Reserve

Section	Potential Inclusions
Introduction	• Background • Objective • Scope of works • Summary of management activities for the period • Assumptions/ limitations
Environmental Setting	• Climatic/weather conditions over the reporting period (rainfall, storms, dry periods) • Changes to topography, drainage or hydrology (surface water runoff, flow direction) • Environmental events such as flooding or fires • Wetlands
Management Activities	• Details of on-ground management works or other works undertaken as per the works operational plan • Identify any works undertaken by third parties and outcome of works undertaken • Identification and justification for deviations from on-ground management works or other works specified in the operational works plan for the period • Identification and justification of any contingency plans (if required) implemented during the period • Result of any surveys undertaken as per the operational works plan (e.g. dieback mapping, weed mapping, flora and vegetation surveys) • Any observed or anecdotal results noted from the implementation of on-ground management works (i.e. observable reduction in feral animals or reduction in weeds)
Financial Arrangements	• Details of expenditure incurred during the management period • Identification and justification for deviations from the Land management contributions in Annexure A incurred during the management period • Provision of invoices for works undertaken during the management period • Specific Purpose Account for the Lowlands Nature Reserve balance sheet showing incomings and outgoings
Proposed Management Activities	• Details of on-ground management works or other works proposed to be undertaken as per the operational works plan • Identification and justification for any proposed deviations from on-ground management works or other works specified in the operational works plan for the period • Identification and justification of any contingency plans (if required) implemented during the period • Risk assessment for proposed management activities for the upcoming period
Proposed Funding Allocation	• Proposed re-allocation of funds from one management activity to another • Any proposed re-allocation of funds from one management period to another • Any proposed re-allocation of funding to be carried forward to future operational years

Section	Potential Inclusions
	• Risk assessment for proposed funding changes for the upcoming management period
Stakeholder Consultation	• PTA • External consultants • Third parties • DWER
Figures	• Site layout • Locations of on-ground management activities (e.g. fencing, signage, weed control, track maintenance) • Locations of work areas (e.g. weed control, track maintenance) • Locations of observations (e.g. areas showing reduced feral animal activity) • Indications of proposed works areas for the upcoming management period • Provision of spatial data
Photographs	• Evidence of works implemented (e.g. fencing, signage, rubbish removal) • Evidence justifying deviations from operational works plan • Visible changes to the site and/or surrounds • Visible changes (improvement or degradation) to environmental values (e.g. vegetation condition, flora, fauna habitat, wetlands)
Conclusions	• Management activities completed to date • Comment on the effectiveness of management activities that have been implemented this far
Recommendations	• Recommendations for management activities for the upcoming management period • Recommendations for deviations to any management activities for the upcoming management period • Recommendations for funding allocation for management activities for the upcoming management period • Any other recommendations

s. 22(1)(a)(ii)

From: s. 47F(1) @pta.wa.gov.au>
Sent: Monday, 30 November 2020 5:15 PM
To: s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: Malaga to Ellenbrook Rail Works - PTA Response to DAWE Draft Conditions 20201130 (A5871870)
Attachments: Malaga to Ellenbrook Rail Works - PTA Response to DAWE Draft Conditions 20201130.pdf

Hello s. 22(1)(a)(ii)

Further to our meeting last week please find attached PTA's response to the MEL DAWE draft conditions.

Should you have any questions on this matter please get back to me.

Kind regards

s. 47F(1)
Senior Environmental Planner | IPLS
Public Transport Authority of Western Australia
34-50 Striling Street, Perth Business Centre, WA, 6849
Tel: s. 47F(1) Fax: s. 47F(1) Mob: s. 47F(1)
Email: s. 47F(1) @pta.wa.gov.au
Web: www.pta.wa.gov.au

s. 47F(1) has sent you a copy of "Malaga to Ellenbrook Rail Works - PTA Response to DAWE Draft Conditions 20201130" (A5871870) v0.1 from Objective.

Table 1 – Malaga to Ellenbrook Rail Works Suggested Changes to Draft Conditions (provided to PTA by DAWE on 20/11/2020)

Draft Condition Number	Suggested Change	Reason for Change
1	To minimise impacts to EPBC Act listed species and ecological communities, the approval holder must not clear more than the following areas within the Development Envelope marked by yellow and labelled as an 'Development Envelope' in Attachments A1 – A4	The PTA preference is to use the terminology Development Envelope rather than Indicative Project Footprint. This also aligns with the State condition 1-1. The indicative project footprint area will not increase, but may move within the Development Envelope.
2, 3, 5, 6, 7	Replace Western Australian EPA Report 1690 with Ministerial Statement	The PTA suggests that all conditions refer to the conditions of the Ministerial Statement. The reason is that this may be changed at a later date to amend conditions referred to in the EPBC approval creating a compliance issue.
4c	If condition 4(a) has not been met due to activities attributable to the action, the approval holder must submit, within twenty two (22) months after cessation of dewatering, a remedial plan for approval by the Minister committing to implementing specified remedial actions to prevent impacts to the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community. The approval holder must implement the approved remedial plan.	The PTA would like to request additional wording included in this condition, to specifically address impacts attributable to the proposed action. The PTA suggests that responsibility for remediation of impacts are attributable only to the proposed action. To eliminate the potential that other external causes outside of the project control may result in not meeting condition 4(a).
5	To minimise impacts to potential nesting Black Cockatoos, the approval holder must implement condition 10-1~~, 11-1, 11-2, 11-3, 11-4 and 11-5~~ of the Western Australian EPA Report 1690	The condition currently references State Conditions 11-1 to 11-5, which addresses minimising noise impacts on humans. The PTA would like to request that reference to State Conditions 11-1 to 11-5 are removed. There are no known nesting sites within 10-20km of this location – noise will not impact black cockatoos

9	"*ocidentalis*" should be corrected to "*occidentalis*"	Spelling error
9	The approval holder must have a suitably qualified person survey areas deemed potentially suitable habitat within the development envelope for *Trithuria ocidentalis* and submit to the Department a report of the survey results prior to commencement of works having the potential to impact areas deemed potentially suitable *Trithuria occidentalis* habitat. Should *Trithuria occidentalis* be found during the surveys, the approval holder must…	The PTA consider the definition for a 'suitably qualified ecologist' as too specific, and may not be available prior to commencement of the action. The PTA preference is to change to 'suitably qualified person'. The PTA believe a suitably qualified person would still satisfy this condition and the survey requirements. The words "prior to the commencement of the action" have been replaced by "prior to commencement of any works having the potential to impact areas deemed potentially suitable habitat" as this is the relevant affected area.
9 & 9c	*'…within 100m of the development envelope for Trithuria ocidentalis* and submit to the Department a report of the survey results prior to works having the potential to impact areas deemed potentially suitable *Trithuria occidentalis* habitat**.'** "….offset strategy for the Minister's approval within six (6) months of commencement of works having the potential to impact *Trithuria occidentalis habitat*."	The provision of the survey or preparation of an offset strategy should not limit works in other areas of the project that do not affect *T. occidentalis*. Based on the Approved Conservation Advice by the Commonwealth, the species is only known from one population, therefore, it is unlikely to occur elsewhere on the Project.
10	New condition (g) Where objectives of the plan have been met, the PTAis to provide a written submission to the Minister demonstrating the objectives have been met and request that the plan be no longer implemented.	The PTA request that an additional condition is included within Condition 10. The proposed condition 10(g) specifies an implementation timeframe for the plan.

EPBC Ref: 2019/8546
EPA Ref: 2238

s. 47F(1)
Director
Public Transport Authority of Western Australia
PO Box 8125
Perth Business Centre
PERTH WA 6849

Dear s. 47F(1)

Decision on approval
Morley-Ellenbrook Line Part 2, Perth, WA

I am writing to you in relation to a proposal to develop part 2 of the Morley-Ellenbrook rail line, in Perth WA.

I have considered the proposal in accordance with Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and have decided to grant an approval to the Public Transport Authority of Western Australia. The details of my decision are attached. The proposal must be undertaken in accordance with the conditions specified in the approval.

I would appreciate your assistance by informing me when you start the action and who will be the contact person responsible for the administration of the approval decision.

Please note, any plans required as conditions of approval will be regarded as public documents unless you provide sufficient justification to warrant commercial-in-confidence status.

You should also note that this EPBC Act approval does not affect obligations to comply with any other laws of the Commonwealth, state or territory that are applicable to the action. Neither does this approval confer any right, title or interest that may be required to access land or waters to take the action.

The department has an active audit program for proposals that have been referred or approved under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned and that there is a high degree of compliance with any associated conditions. Please note that your project may be selected for audit by the department at any time and all related records and documents may be subject to scrutiny.

I have also written to the Western Australia Department of Water and Environmental Regulation to inform them of my decision.

If you have any questions about this decision, please contact the project manager s. 22(1)(a)(ii) by email to s. 22(1)(a)(ii)@awe.gov.au, or telephone s. 22(1)(a)(ii) and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely s. 47F(1)

s. 47F(1)

Chris Videroni
Acting Assistant Secretary
Environment Assessments West (WA, SA, NT) Branch
17 December 2020

Australian Government
Department of Agriculture, Water and the Environment

APPROVAL

Morley-Ellenbrook line part 2, Western Australia, (EPBC 2019/8546)

This decision is made under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*. Note that section 134(1A) of the **EPBC Act** applies to this approval, which provides in general terms that if the approval holder authorises another person to undertake any part of the action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such condition.

Details

Person to whom the approval is granted (approval holder)	Public Transport Authority of Western Australia
ACN or ABN of approval holder	ABN: 61 850 109 576
Action	To develop Part 2 of the Morley-Ellenbrook rail line, between Malaga and Ellenbrook, Western Australia, subject to the variation of the action accepted by the Minister under section 156B on Wednesday, 15 July 2020

Approval decision

My decision on whether or not to approve the taking of the action for the purposes of the controlling provision for the action is as follows.

Controlling Provisions

Listed Threatened Species and Communities	
Section 18	Approve
Section 18A	Approve

Period for which the approval has effect

This approval has effect until 01/01/2040

Decision-maker

Name and position	Chris Videroni Acting Assistant Secretary of Environment Assessments West (WA, SA, NT) Branch Department of Agriculture, Water and the Environment
Signature	s. 47F(1)
Date of decision	17 December 2020.

Conditions of approval

This approval is subject to the conditions under the EPBC Act as set out in ANNEXURE A.

ANNEXURE A – CONDITIONS OF APPROVAL

Part A – Conditions specific to the action

1. To minimise impacts to **EPBC Act listed species and ecological communities**, the approval holder must not **clear** more than the following areas within the development envelope marked by yellow and labelled as 'Development Envelope' in Attachments A1 – A4:
   a. 81.4 ha of **Carnaby's Cockatoo Foraging Habitat** (Attachment B1 – B5)
   b. 68.1 ha of **Forest Red-tailed Black Cockatoo Foraging Habitat** (Attachment B1 – B5)
   c. 81.4 ha of **Baudin's Cockatoo Foraging Habitat** (Attachment B1 – B5)
   d. 423 **Black Cockatoo potential breeding trees** (Attachment B1 – B5)
   e. 10.05 ha of **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** (Attachment C)
2. To minimise indirect impacts from weeds, *Phytophthora cinnamomi,* grazing and hydrological changes to the retained areas of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** and retained **Black Cockatoo Foraging Habitat**, the approval holder must implement conditions 8-1, 8-2(1), 8-2(2), 8-2(3), 9-1(1) of the Western Australian Ministerial Statement 1156.
3. To reduce the risk of impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** from dewatering at the **Malaga dive structure** the approval holder must implement conditions 9-2, 9-3 and 9-6 of the Western Australian Ministerial Statement 1156.
4. Following completion of ground-disturbing activities associated with construction of the **Malaga dive structure** the approval holder must:
   a. Within two (2) months of cessation of dewatering, commence monitoring for at least twelve (12) months so as to be capable of determining whether the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** is maintained; and
   b. Submit a report to the **Department,** within twenty (20) **business days** after the sooner of the last monitoring required by condition 4(a) or eighteen (18) months after cessation of dewatering, that demonstrates whether or not the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** has been maintained.
   c. If the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** has not been maintained due to activities attributable to the action, the approval holder must submit, within twenty two (22) months after cessation of dewatering, a remedial plan for approval by the **Minister** committing to implementing specified remedial actions to prevent impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**. The approval holder must implement the approved remedial plan.
5. To minimise impacts to potential nesting **Black Cockatoos**, the approval holder must implement condition 10-1of the Western Australian Ministerial Statement 1156.
6. To minimise impacts to terrestrial fauna associated with the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**, the approval holder must implement condition 10-2 of the Western Australian Ministerial Statement 1156.

7. To reduce the risk of impacts to the Carter's Freshwater Mussel, the approval holder must implement conditions 6-1 and 6-2 of the Western Australian Ministerial Statement 1156.

8. To compensate for residual significant impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo,** and **Baudin's Cockatoo**, the approval holder must implement the **Malaga to Ellenbrook Offsets Strategy** including annual reporting commitments specified in section 6.3 of the strategy.

9. The approval holder must have a **suitably qualified person** survey areas deemed potentially suitable ***Trithuria occidentalis* habitat** within 100m of the **development envelope** for *Trithuria occidentalis* and submit to the **Department** a report of the survey results prior to commencement of any works that have the potential to impact areas deemed potentially suitable ***Trithuria occidentalis* habitat**. Should *Trithuria occidentalis* be found during the surveys, the approval holder must:

    a. Submit a *Trithuria occidentalis* management plan for the **Minister's** approval that demonstrates the action will avoid impacts on the species. If the **Minister** approves the *Trithuria occidentalis* management plan then the *Trithuria occidentalis* management plan must be implemented;

    b. Not undertake any action that will impact on *Trithuria occidentalis* unless the **Minister** has approved the *Trithuria occidentalis* management plan in writing; and

    c. If, under the approved *Trithuria occidentalis* management plan, it is not possible to avoid impacts to *Trithuria occidentalis* the approval holder must submit a *Trithuria occidentalis* offsets strategy for the **Minister's** approval within six (6) months of commencement of any works that have the potential to impact areas deemed potentially suitable ***Trithuria occidentalis* habitat**. The offset strategy must demonstrate how any residual impacts will be offset, be consistent with the **environmental offsets policy**, and align with the **Approved Conservation Advice for Hydatella dioica (One-sexed Hydatella)**.

10. If a *Trithuria occidentalis* management plan is required in accordance with the provisions of condition 9, the approval holder must implement the approved *Trithuria occidentalis* management plan, which must be consistent with the **Department's *Environmental Management Plan Guidelines***, and must include:

    a. Environmental objectives, relevant **EPBC Act protected matter/s** and a reference to **EPBC Act** approval conditions to which the *Trithuria occidentalis* management plan refers;

    b. A table of commitments to achieve the objectives, and a reference to where the commitments are detailed in the *Trithuria occidentalis* management plan;

    c. Reporting and review mechanisms, and documentation standards to demonstrate compliance with the management plan;

    d. An assessment of risks to achieving management plan environmental objectives and risk management strategies that will be applied;

    e. Impact avoidance, mitigation and/or repair measures, and their timing; and

    f. A monitoring program, which must include:

        i. measurable performance indicators;

        ii. the timing and frequency of monitoring to detect changes in the performance indicators;

        iii. trigger values for corrective actions; and

        iv. proposed corrective actions, if trigger values are reached.

Part B – Standard administrative conditions

Notification of date of commencement of the action

11. The approval holder must notify the **Department** in writing of the date of **commencement of the action** within 10 **business days** after the date of **commencement of the action.**

Compliance records

12. The approval holder must maintain accurate and complete **compliance records**.

13. If the **Department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **Department** within the timeframe specified in the request.

Note: **Compliance records** may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the **Department**'s website or through the general media.

Submission and publication of plans

14. The approval holder must:

    a. submit **plans** electronically to the **Department**;

    b. unless otherwise agreed to in writing by the **Minister**, publish each **plan** on the **website** within 20 **business days** of the date of:

        i. this approval, if the version of the **plan** to be implemented is specified in these conditions; or

        ii. that the **plan** is submitted to the **Minister** or the **Department** if the **plan** does not require the approval of the **Minister** but was not finalised before the date of this approval; or

        iii. that the **plan** is approved by the **Minister** in writing, if the **plan** requires the approval of the **Minister**

    c. exclude or redact **sensitive ecological data** from **plans** that are to be published on the **website** or provided to a member of the public; and

    d. keep **plans** published on the **website** until the end date of this approval.

15. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under conditions of this approval, is prepared in accordance with the **Department's** *Guidelines for biological survey and mapped data* (2018) and submitted electronically to the **Department** in accordance with the requirements of the **plan** and conditions.

Annual compliance reporting

16. The approval holder must prepare a **compliance report** for each 12 month period following the date of **commencement of the action**, or as otherwise agreed in writing by the **Minister**. The approval holder must:

    a. publish each **compliance report** on the **website** within 60 **business days** following the relevant 12 month period;

    b. notify the **Department** by email that a **compliance report** has been published on the **website** and provide the weblink for the **compliance report** within five **business days** of the date of publication;

    c. keep all **compliance reports** publicly available on the **website** until this approval expires;

    d. exclude or redact **sensitive ecological data** from **compliance reports** to be published on the **website**; and

e. where any **sensitive ecological data** has been excluded from the version published, submit the full **compliance report** to the **Department** within 5 **business days** of publication.

Note: **Compliance reports** may be published on the **Department**'s website.

Reporting non-compliance

17. The approval holder must notify the **Department** in writing of any: **incident;** non-compliance with the conditions; or non-compliance with the commitments made in **plans**. The notification must be given as soon as practicable, and no later than two **business days** after becoming aware of the **incident** or non-compliance. The notification must specify:

    a. any condition which is or may be in breach;

    b. a short description of the **incident** and/or non-compliance; and

    c. the location (including co-ordinates), date, and time of the **incident** and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.

18. The approval holder must provide to the **Department** the details of any **incident** or non-compliance with the conditions or commitments made in **plans** as soon as practicable and no later than 10 **business days** after becoming aware of the **incident** or non-compliance, specifying:

    a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;

    b. the potential impacts of the **incident** or non-compliance; and

    c. the method and timing of any remedial action that will be undertaken by the approval holder.

Independent audit

19. The approval holder must ensure that **independent audits** of compliance with the conditions are conducted for the 12 month period from **the commencement of the action** and for every subsequent 12 month period, or as otherwise requested in writing by the **Minister**.

20. For each **independent audit**, the approval holder must:

    a. provide the name and qualifications of the independent auditor and the draft audit criteria to the **Department**;

    b. only commence the **independent audit** once the audit criteria have been approved in writing by the **Department**; and

    c. submit an audit report to the **Department** within the timeframe specified in the approved audit criteria.

21. The approval holder must publish the audit report on the **website** within 10 **business days** of receiving the **Department's** approval of the audit report and keep the audit report published on the **website** until the end date of this approval.

Revision of action management plans

22. The approval holder may, at any time, apply to the **Minister** for a variation to an action management **plan** approved by the **Minister** under condition 9 or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the **EPBC Act**. If the **Minister** approves a revised action management **plan** (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management **plan**.

23. The approval holder may choose to revise an action management **plan** approved by the **Minister** under condition 9, or as subsequently revised in accordance with these conditions, without

submitting it for approval under section 143A of the **EPBC Act**, if the taking of the action in accordance with the RAMP would not be likely to have a **new or increased impact**.

24. If the approval holder makes the choice under condition 23 to revise an action management plan without submitting it for approval, the approval holder must:

    a. notify the **Department** in writing that the approved action management plan has been revised and provide the **Department** with:

        i. an electronic copy of the RAMP;

        ii. an electronic copy of the RAMP marked up with track changes to show the differences between the approved action management **plan** and the RAMP;

        iii. an explanation of the differences between the approved action management **plan** and the RAMP;

        iv. the reasons the approval holder considers that taking the action in accordance with the RAMP would not be likely to have a **new or increased impact**; and

        v. written notice of the date on which the approval holder will implement the RAMP (RAMP implementation date), being at least 20 **business days** after the date of providing notice of the revision of the action management **plan**, or a date agreed to in writing with the **Department**.

    b. subject to condition 26, implement the RAMP from the RAMP implementation date.

25. The approval holder may revoke their choice to implement a RAMP under condition 23 at any time by giving written notice to the **Department**. If the approval holder revokes the choice under condition 23, the approval holder must implement the action management plan in force immediately prior to the revision undertaken under condition 23.

26. If the **Minister** gives a notice to the approval holder that the **Minister** is satisfied that the taking of the action in accordance with the RAMP would be likely to have a **new or increased impact**, then:

    a. condition 23 does not apply, or ceases to apply, in relation to the RAMP; and

    b. the approval holder must implement the action management plan specified by the **Minister** in the notice.

27. At the time of giving the notice under condition 26, the **Minister** may also notify that for a specified period of time, condition 23 does not apply for one or more specified action management plans.

Note: conditions 22, 23, 24, 25, 26 and 27 are not intended to limit the operation of section 143A of the **EPBC Act** which allows the approval holder to submit a revised action management plan, at any time, to the **Minister** for approval.

Completion of the action

28. Within 20 **business days** after the **completion of the action**, the approval holder must notify the **Department** in writing of the date of **completion of the** action and provide **completion data**.

Part C - Definitions

In these conditions, except where contrary intention is expressed, the following definitions are used:

Approved Conservation Advice for Hydatella dioica (One-sexed Hydatella) means the Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for* Hydatella dioica *(One-sexed Hydatella*). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4898-conservation-advice.pdf.

Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community means the **EPBC Act** listed Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community

Baudin's Cockatoo means the **EPBC Act** listed Baudin's Cockatoo (*Calyptorhynchus baudinii*).

Black Cockatoo/s means one or more of the **EPBC Act** listed Baudin's Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Carnaby's Cockatoo means the **EPBC Act** listed Carnaby's Cockatoo (*Calyptorhynchus latirostris*).

Clear/ing means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including weeds – see the *Australian weeds strategy 2017 to 2027* for further guidance).

Commencement of the action means the first instance of any specified activity associated with the action including clearing and **construction**. **Commencement of the action** does not include minor physical disturbance necessary to:

i. undertake pre-clearance surveys or monitoring programs;

ii. install signage and /or temporary fencing to prevent unapproved use of the project area;

iii. protect environmental and property assets from fire, weeds and feral animals, including erection of temporary fencing, and use of existing surface access tracks; and

iv. install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on the **protected matters**.

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **Department**'s preferred spatial data format is **shapefile**.

Completion of the action means all specified activities associated with the action have permanently ceased.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession or that are within the approval holder's power to obtain lawfully.

Compliance reports means written reports:

i. providing accurate and complete details of compliance, **incidents**, and non-compliance with the conditions and the **plans**;

ii. consistent with the **Department's** *Annual Compliance Report Guidelines* (2014);

iii. include a **shapefile** of any clearance of any **protected matters**, or their habitat, undertaken within the relevant 12 month period; and

iv. annexing a schedule of all **plans** prepared and in existence in relation to the conditions during the relevant 12 month period.

Construction means the erection of a building or structure that is or is to be fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; preliminary site preparation work which involves breaking of the ground (including pile driving); the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of temporary fences and signage.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Development envelope means the area enclosed by the yellow lines designated as 'Development Envelope' in the maps at Attachment A1, Attachment A2, Attachment A3 and Attachment A4.

Ecological integrity is the composition, structure, function and processes of ecosystems, and the natural variation of these elements.

Environmental Management Plan Guidelines means *Environmental Management Plan Guidelines, Commonwealth of Australia 2014* or any revisions of this.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

EPBC Act listed species and ecological communities means the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo**, **Baudin's Cockatoo** and **Trithuria occidentalis.**

Environmental Offsets Policy means Commonwealth of Australia 2012. *Environment Protection and Biodiversity Conservation Act Environmental Offsets Policy*. Available from https://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.

Forest Red-tailed Black Cockatoo means the **EPBC Act** listed Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Foraging habitat means the areas shown marked shaded in red, amber, and green and labelled as 'Black Cockatoo Foraging Habitat Quality' on the maps *Black Cockatoo Foraging Habitat* in Attachments B1 – B5.

Incident means any event which has the potential to, or does, impact on one or more **protected matter(s)**, other than as authorised by this approval.

Independent audit: means an audit conducted by an independent and **suitably qualified person** as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019).

Malaga dive structure means the area where the railway extends below ground surface west of the Malaga station and connects to the Bayswater to Malaga rail line.

Malaga to Ellenbrook Offsets Strategy mean the document 'Offsets Strategy, Malaga to Ellenbrook Rail Works Proposal, final_rev_0, October 2020' or subsequent revisions as approved by the **Minister**.

Monitoring data means the data required to be recorded under the conditions of this approval.

Minister means the Australian Government Minister administering the **EPBC Act** including any delegate thereof.

New or increased impact means a new or increased environmental impact or risk relating to any **protected matter**, when compared to the likely impact of implementing the action management **plan** that has been approved by the **Minister** under condition 9, including any subsequent revisions approved by the **Minister,** as outlined in the *Guidance on 'New or Increased Impact' relating to changes to approved management plans under EPBC Act environmental approvals (2017).*

Plan(s) means any of the documents required to be prepared, approved by the **Minister**, and/or implemented by the approval holder and published on the **website** in accordance with these conditions (includes action management plans and/or strategies).

Potential breeding trees means Eucalyptus and Marri (*Corymbia calophylla*) trees with a Diameter at Breast Height of greater than 500 mm, or for Salmon gum and wandoo, a Diameter at Breast Height of greater than 300 mm.

Protected matter means a matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment (2016) *Sensitive Ecological Data – Access and Management Policy V1.0.*

Shapefile means location and attribute information of the action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes.

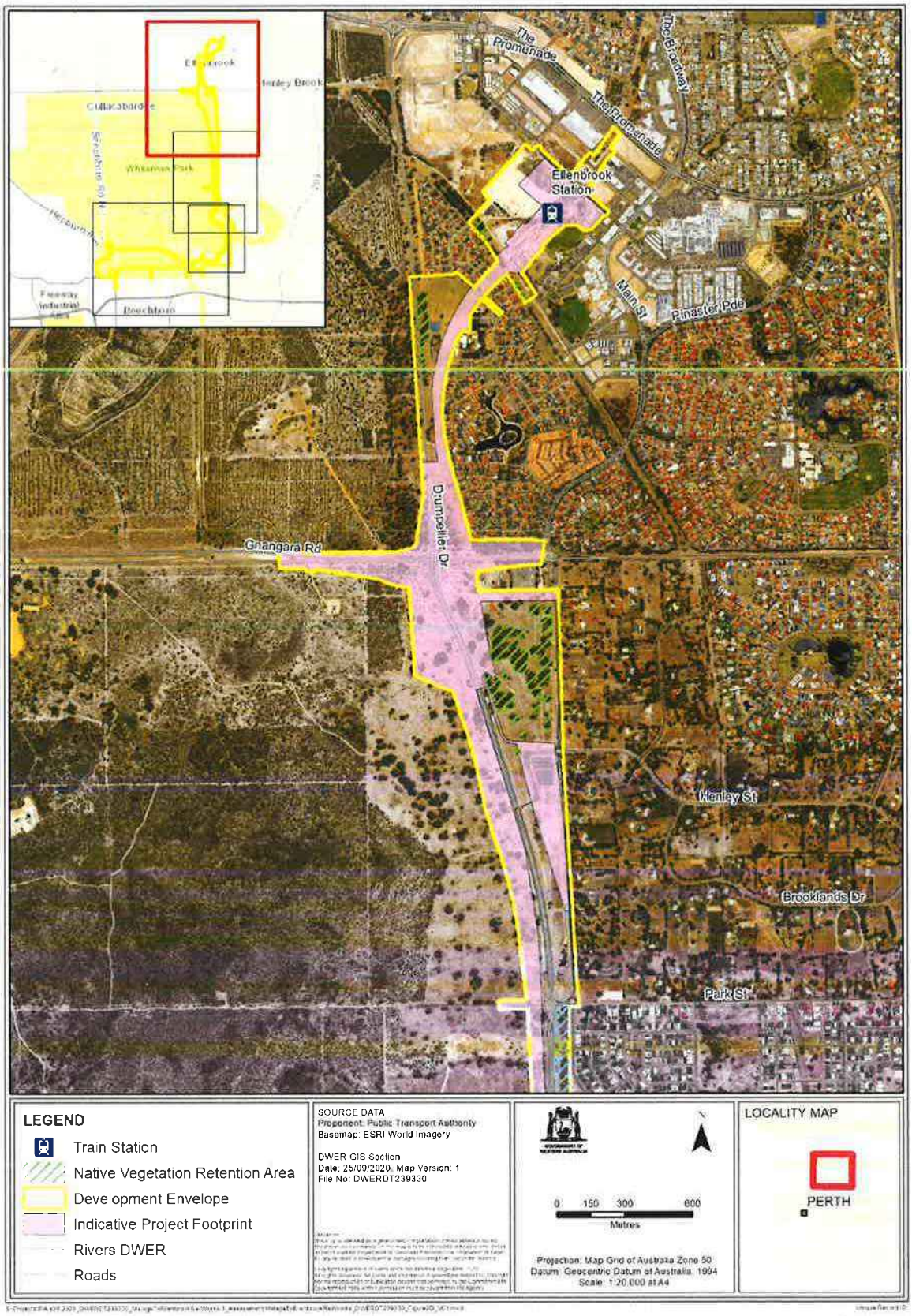
Suitably qualified person means a person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.

Trithuria occidentalis habitat is habitat as defined in Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for* Hydatella dioica *(One-sexed Hydatella*). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4898-conservation-advice.pdf.

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

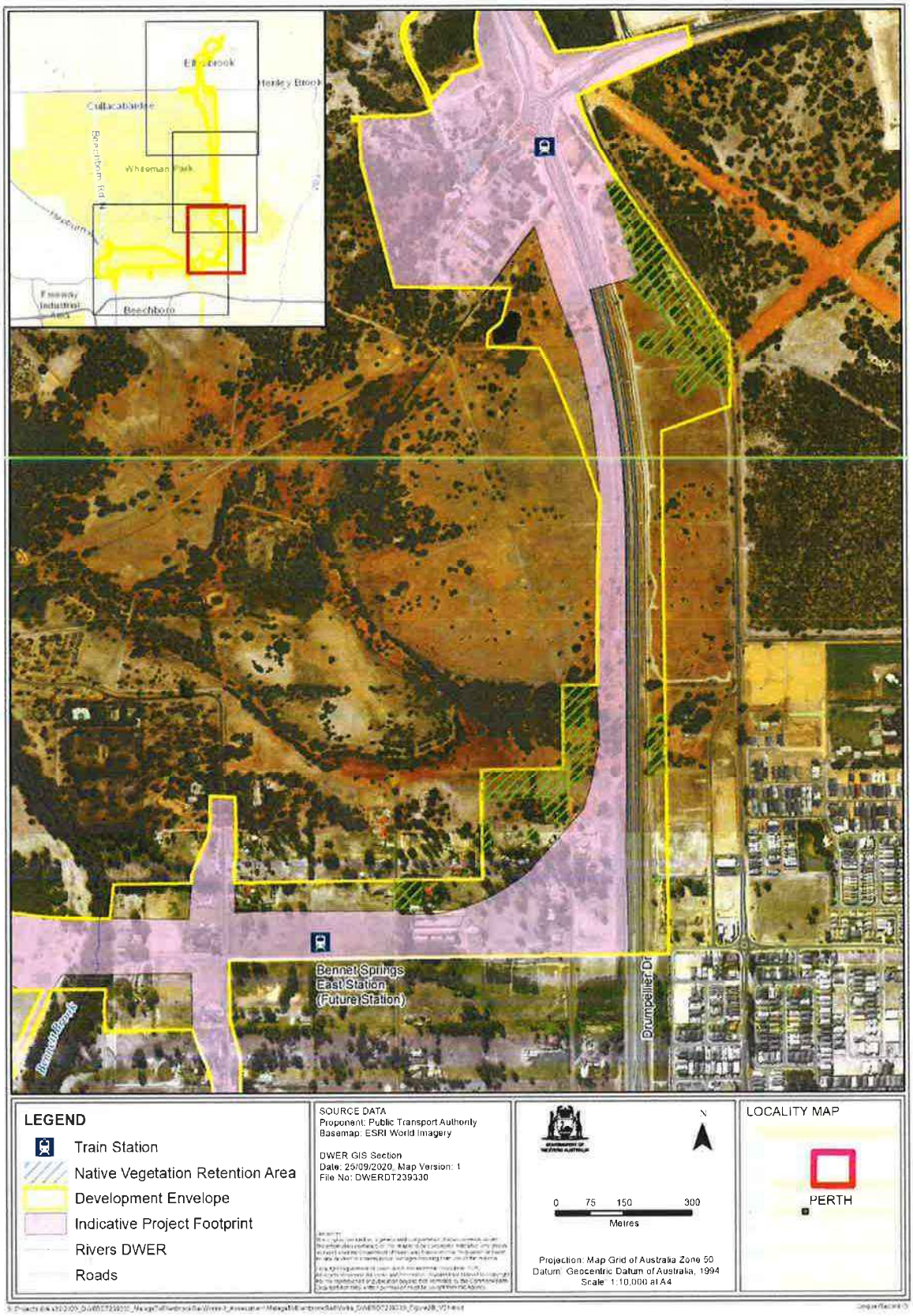
ATTACHMENTS

1. **Attachment A1 – Development envelope and construction footprint**



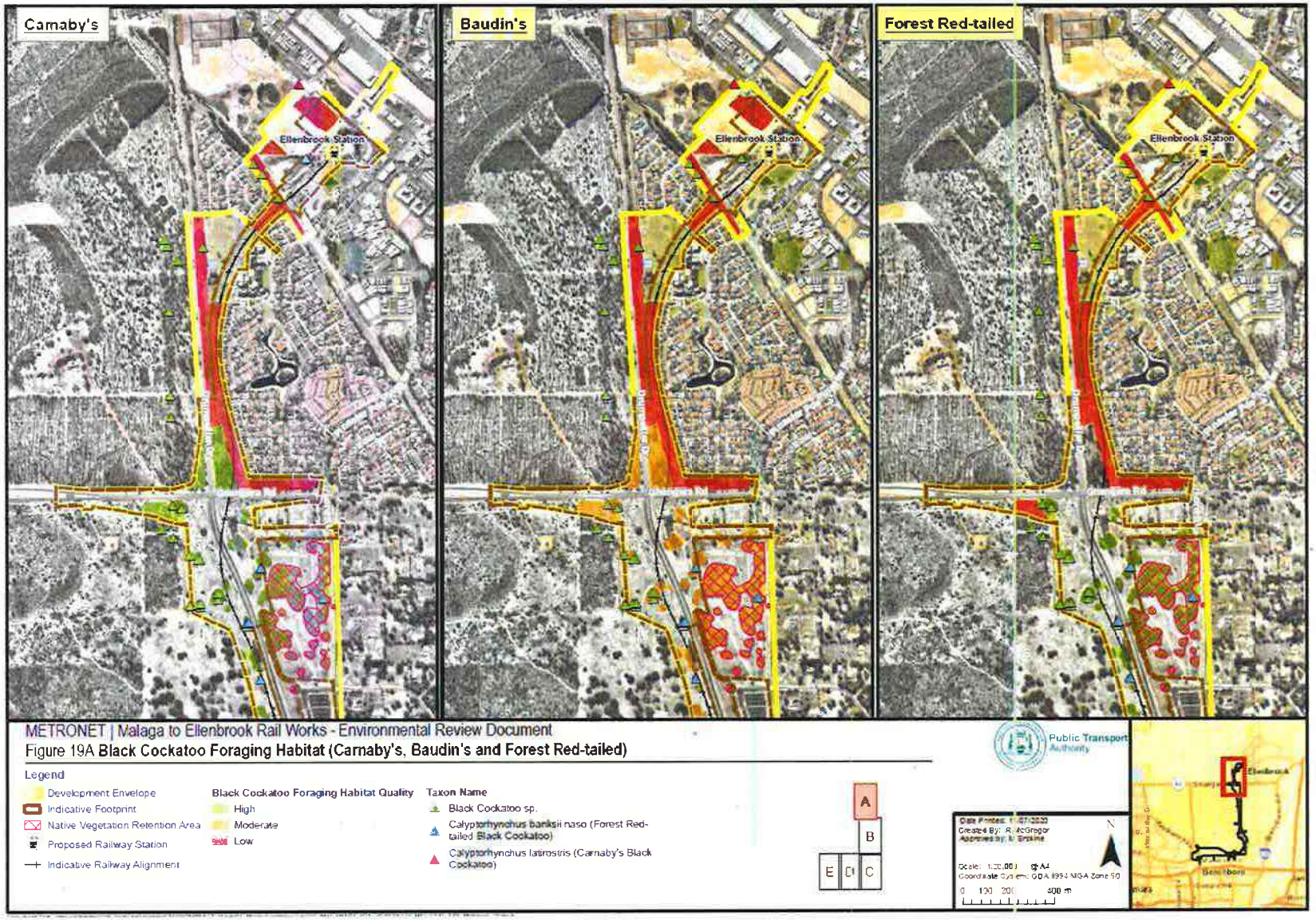
2. Attachment A2 – Development envelope and construction footprint

3. Attachment A3 – Development envelope and construction footprint

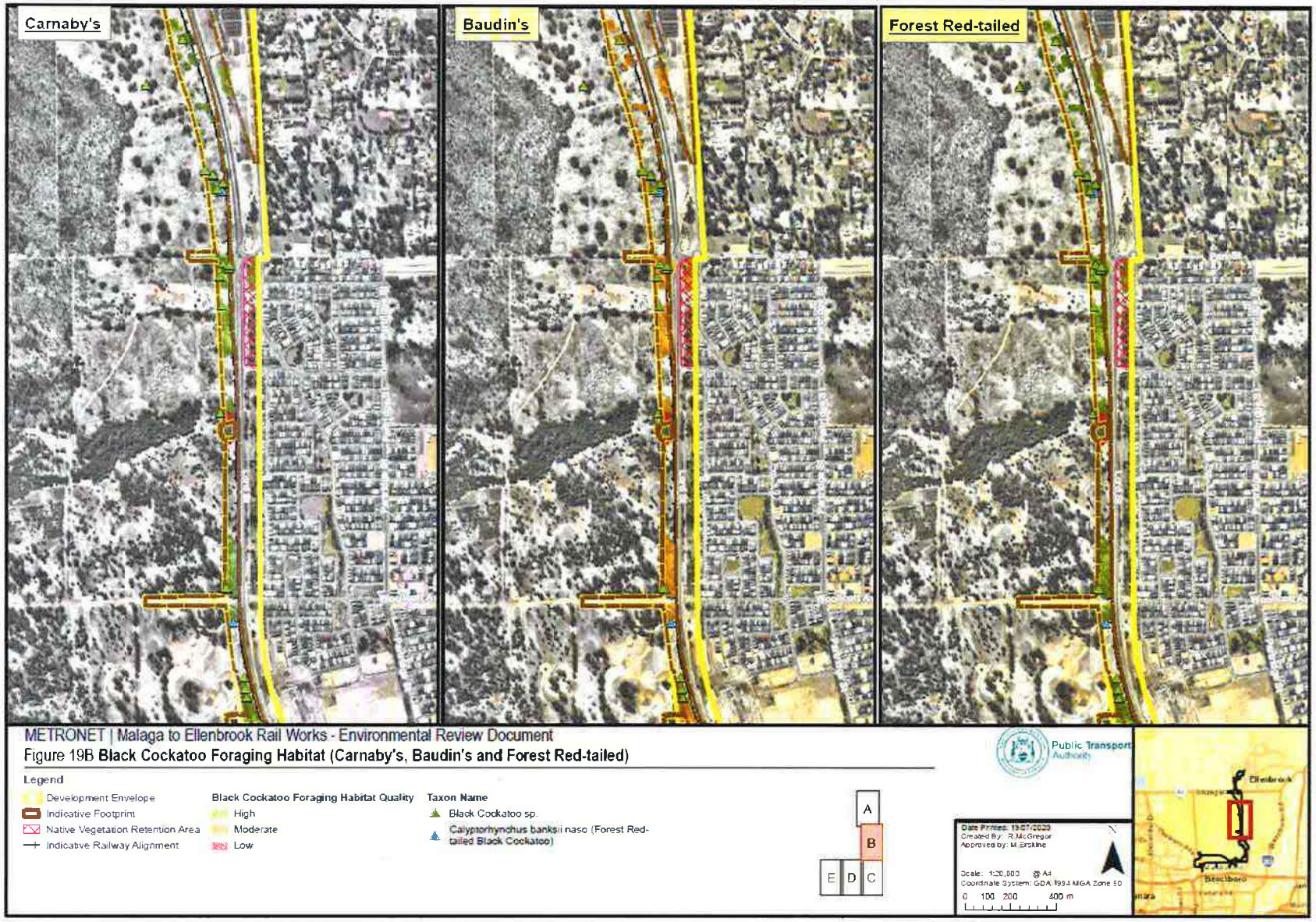


4. Attachment A4 – Development envelope and construction footprint

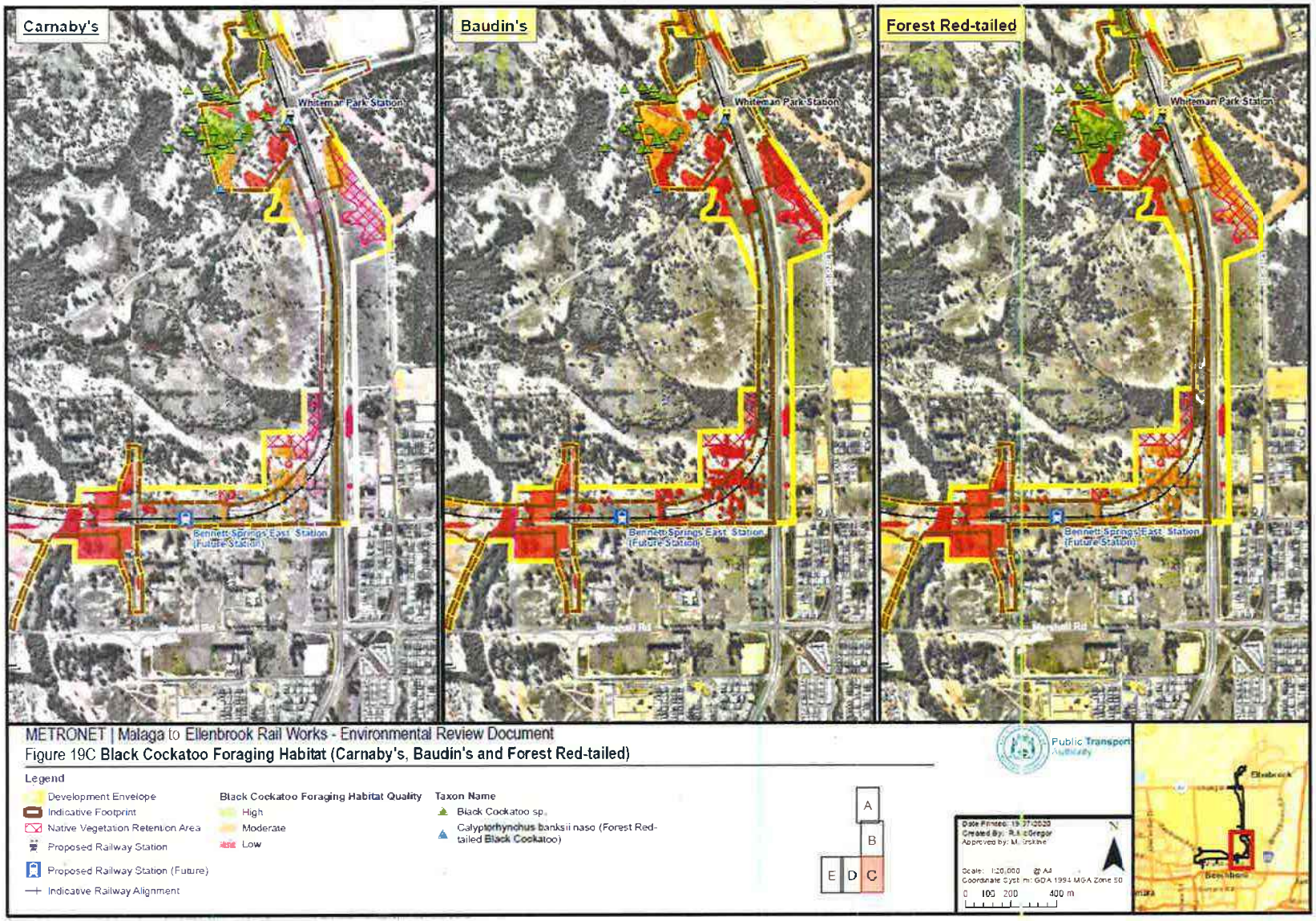
5. Attachment B1 – Black Cockatoo Foraging Habitat



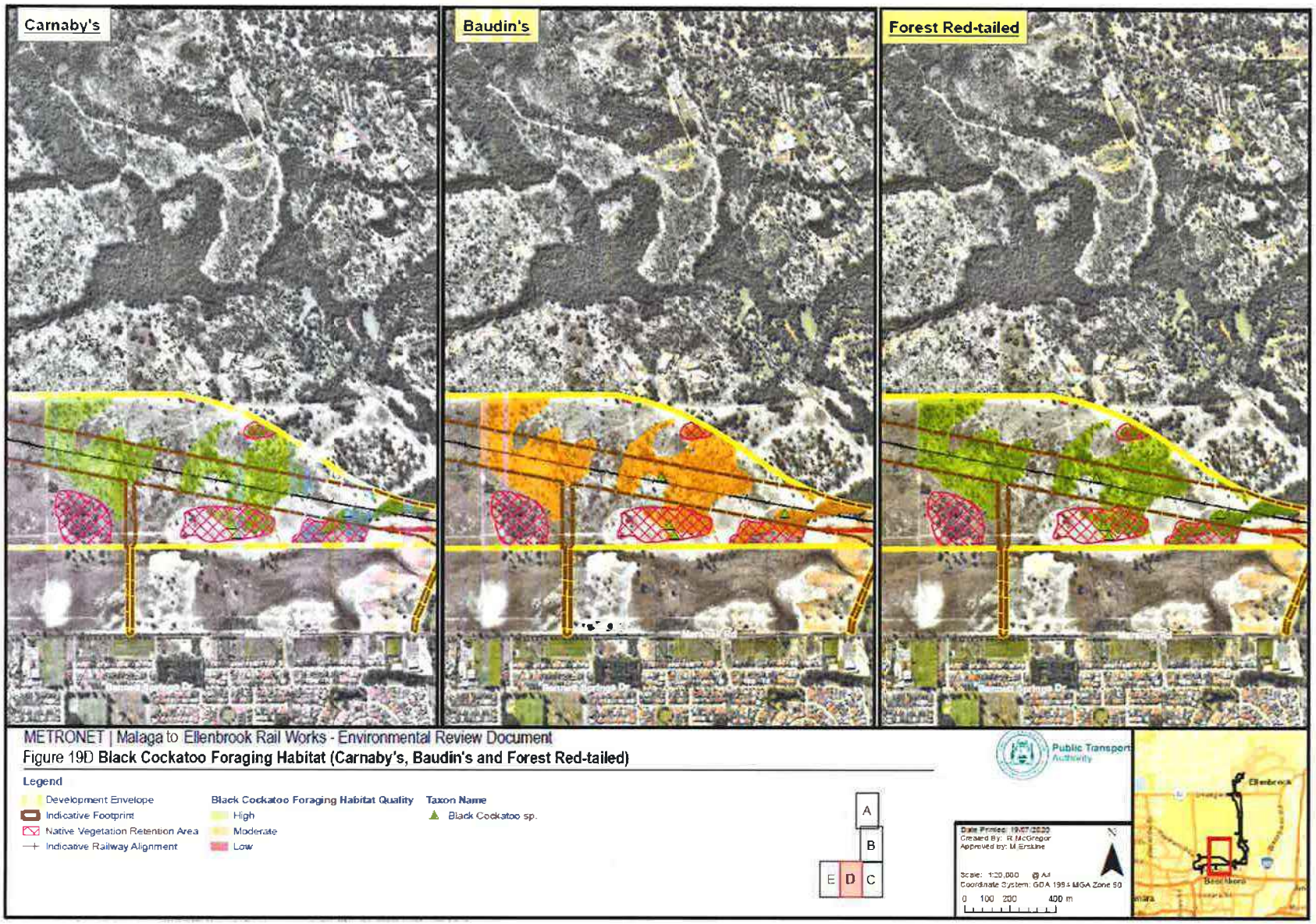
6. **Attachment B2 – Black Cockatoo Foraging Habitat**



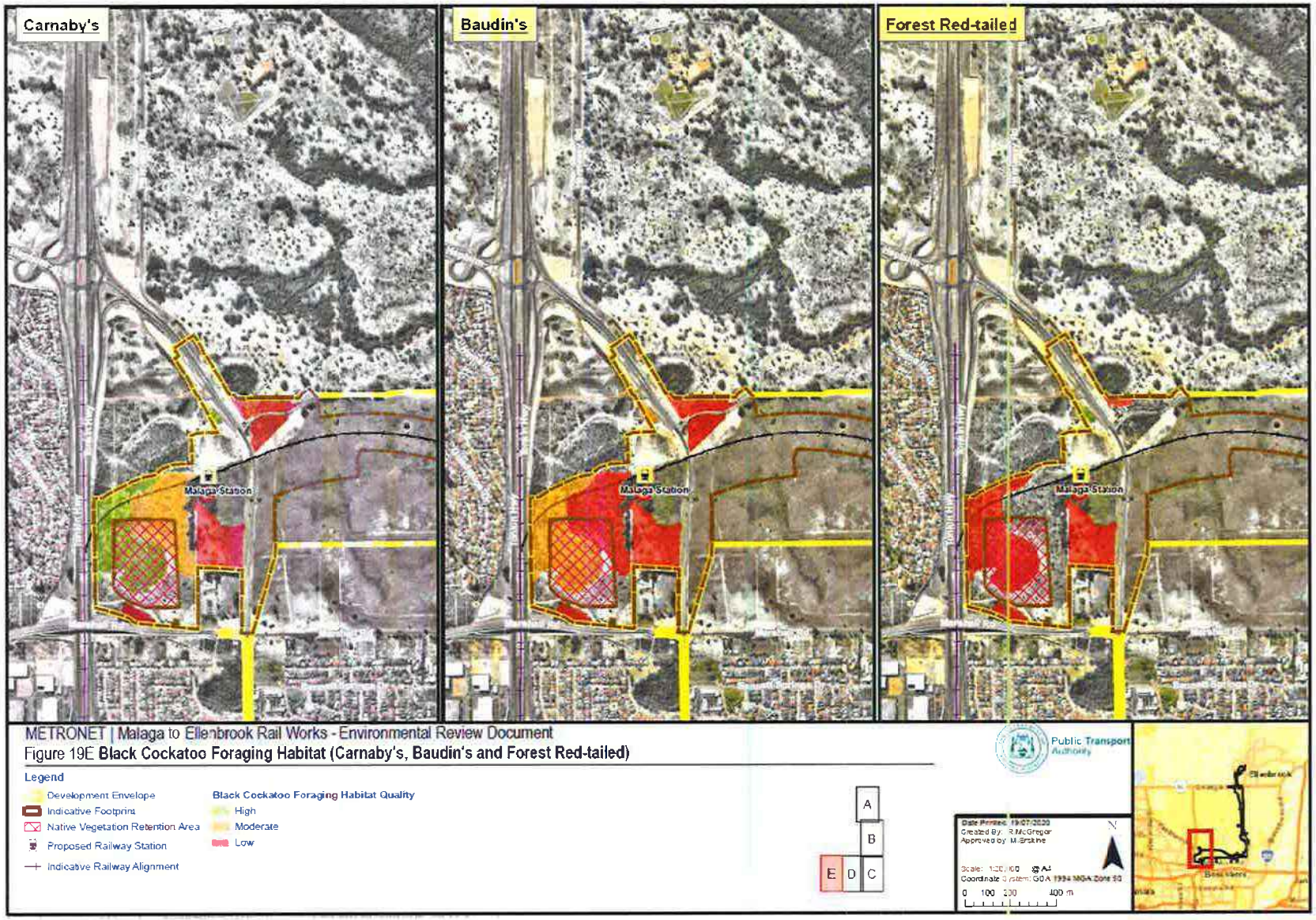
7. Attachment B3 – Black Cockatoo Foraging Habitat



8. **Attachment B4 – Black Cockatoo Foraging Habitat**



9. **Attachment B5 – Black Cockatoo Foraging Habitat**



10. **Attachment C – Banksia Woodlands of the Swan Coastal Plain TEC within the development envelope. The approval holder is only permitted to clear areas within the dashed yellow line labelled 'Development Envelope' that is not within areas marked by pink hatch pattern labelled as 'Native Vegetation Retention Area'.**

To: Chris Videroni, Acting Assistant Secretary, Environment Assessments West (WA, SA, NT) Branch

Approval Decision Brief (assessment report) – Morley Ellenbrook Rail Line Part 2, WA, (EPBC2019/8546)

Timing: 17 December (statutory time frame)

Recommendation/s:

1. Consider the assessment report at Attachment B1.

Considered / Please discuss

2. Consider the responses to the invitation for comment on the proposed decision at Attachments C1 and C2.

Considered / Please discuss

3. Approve, for each controlling provision, the action as summarised in the table below.

Approved / Not approved

4. Agree to attach the conditions of approval as set out in Attachment A.

Agreed / Not agreed

5. If you agree to 3 and 4, accept the reasoning in the Departmental briefing package as the reasons for your decision.

Accepted / Not accepted

6. Sign the notice of your decision at Attachment A.

Signed / Not signed

7. Sign the letters at Attachments D1 and D2 advising the person proposing to take the action, and other relevant parties, of your decision.

Signed / Not signed

Summary of recommendations on each controlling provision:

Controlling Provisions for the action	Recommendation	
	Approve	Refuse to Approve
Listed threatened species and comm s. 47F(1) s 18, 18A)		

Chris Videroni
Acting Assistant Secretary
Environment Assessments s. 47F(1) /A, SA, NT) Branch

s. 47F(1)

Date: 17 December 2020

Comments:

Key Points:

Background

1. This brief seeks your decision on whether or not to approve (and what conditions to attach to) the taking of the proposed action, to construct and operate approximately 13 km of new railway line, from Tonkin Highway to Ellenbrook including three new train stations at Malaga, Whiteman Park and Ellenbrook, with scope for a future fourth station at Bennet Springs East.

2. The Australian Government has contributed $500 million towards this project, as part of a more than $2 billion funding package for METRONET projects in Perth. The project is also included in the list of 15 identified major projects with national economic significance announced by the Prime Minister on 15 June 2020.

3. On 20 November 2020, as recommended in the Proposed Approval Decision Brief (Attachment B2) the delegate wrote to the Public Transport Authority of Western Australia (the proponent) and Mr Mike Rowe, the Director General of the Western Australian Department of Water and Environmental Regulation and delegated contact for the Western Australian Minister for Environment and Disability Services, Mr Stephen Dawson MLC, seeking comments on the proposed decision.

Issues/ Sensitivities

4. The proposed action is likely to directly impact on:

   - 10.05 ha of Banksia Woodlands threatened ecological community;
   - 81.4 ha of foraging habitat for Carnaby's Black Cockatoos;
   - 81.4 ha of foraging habitat for Baudin's Black Cockatoos;
   - 68.1 ha of foraging habitat for Forest Red-tailed Black Cockatoo; and
   - 423 Black Cockatoo potential breeding trees.

5. Discussion of these matters and factors to be regarded in your decision remain as set out in the Proposed Approval Decision Brief (Attachment B2).

Consultation

6. The proponent and the Western Australian Department of Water and Environmental Regulation were invited to comment on the proposed decision between 20 November 2020 and 4 December 2020.

7. The proponent provided comment on 30 November 2020 (Attachment C1) and the Western Australian Department of Water and Environmental Regulation provided comment on 1 December 2020 (Attachment C2).

8. On 27 November 2020, the proponent and Department held a teleconference to discuss the draft conditions and suggested changes.

9. The Department has considered comments received and included changes where relevant in drafting the final conditions of approval (Attachment A) (see also the track changed version at Attachment E3). These comments and the Department's response are summarised in Attachment C3.

10. The Department sent a section 132 request for further information to the proponent on 10 December 2020, requesting the final Western Australia Ministerial Statement (see Attachment E4). This had the effect of stopping the assessment clock on the final decision until the information was received. The proponent provided the Ministerial Statement to the Department on 15 December 2020.

11. For the reasons set out in the proposed approval decision brief (Attachment B2), the Department recommends that you approve the taking of the proposed action, for the purposes of the controlling provisions in sections 18 and 18A (listed threatened species and ecological communities), subject to conditions.

12. The Department consulted the Species Information and Policy Section (SIPS) regarding the statutory documents used in the Proposed Approval Decision Brief (Attachment E2). On 11 November 2020, SIPS advised that they were not anticipating any changes to the documents relating to the threatened species and ecological communities identified in the Proposed Approval Decision Brief in the coming six weeks. The EPBC Species and Communities Update on the 3 December 2020 (Attachment E1) was also reviewed and there were no decisions relevant to this project.

s. 22(1)(a)(ii)

Director
Projects Assessments West 1
Environment Assessments West (WA, SA, NT) Branch
Ph: s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Projects Assessments West 1
Environment Assessments West (WA, SA, NT) Branch
Ph: s. 22(1)(a)(ii)

ATTACHMENTS

Attachment	Description of Attachment
Decision notice (FOR SIGNATURE)	
A	Final approval decision notice
Assessment documentation	
B1	Assessment report
B2	Proposed decision brief
Comments on proposed decision	
C1	Proponent
C2	Western Australia DWER
C3	Response to comments
Letters (FOR SIGNATURE)	
D1	Proponent
D2	Western Australia DWER
Additional documents	
E1	EPBC Species and Communities Update (3 December 2020)
E2	SIPS statutory document check
E3	Final approval decision notice (tracked changes)
E4	Request for information (final decision)
E5	Ministerial Statement 1156

Australian Government
Department of Agriculture, Water and the Environment

APPROVAL

Morley-Ellenbrook line part 2, Western Australia, (EPBC 2019/8546)

This decision is made under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth).* Note that section 134(1A) of the **EPBC Act** applies to this approval, which provides in general terms that if the approval holder authorises another person to undertake any part of the action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such condition.

Details

Person to whom the approval is granted (approval holder)	Public Transport Authority of Western Australia
ACN or ABN of approval holder	ABN: 61 850 109 576
Action	To develop Part 2 of the Morley-Ellenbrook rail line, between Malaga and Ellenbrook, Western Australia, subject to the variation of the action accepted by the Minister under section 156B on Wednesday, 15 July 2020

Approval decision

My decision on whether or not to approve the taking of the action for the purposes of the controlling provision for the action is as follows.

Controlling Provisions

Listed Threatened Species and Communities	
Section 18	Approve
Section 18A	Approve

Period for which the approval has effect

This approval has effect until 01/01/2040

Decision-maker

Name and position	Chris Videroni Acting Assistant Secretary of Environment Assessments West (WA, SA, NT) Branch Department of Agriculture, Water and the Environment
Signature	
Date of decision	

Conditions of approval

This approval is subject to the conditions under the EPBC Act as set out in ANNEXURE A.

ANNEXURE A – CONDITIONS OF APPROVAL

Part A – Conditions specific to the action

1. To minimise impacts to **EPBC Act listed species and ecological communities**, the approval holder must not **clear** more than the following areas within the development envelope marked by yellow and labelled as 'Development Envelope' in Attachments A1 – A4:
   a. 81.4 ha of **Carnaby's Cockatoo Foraging Habitat** (Attachment B1 – B5)
   b. 68.1 ha of **Forest Red-tailed Black Cockatoo Foraging Habitat** (Attachment B1 – B5)
   c. 81.4 ha of **Baudin's Cockatoo Foraging Habitat** (Attachment B1 – B5)
   d. 423 **Black Cockatoo potential breeding trees** (Attachment B1 – B5)
   e. 10.05 ha of **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** (Attachment C)
2. To minimise indirect impacts from weeds, *Phytophthora cinnamomi,* grazing and hydrological changes to the retained areas of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** and retained **Black Cockatoo Foraging Habitat**, the approval holder must implement conditions 8-1, 8-2(1), 8-2(2), 8-2(3), 9-1(1) of the Western Australian Ministerial Statement 1156.
3. To reduce the risk of impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** from dewatering at the **Malaga dive structure** the approval holder must implement conditions 9-2, 9-3 and 9-6 of the Western Australian Ministerial Statement 1156.
4. Following completion of ground-disturbing activities associated with construction of the **Malaga dive structure** the approval holder must:
   a. Within two (2) months of cessation of dewatering, commence monitoring for at least twelve (12) months so as to be capable of determining whether the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** is maintained; and
   b. Submit a report to the **Department,** within twenty (20) **business days** after the sooner of the last monitoring required by condition 4(a) or eighteen (18) months after cessation of dewatering, that demonstrates whether or not the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** has been maintained.
   c. If the quality and the hydrological regime of groundwater that supports the biological diversity and **ecological integrity** of the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community** has not been maintained due to activities attributable to the action, the approval holder must submit, within twenty two (22) months after cessation of dewatering, a remedial plan for approval by the **Minister** committing to implementing specified remedial actions to prevent impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**. The approval holder must implement the approved remedial plan.
5. To minimise impacts to potential nesting **Black Cockatoos**, the approval holder must implement condition 10-1 of the Western Australian Ministerial Statement 1156.
6. To minimise impacts to terrestrial fauna associated with the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**, the approval holder must implement condition 10-2 of the Western Australian Ministerial Statement 1156.

7. To reduce the risk of impacts to the Carter's Freshwater Mussel, the approval holder must implement conditions 6-1 and 6-2 of the Western Australian Ministerial Statement 1156.

8. To compensate for residual significant impacts to the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo,** and **Baudin's Cockatoo**, the approval holder must implement the **Malaga to Ellenbrook Offsets Strategy** including annual reporting commitments specified in section 6.3 of the strategy.

9. The approval holder must have a **suitably qualified person** survey areas deemed potentially suitable ***Trithuria occidentalis* habitat** within 100m of the **development envelope** for *Trithuria occidentalis* and submit to the **Department** a report of the survey results prior to commencement of any works that have the potential to impact areas deemed potentially suitable ***Trithuria occidentalis* habitat**. Should *Trithuria occidentalis* be found during the surveys, the approval holder must:

    a. Submit a *Trithuria occidentalis* management plan for the **Minister's** approval that demonstrates the action will avoid impacts on the species. If the **Minister** approves the *Trithuria occidentalis* management plan then the *Trithuria occidentalis* management plan must be implemented;

    b. Not undertake any action that will impact on *Trithuria occidentalis* unless the **Minister** has approved the *Trithuria occidentalis* management plan in writing; and

    c. If, under the approved *Trithuria occidentalis* management plan, it is not possible to avoid impacts to *Trithuria occidentalis* the approval holder must submit a *Trithuria occidentalis* offsets strategy for the **Minister's** approval within six (6) months of commencement of any works that have the potential to impact areas deemed potentially suitable ***Trithuria occidentalis* habitat**. The offset strategy must demonstrate how any residual impacts will be offset, be consistent with the **environmental offsets policy**, and align with the **Approved Conservation Advice for Hydatella dioica (One-sexed Hydatella)**.

10. If a *Trithuria occidentalis* management plan is required in accordance with the provisions of condition 9, the approval holder must implement the approved *Trithuria occidentalis* management plan, which must be consistent with the **Department's *Environmental Management Plan Guidelines***, and must include:

    a. Environmental objectives, relevant **EPBC Act protected matter/s** and a reference to **EPBC Act** approval conditions to which the *Trithuria occidentalis* management plan refers;

    b. A table of commitments to achieve the objectives, and a reference to where the commitments are detailed in the *Trithuria occidentalis* management plan;

    c. Reporting and review mechanisms, and documentation standards to demonstrate compliance with the management plan;

    d. An assessment of risks to achieving management plan environmental objectives and risk management strategies that will be applied;

    e. Impact avoidance, mitigation and/or repair measures, and their timing; and

    f. A monitoring program, which must include:

        i. measurable performance indicators;

        ii. the timing and frequency of monitoring to detect changes in the performance indicators;

        iii. trigger values for corrective actions; and

        iv. proposed corrective actions, if trigger values are reached.

Part B – Standard administrative conditions

Notification of date of commencement of the action

11. The approval holder must notify the **Department** in writing of the date of **commencement of the action** within 10 **business days** after the date of **commencement of the action.**

Compliance records

12. The approval holder must maintain accurate and complete **compliance records**.

13. If the **Department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **Department** within the timeframe specified in the request.

Note: **Compliance records** may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the **Department**'s website or through the general media.

Submission and publication of plans

14. The approval holder must:

    a. submit **plans** electronically to the **Department**;

    b. unless otherwise agreed to in writing by the **Minister**, publish each **plan** on the **website** within 20 **business days** of the date of:

        i. this approval, if the version of the **plan** to be implemented is specified in these conditions; or

        ii. that the **plan** is submitted to the **Minister** or the **Department** if the **plan** does not require the approval of the **Minister** but was not finalised before the date of this approval; or

        iii. that the **plan** is approved by the **Minister** in writing, if the **plan** requires the approval of the **Minister**

    c. exclude or redact **sensitive ecological data** from **plans** that are to be published on the **website** or provided to a member of the public; and

    d. keep **plans** published on the **website** until the end date of this approval.

15. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under conditions of this approval, is prepared in accordance with the **Department's** *Guidelines for biological survey and mapped data* (2018) and submitted electronically to the **Department** in accordance with the requirements of the **plan** and conditions.

Annual compliance reporting

16. The approval holder must prepare a **compliance report** for each 12 month period following the date of **commencement of the action**, or as otherwise agreed in writing by the **Minister**. The approval holder must:

    a. publish each **compliance report** on the **website** within 60 **business days** following the relevant 12 month period;

    b. notify the **Department** by email that a **compliance report** has been published on the **website** and provide the weblink for the **compliance report** within five **business days** of the date of publication;

    c. keep all **compliance reports** publicly available on the **website** until this approval expires;

    d. exclude or redact **sensitive ecological data** from **compliance reports** to be published on the **website**; and

e. where any **sensitive ecological data** has been excluded from the version published, submit the full **compliance report** to the **Department** within 5 **business days** of publication.

Note: **Compliance reports** may be published on the **Department**'s website.

Reporting non-compliance

17. The approval holder must notify the **Department** in writing of any: **incident;** non-compliance with the conditions; or non-compliance with the commitments made in **plans**. The notification must be given as soon as practicable, and no later than two **business days** after becoming aware of the **incident** or non-compliance. The notification must specify:

    a. any condition which is or may be in breach;

    b. a short description of the **incident** and/or non-compliance; and

    c. the location (including co-ordinates), date, and time of the **incident** and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.

18. The approval holder must provide to the **Department** the details of any **incident** or non-compliance with the conditions or commitments made in **plans** as soon as practicable and no later than 10 **business days** after becoming aware of the **incident** or non-compliance, specifying:

    a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;

    b. the potential impacts of the **incident** or non-compliance; and

    c. the method and timing of any remedial action that will be undertaken by the approval holder.

Independent audit

19. The approval holder must ensure that **independent audits** of compliance with the conditions are conducted for the 12 month period from **the commencement of the action** and for every subsequent 12 month period, or as otherwise requested in writing by the **Minister**.

20. For each **independent audit**, the approval holder must:

    a. provide the name and qualifications of the independent auditor and the draft audit criteria to the **Department**;

    b. only commence the **independent audit** once the audit criteria have been approved in writing by the **Department**; and

    c. submit an audit report to the **Department** within the timeframe specified in the approved audit criteria.

21. The approval holder must publish the audit report on the **website** within 10 **business days** of receiving the **Department's** approval of the audit report and keep the audit report published on the **website** until the end date of this approval.

Revision of action management plans

22. The approval holder may, at any time, apply to the **Minister** for a variation to an action management **plan** approved by the **Minister** under condition 9 or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the **EPBC Act**. If the **Minister** approves a revised action management **plan** (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management **plan**.

23. The approval holder may choose to revise an action management **plan** approved by the **Minister** under condition 9, or as subsequently revised in accordance with these conditions, without

submitting it for approval under section 143A of the **EPBC Act**, if the taking of the action in accordance with the RAMP would not be likely to have a **new or increased impact**.

24. If the approval holder makes the choice under condition 23 to revise an action management plan without submitting it for approval, the approval holder must:

    a. notify the **Department** in writing that the approved action management plan has been revised and provide the **Department** with:

        i. an electronic copy of the RAMP;

        ii. an electronic copy of the RAMP marked up with track changes to show the differences between the approved action management **plan** and the RAMP;

        iii. an explanation of the differences between the approved action management **plan** and the RAMP;

        iv. the reasons the approval holder considers that taking the action in accordance with the RAMP would not be likely to have a **new or increased impact**; and

        v. written notice of the date on which the approval holder will implement the RAMP (RAMP implementation date), being at least 20 **business days** after the date of providing notice of the revision of the action management **plan**, or a date agreed to in writing with the **Department**.

    b. subject to condition 26, implement the RAMP from the RAMP implementation date.

25. The approval holder may revoke their choice to implement a RAMP under condition 23 at any time by giving written notice to the **Department**. If the approval holder revokes the choice under condition 23, the approval holder must implement the action management plan in force immediately prior to the revision undertaken under condition 23.

26. If the **Minister** gives a notice to the approval holder that the **Minister** is satisfied that the taking of the action in accordance with the RAMP would be likely to have a **new or increased impact**, then:

    a. condition 23 does not apply, or ceases to apply, in relation to the RAMP; and

    b. the approval holder must implement the action management plan specified by the **Minister** in the notice.

27. At the time of giving the notice under condition 26, the **Minister** may also notify that for a specified period of time, condition 23 does not apply for one or more specified action management plans.

Note: conditions 22, 23, 24, 25, 26 and 27 are not intended to limit the operation of section 143A of the **EPBC Act** which allows the approval holder to submit a revised action management plan, at any time, to the **Minister** for approval.

Completion of the action

28. Within 20 **business days** after the **completion of the action**, the approval holder must notify the **Department** in writing of the date of **completion of the** action and provide **completion data**.

Part C - Definitions

In these conditions, except where contrary intention is expressed, the following definitions are used:

Approved Conservation Advice for Hydatella dioica (One-sexed Hydatella) means the Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for* Hydatella dioica *(One-sexed Hydatella*). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4898-conservation-advice.pdf.

Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community means the **EPBC Act** listed Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community

Baudin's Cockatoo means the **EPBC Act** listed Baudin's Cockatoo (*Calyptorhynchus baudinii*).

Black Cockatoo/s means one or more of the **EPBC Act** listed Baudin's Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Carnaby's Cockatoo means the **EPBC Act** listed Carnaby's Cockatoo (*Calyptorhynchus latirostris*).

Clear/ing means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including weeds – see the *Australian weeds strategy 2017 to 2027* for further guidance).

Commencement of the action means the first instance of any specified activity associated with the action including clearing and **construction**. **Commencement of the action** does not include minor physical disturbance necessary to:

i. undertake pre-clearance surveys or monitoring programs;

ii. install signage and /or temporary fencing to prevent unapproved use of the project area;

iii. protect environmental and property assets from fire, weeds and feral animals, including erection of temporary fencing, and use of existing surface access tracks; and

iv. install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on the **protected matters**.

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **Department**'s preferred spatial data format is **shapefile**.

Completion of the action means all specified activities associated with the action have permanently ceased.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession or that are within the approval holder's power to obtain lawfully.

Compliance reports means written reports:

i. providing accurate and complete details of compliance, **incidents**, and non-compliance with the conditions and the **plans**;

ii. consistent with the **Department's** *Annual Compliance Report Guidelines* (2014);

iii. include a **shapefile** of any clearance of any **protected matters**, or their habitat, undertaken within the relevant 12 month period; and

iv. annexing a schedule of all **plans** prepared and in existence in relation to the conditions during the relevant 12 month period.

Construction means the erection of a building or structure that is or is to be fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; preliminary site preparation work which involves breaking of the ground (including pile driving); the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of temporary fences and signage.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Development envelope means the area enclosed by the yellow lines designated as 'Development Envelope' in the maps at Attachment A1, Attachment A2, Attachment A3 and Attachment A4.

Ecological integrity is the composition, structure, function and processes of ecosystems, and the natural variation of these elements.

Environmental Management Plan Guidelines means *Environmental Management Plan Guidelines, Commonwealth of Australia 2014* or any revisions of this.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

EPBC Act listed species and ecological communities means the **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo**, **Baudin's Cockatoo** and **Trithuria occidentalis.**

Environmental Offsets Policy means Commonwealth of Australia 2012. *Environment Protection and Biodiversity Conservation Act Environmental Offsets Policy*. Available from https://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.

Forest Red-tailed Black Cockatoo means the **EPBC Act** listed Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Foraging habitat means the areas shown marked shaded in red, amber, and green and labelled as 'Black Cockatoo Foraging Habitat Quality' on the maps *Black Cockatoo Foraging Habitat* in Attachments B1 – B5.

Incident means any event which has the potential to, or does, impact on one or more **protected matter(s)**, other than as authorised by this approval.

Independent audit: means an audit conducted by an independent and **suitably qualified person** as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019)**.**

Malaga dive structure means the area where the railway extends below ground surface west of the Malaga station and connects to the Bayswater to Malaga rail line.

Malaga to Ellenbrook Offsets Strategy mean the document 'Offsets Strategy, Malaga to Ellenbrook Rail Works Proposal, final_rev_0, October 2020' or subsequent revisions as approved by the **Minister**.

Monitoring data means the data required to be recorded under the conditions of this approval.

Minister means the Australian Government Minister administering the **EPBC Act** including any delegate thereof.

New or increased impact means a new or increased environmental impact or risk relating to any **protected matter**, when compared to the likely impact of implementing the action management **plan** that has been approved by the **Minister** under condition 9, including any subsequent revisions approved by the **Minister,** as outlined in the *Guidance on 'New or Increased Impact' relating to changes to approved management plans under EPBC Act environmental approvals (2017).*

Plan(s) means any of the documents required to be prepared, approved by the **Minister**, and/or implemented by the approval holder and published on the **website** in accordance with these conditions (includes action management plans and/or strategies).

Potential breeding trees means Eucalyptus and Marri (*Corymbia calophylla*) trees with a Diameter at Breast Height of greater than 500 mm, or for Salmon gum and wandoo, a Diameter at Breast Height of greater than 300 mm.

Protected matter means a matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment (2016) *Sensitive Ecological Data – Access and Management Policy V1.0.*

Shapefile means location and attribute information of the action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes**.**

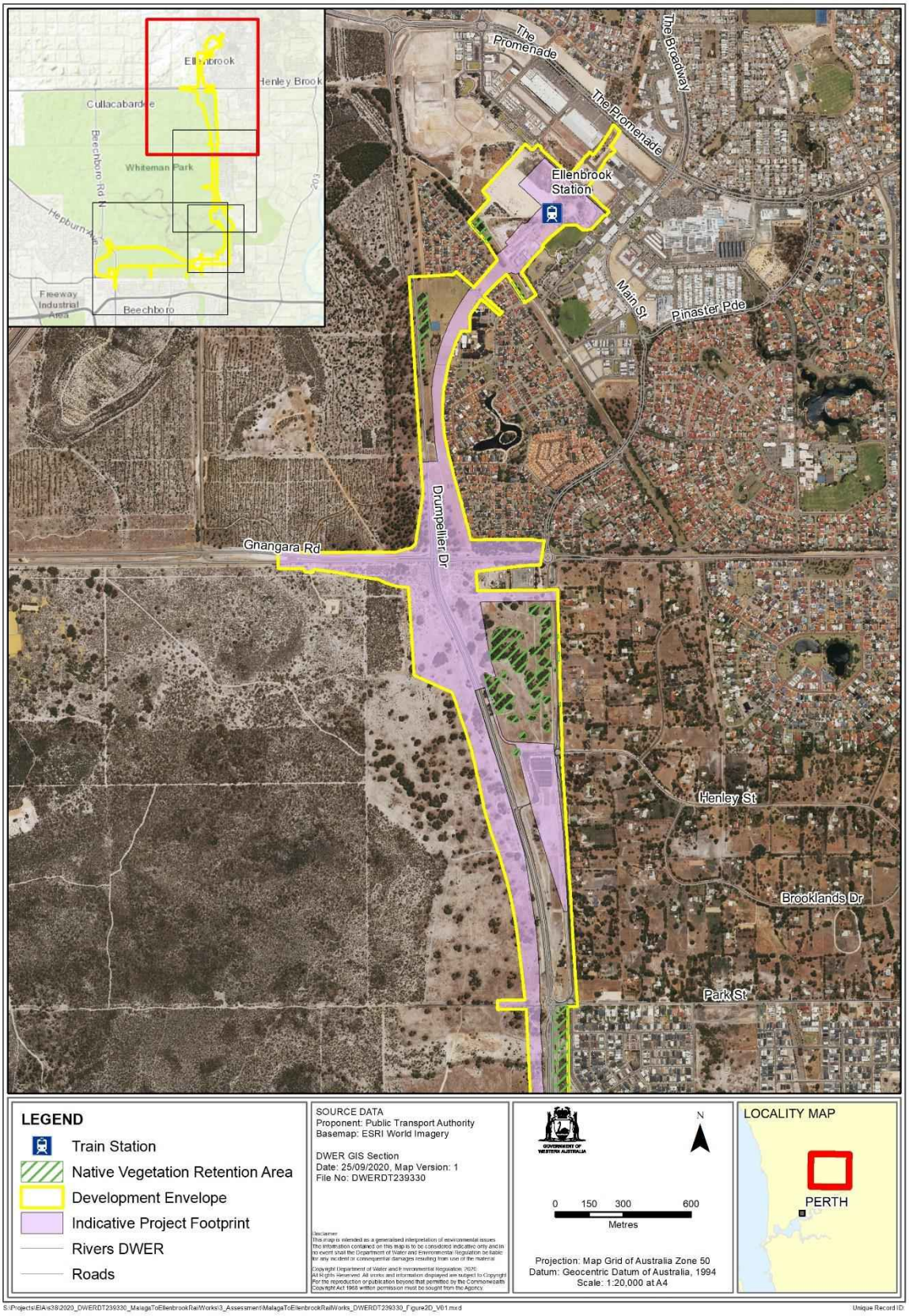
Suitably qualified person means a person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.

Trithuria occidentalis habitat is habitat as defined in Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for* Hydatella dioica *(One-sexed Hydatella*). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4898-conservation-advice.pdf.

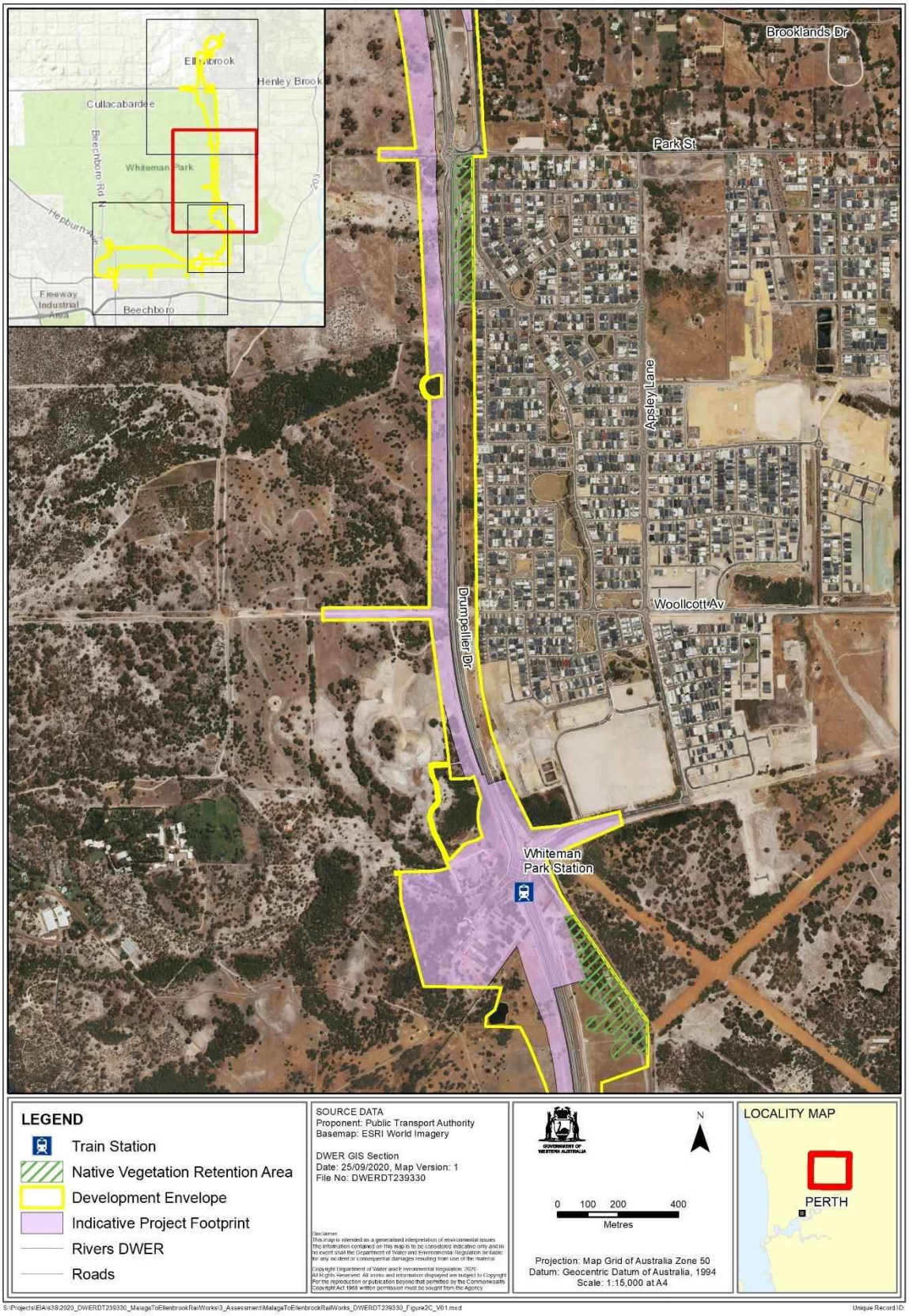
Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

ATTACHMENTS

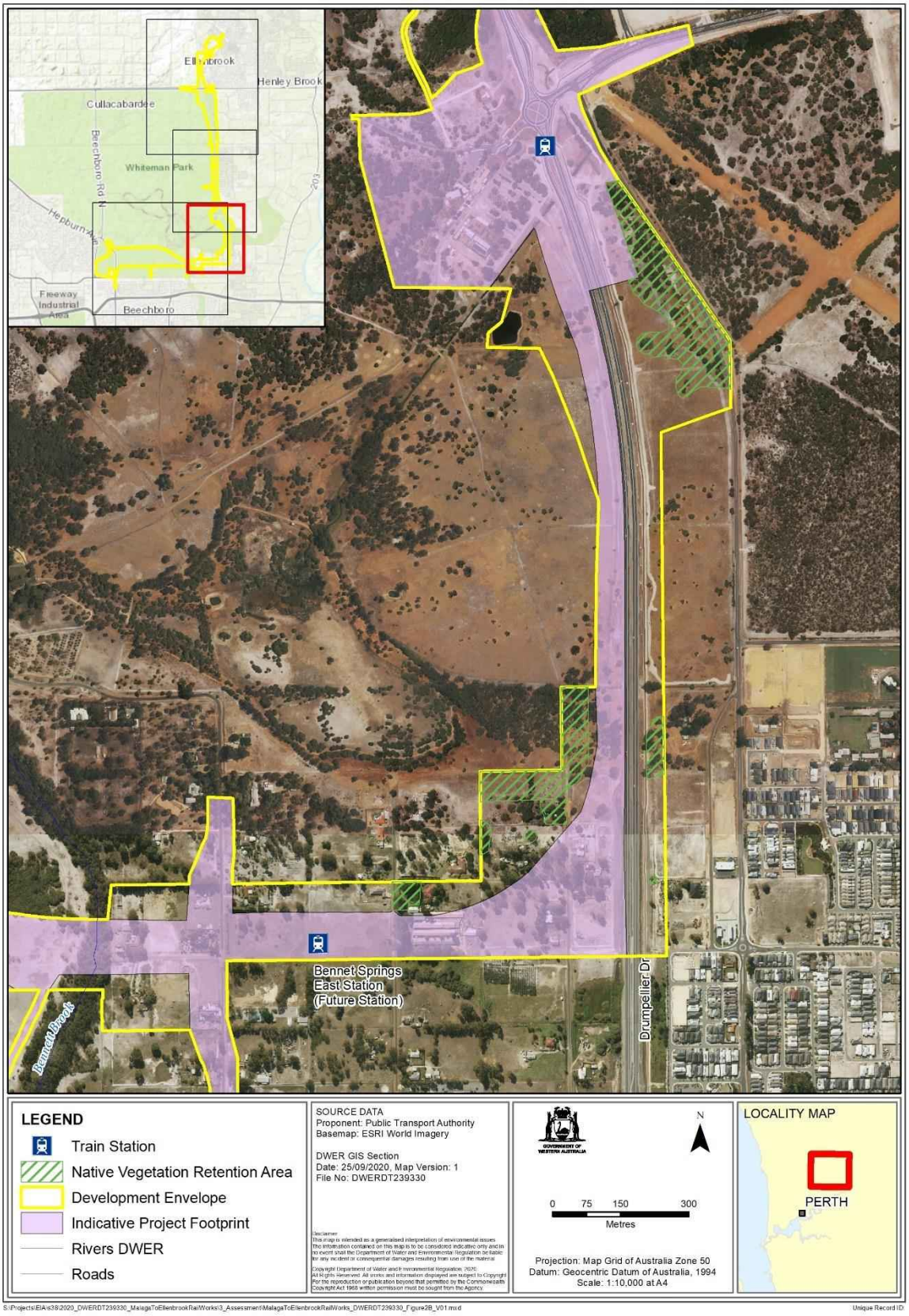
1. **Attachment A1 – Development envelope and construction footprint**



2. Attachment A2 – Development envelope and construction footprint

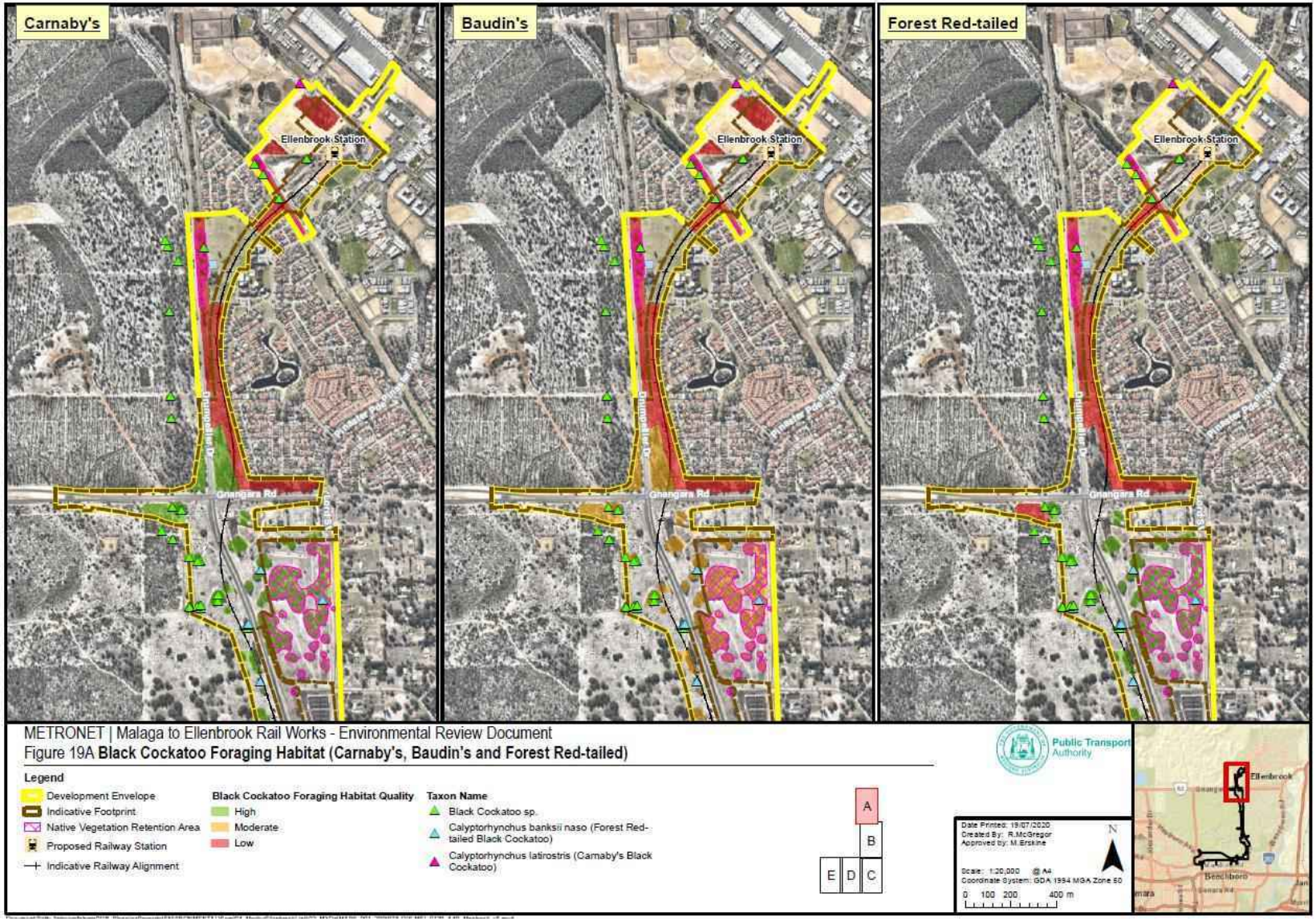


3. **Attachment A3 – Development envelope and construction footprint**

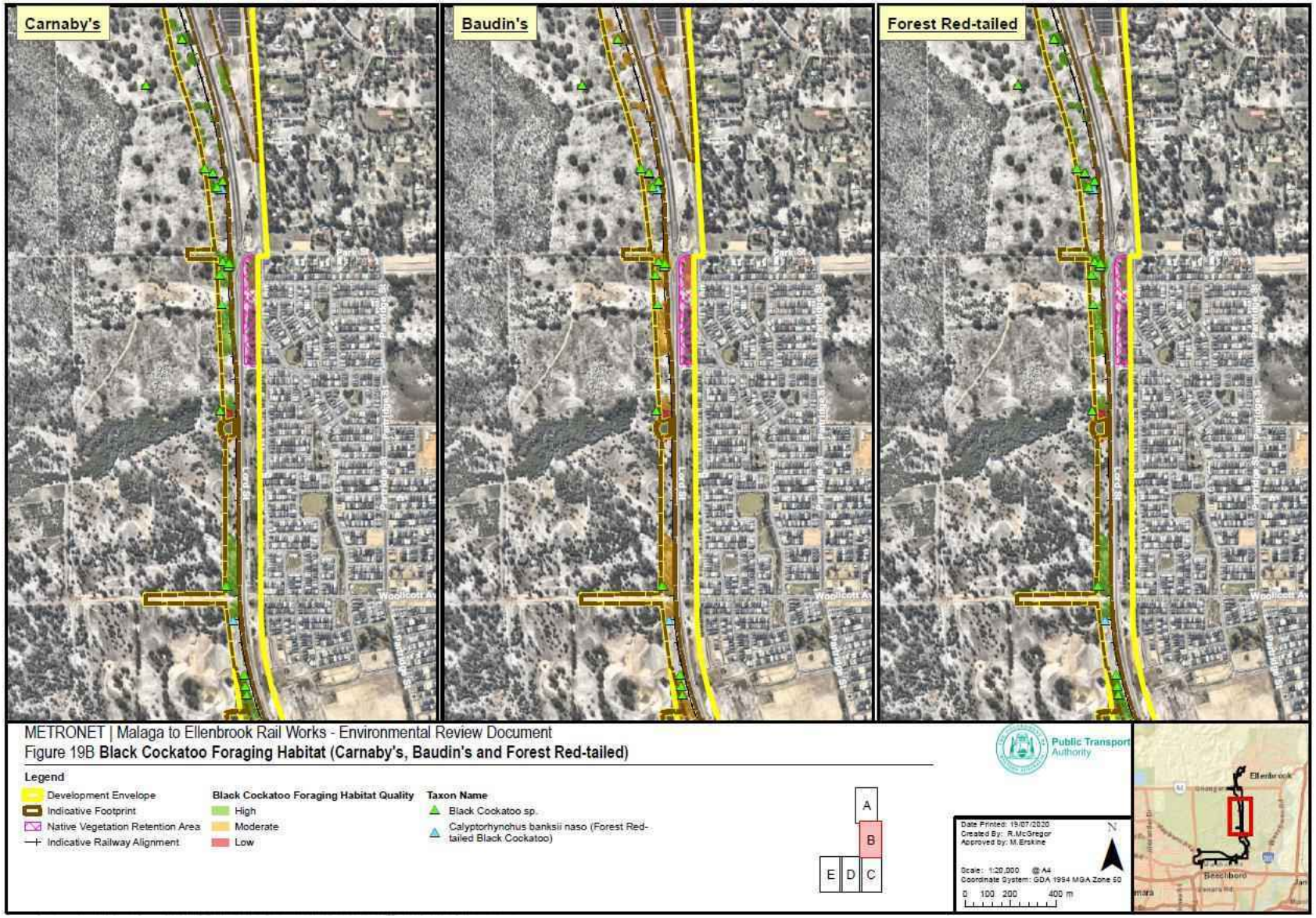


4. **Attachment A4 – Development envelope and construction footprint**

5. **Attachment B1 – Black Cockatoo Foraging Habitat**



6. **Attachment B2 – Black Cockatoo Foraging Habitat**



7. **Attachment B3 – Black Cockatoo Foraging Habitat**