AECOM Australia Pty Ltd
Whadjuk Nyoongar Country
Level 15, Alluvion Building
58 Mounts Bay Road
Perth WA 6000
GPO Box B59
Perth WA 6849
Australia
www.aecom.com

+61 1800 868 654 tel

ABN 20 093 846 925

07 May 2024

Commercial-in-Confidence

Clare Collett
Main Roads WA
PO Box 6202
East Perth WA 6892

Dear Clare

60710683 : Reconnaissance Vegetation and Black Cockatoo Survey - Lot 3 Albany Highway Crossman and Lot 579 Lancaster Road Hoffman

Main Roads engaged AECOM to undertake a reconnaissance vegetation survey and Black Cockatoo survey (the Program) at Lot 3 Albany Hwy Crossman and Lot 579 Lancaster Rd Hoffman (the "survey area"). The total area surveyed was 429.26 ha, comprising 343.75 ha at Crossman (Figure 1a) and 85.04 ha at Hoffman (Figure 1b), situated in the Department of Biodiversity and Conservation (DBCA) Wellington District and Perth Hills District. Both districts were advised of our visit.

The purpose of this Program is to support the development of Offset Strategies under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Environmental Protection Act 2016* (EP Act).

This technical memo presents the methodology and survey results from Stage 1 of the Program, which included the following:

- Desktop assessment
    - Literature review
    - Desktop assessment and database interrogation
- Stage 1 Survey: reconnaissance flora vegetation and Black Cockatoo foraging assessment.
    - Vegetation unit mapping and vegetation condition mapping
    - Black Cockatoo habitat quality scoring

Stage 2 of the Program is planned for late 2023 and will comprise a Black Cockatoo breeding assessment of the two sites.

1.0 Methodology

1.1 Desktop Assessment

A detailed desktop assessment was undertaken utilising DBCA purchased datasets and a review of the existing environment using aerial imagery and pre-European vegetation mapping. A scoring method was used to determine the likelihood of species present based on distance and age of known records, and suitable habitat presence. A preliminary assessment conducted by Tony Kirkby (2023) informed the scoring, as well as confirmed Black Cockatoo breeding and roosting site data.

1.2 Field Survey

1.2.1 Black Cockatoo Foraging Assessment

Black Cockatoo foraging assessments were completed for both sites. This involved meandering traverses throughout the survey area to capture all vegetation types and landforms. The methodology for the foraging assessment was developed based on the Commonwealth Draft Habitat Quality Scoring Tool supplied by the Department of Climate Change, Energy, the Environment, and Water (DCCEEW). The foraging value score considered five factors:

1. Foliage Cover Percentage – measured using the National Vegetation Information System (NVIS) Technical Working Group's (2017) Structural Formation Terminology.
2. Presence of Suitable Foraging Trees – includes *Corymbia calophylla, Eucalyptus marginata*, and *Banksia sessilis*. Publicly available resources such as DCCEEW's Species Profile and Threats (SPRAT) Database and Department of Environment and Conservation's (DEC) (2011) List of plants used by Carnaby's Black Cockatoo, were used to make informed decisions of tree suitability for foraging.
3. Evidence of Black Cockatoo Foraging and Presence – including spotting or hearing calls from Black Cockatoos (direct evidence), or observed feeding residue such as chewed nuts (indirect evidence).
4. Vegetation Condition of Foraging Habitat – condition of native vegetation was mapped as a component of the Reconnaissance vegetation field survey. Sick or unhealthy trees bearing no fruit were determined unlikely to attract Black Cockatoos for foraging.
5. Other Factors Impacting Foraging Quality – included recent fire, abundance of weeds (suppressing seedling propagation and new tree growth), evidence of grazing, presence of dieback, and signs of anthropogenic disturbances (e.g., rubbish, vehicle tracks, logging).

Site context, which considers proximity to known breeding sites and other foraging resources, was also considered when assessing foraging quality.

The draft Habitat Quality Scoring Tool, including the assessment method and scoring approach, is illustrated in Table 1. The tool scores foraging habitat on a scale of 0-10, with site context given a maximum score of 3, for known breeding sites within a 6km radius or foraging sites within a 12km radius. Vegetation condition, structure, and habitat features are given a maximum score of 7, for extensive foliage cover of suitable Black Cockatoo foraging trees.

1.2.2 Reconnaissance Vegetation Field Survey

A reconnaissance flora and vegetation assessment was undertaken in accordance with the EPA Flora Survey Technical Guide (EPA, 2016). The survey included low-level sampling across the survey area to verify findings of the desktop study and define and map vegetation communities and condition.

Relevés were used to collect floristic data, restricted to dominant species from the typical three strata expected in the Jarrah Forest. The survey focussed on identifying current threats which may cause decline in vegetation condition. Threats targeted for observation were weeds, erosion, evidence of grazing by native and non-native animals or indications of dieback (a dieback survey was not included).

Table 1 DCCEEW Habitat Quality Scoring (HQS) Tool Template

Vegetation condition and structure, Habitat features	Score	Value
Carnaby's Black Cockatoo	**7**	Very High
Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths [1].		
Baudin's Black Cockatoo		
Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other eucalypt woodlands, or *Allocasuarina* woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.		
Carnaby's Black Cockatoo	**6**	High
Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.		
Baudin's Black Cockatoo		
Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other eucalypt woodlands, or *Allocasuarina* woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.		
Carnaby's Black Cockatoo	**5**	Moderate to high
Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).		
Baudin's Black Cockatoo		
Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other Eucalypt woodlands, or *Allocasuarina* woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).		
Carnaby's Black Cockatoo	**4**	Moderate
Native kwongan heath and shrubland, Banksia or Eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).		
Baudin's Black Cockatoo		
Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other Eucalypt woodlands, or *Allocasuarina* woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).		
Carnaby's Black Cockatoo	**3**	Low to moderate
Native kwongan heath and shrubland, Banksia or Eucalypt woodlands with 10-20% projected foliage cover.		
Baudin's Black Cockatoo		
Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other Eucalypt woodlands, or *Allocasuarina* woodlands with 5-20% projected foliage cover.		

Vegetation condition and structure, Habitat features	Score	Value
Carnaby's Black Cockatoo	**2**	Low
Native kwongan heath and shrubland, Banksia and Eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.		
Baudin's Black Cockatoo		
Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.		
Forest Red-tailed Black Cockatoo		
Marri-Jarrah-Karri Forest, other eucalypt woodlands, or *Allocasuarina* woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.		
All species	**1**	Negligible to low
Scattered specimens of known food plants but projected foliage cover of these is <2%. May include: paddocks or urban areas with scattered foraging trees.		
All species	**0**	None
No *Proteaceae*, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).		

Site Context				
Proximity of the site in relation to other habitat.	**3**	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.

Presence/absence		
Confirm presence/absence of species	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.

Included in Table 12 are the finalised results from the preliminary Black Cockatoo foraging assessment. These calculations were conducted separately to the Commonwealth's draft Habitat Quality Scoring (HQS) Tool based on findings from the fauna team. Utilisation of vegetation communities for each Black Cockatoo species were calculated based on the presence and absence of known food species. The table provided to Main Roads (pers. comms. Chinnery and Collett) in previous correspondence has been superseded by the contents of Table 12.

2.0 Crossman Results

2.1 Fauna Desktop Assessment

A total of 29 significant fauna species were identified in the desktop study as potentially occurring in the survey area (Figure 2a). This included 17 birds, 10 mammals, one invertebrate and one reptile. Species identified in the desktop that are oceanic species, or strictly marine or coastal were excluded from the desktop assessment as the survey does not include marine or coastal waters.

Of the 29 significant fauna species, ten species were evaluated to be either known or highly likely to occur, seven species had a 'moderate' likelihood of occurrence, and the remaining twelve species were considered to have a low or negligible likelihood of occurrence due to lack of suitable habitat or historical records. The complete desktop assessment can be found in Appendix B, with locations of species shown on Figure 2a.

2.2 Black Cockatoos

The Commonwealth's draft Habitat Quality Scoring (HQS) Tool supplied by DCCEEW was used to assess Black Cockatoo habitat quality by recording and comparing foliage cover and any threats or potential impacts that may degrade the quality of habitat over time. Foliage cover of suitable foraging species was calculated for each relevé and averaged across the site, as shown in Table 2.

Table 2 Black Cockatoo foraging species foliage cover across recorded relevé

Crossman Site	Black Cockatoo Foraging Species Foliage (%)		
	Carnaby's Cockatoo	Baudin's Cockatoo	FRTBC
Relevé 1	18.5	18.5	0
Relevé 2	45.2	43.1	20
Relevé 3	87.2	12	85
Relevé 4	45.6	30.6	45
Relevé 5	42	42	22
Relevé 6	27.4	27.1	20
Relevé 7	72	2	70
Relevé 8	38	35	22
Relevé 9	10.4	10.2	5
Relevé 10	9.2	7.2	2.2
Relevé 11	46.2	45.2	10
Relevé 12	65.1	65.1	55
Average Total	**42.23**	**28.17**	**29.68**

The scores using the HQS Tool have been summarised in Table 3 and explained in greater detail below. Evidence of Black Cockatoos including foraging evidence, opportunistic sightings, and other indicators (feathers or remains) are mapped in Figure 3.

Table 3 Crossman Black Cockatoo foraging habitat scores

Black Cockatoo Species	Average Vegetation condition and structure score	Proximity of the site in relation to other habitat score	Confirmed presence	Total Score (0-10)
Carnaby's Cockatoo	5	3	Yes	8
Baudin's Cockatoo	4	3	Yes	7
FRTBC	4	3	Yes	7

DCCEEW (2022) high quality Black Cockatoo foraging habitat quality score

Suitable foraging habitat has been identified separately in Table 12, based on the presence of foraging species in each vegetation community. This assessment is supplementary to the HQS scoring tool.

The vegetation field survey identified Jarrah (*Eucalyptus marginata*), Wandoo (*Eucalyptus wandoo*), and Powderbark Wandoo (*Eucalyptus accedens*) as the dominant upper storey species in the area, with limited Marri (*Corymbia calophylla*). All of these species excluding Powderbark Wandoo are used by Black Cockatoos as food. Dominant understorey and midstorey species used by Black Cockatoos as food included Rock Sheoak (*Allocasuarina hugeliana*), *Allocasuarina humilis*, *Hakea lissocarpha, Hakea trifurcate, Hakea undulata, Banksia sessilis, Banksia dallanneyi, Banksia fraseri, Xanthorrhoea preissii* and *Banksia squarrosa*.

Foliage cover of suitable Black Cockatoo foraging trees ranged from 0 to 72 percent depending on the relevé and Black Cockatoo species. The average foliage cover of suitable Black Cockatoo foraging trees across the 12 relevé was 42, 28, and 30 percent for Carnaby's Cockatoo, Baudin's Cockatoo, and FRTBC respectively. Threats and potential impacts were mostly the same for all three Black Cockatoo species, excluding the availability of preferred foraging food. Threats that were the same for all three species included:

- Feral pigs and foxes – with foxes posing as a predatory threat to Black Cockatoos and pigs indirectly threatening Black Cockatoos through grazing and the potential spread of dieback, leading to the degradation of suitable foraging thouhabitat.
- Signs of rubbish, littering, and past logging – suggesting past and possibly present anthropogenic disturbance.
- Weeds – although they pose a minimal threat generally comprising less than 1% of the foliage cover for recorded relevé.

A score of 5 (moderate to high) for Carnaby's Cockatoo, and score of 4 (moderate) for Baudin's and FRTBC was calculated for vegetation condition and structure, based on the average foliage cover percentages for suitable foraging trees, and identified potential threats. Proximity of the site in relation to other habitat was scored a 3 for all three Black Cockatoo species, based primarily on abundant foraging evidence for each species within the offset site and similar foraging habitat in the surrounding bush. DBCA's Carnaby's Cockatoo Breeding Areas dataset (DBCA-054) indicated there is a Carnaby's Cockatoo breeding site within 6km of the site. No evidence of Baudin's Cockatoo or FRTBC breeding areas within a 15km radius was found. Foraging evidence confirmed the presence of all three Black Cockatoo species at the site. Overall, the total habitat quality scores for Crossman were 8, 7, and 7 for Carnaby's Cockatoo, Baudin's Cockatoo, and FRTBC respectively.

Due to deterioration, some evidence of foraging was unable to be narrowed down to a species of Black Cockatoo. In instances where this occurred the foraging evidence was identified as 'Black Cockatoo' in the results.

2.3 Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) listed under the EPBC Act or BC Act are known to occur within 10 km the survey area. One Priority Ecological Community (PEC) listed as Priority One by DBCA was identified with 10 km of the survey area: *Mount Saddleback heath communities* and is described in Table 4. This PEC was determined unlikely to occur within the survey area due to the lack of suitable habitat. No PECs or TECs included a known buffer that overlapped the survey area.

Table 4 PEC and TEC likelihood assessment for the Crossman site

Community Name and Description[1]	Cons. Status[2]		Distance from Survey Area	Likelihood of Occurrence
	EPBC	WA		
Mount Saddleback health communities Mount Saddleback heath communities are variants of Site-Vegetation Type G. Site-vegetation mapping in the Northern Jarrah Forest (Darling Range) includes areas associated with shallow soils and granite outcrops. The heath types include (but are not limited to): "Site-vegetation Type G: Open Heath of *Grevillea bipinnatifida, Hakea undulata, Banksia squarrosa* subsp. *squarrosa, Hakea incrassata, Hakea undulata*, and *Petrophile serruriae over Borya sphaerocephala* on shallow soils and outcrops; Site-vegetation Type G1: Mosaic of open heath of Proteaceae – Myrtaceae species, with emergent patches of *Eucalyptus drummondii* on shallow soils on slopes and Site-vegetation Type G3: Open heath of *Banksia squarrosa* subsp. *squarrosa, Hakea incrassata, Hakea undulata, Petrophile heterophylla* and *Petrophile serruriae* on shallow soils over granite outcrops on slopes with occasional emergent *Eucalyptus drummondii*.	NA	P1	7.11 km west of the survey area	Unlikely

1: Description from DBCA (2023) Version 35 of PEC for Western Australia

2: WA Conservation Category: P Priority

2.4 Flora Desktop Assessment

A total of 26 conservation significant flora species were identified in the database searches undertaken during the desktop study. Of these, 11 species are listed under the EPBC and BC Acts. The remaining 15 species are listed as Priority Flora by DBCA.

Based on the desktop assessment of specimen records and preferred habitat, two species (*Caladenia integra,* P4 and *Halgania corymbose,* P3) are considered to have a 'high' likelihood of occurrence. A further eight species have a 'moderate' likelihood of occurrence, 11 species had a 'low' likelihood of occurrence, and five species a 'negligible' likelihood of occurrence. All desktop results are presented in Appendix A which includes a post-survey likelihood assessment.

2.4.1 Vegetation Communities

The survey area was characterised by Jarrah/Marri Forest on steep slopes incised by ephemeral drainage channels. Vegetation along the shallow drainage channels was homogenous with the Jarrah/Marri Forest on slopes. One major creek runs along the northern edge of the survey area mapped as Flooded Gum riparian vegetation.

Five native and two altered vegetation communities were defined and mapped, described in Table 5 and mapped in Figure 4. Commentary is also provided regarding the communities suitability as Black Cockatoo foraging habitat. The flora species list is presented in Appendix C.

Table 5 Vegetation communities of the Crossman Site

Description	Photograph
1 – CF Closed Forest Sheoak *Allocasuarina huegeliana* with *Eucalyptus wandoo* Recorded on slopes with granite outcrops and boulders. Survey effort: relevés 3, 4 and 7 Area: 77.36 ha *Contains foraging species for all three Western Australian Black Cockatoo species.*	
2 – OW Open Woodland Jarrah *Eucalyptus marginata* and *Corymbia calophylla* Recorded in small patches on slopes with lateritic soils and some outcrops. Survey effort: relevés 2, 5, 11 and 12 Area: 69.84 ha *Contains foraging species for all three Western Australian Black Cockatoo species.*	

Description	Photograph
3 – OW Open Woodland Wandoo *Eucalyptus wandoo* Recorded on gentle lower slopes and valleys with variable density understorey. Survey effort: relevé 6 Area: 56.59 ha Contains foraging species for all three Western Australian Black Cockatoo species.	
4 – OW Open Woodland Wandoo *Eucalyptus accedens* Recorded on ridges and slopes with laterite outcrops and lateritic soils throughout. Includes some shallow drainage where understorey becomes dense. Survey effort: relevés 1, 8 and 9 Area: 125.23 ha Does not contain known foraging species for all three Western Australian Black Cockatoo species.	
5 – S Shrubland *Calothamnus* species Recorded on northwest facing slope with granite boulders. Lacks tree overstorey. Survey effort: relevé 10 Area: 5.08 ha Does not contain known foraging species for all three Western Australian Black Cockatoo species.	
6 – OW Open Woodland Flooded Gum *Eucalyptus rudis* Minor channel of *Eucalyptus rudis* and *Melaleuca* spp. Over herbs and grasses. Survey effort: observation only Area: 8.30 ha Does not contain known foraging species for all three Western Australian Black Cockatoo species.	**No photograph available**

Description	Photograph
Pine Altered community, represents small patches of **Pinus pinaster* with minimal understorey. Survey effort: observations only Area: 1.15 ha *Contains foraging species for Baudin's Cockatoo (Zanda baudinii) and Carnaby's Cockatoo (Zanda latirostris).*	

Cleared represents 0.54 ha

2.4.2 Vegetation Condition

Vegetation condition varied from Completely Degraded to Excellent. The majority of vegetation was considered Excellent (323.58 ha, 94%). Extent of condition is presented in Table 6 and mapped in Figure 5. Areas of degradation were at the edge of the survey area where vegetation has been cleared and subject to grazing. Some weeds were recorded along the drainage channel, where Declared Pest One Leaf Cape Tulip **Moraea flaccida* has established.

Table 6 Vegetation condition extents of the Crossman Site

Condition Rating	Extent (ha)	Proportion (%)
Excellent	323.58	94
Good	12.11	3
Degraded	3.17	1
Completely Degraded	4.64	1
Total (Cleared not included)	**343.50**	**100**
Cleared	0.54	-

3.0 Existing threats at Crossman Site

3.1 Weeds and Introduced Flora

Nine weed species were recorded. The One Leaf Cape Tulip, **Moraea flaccida* was recorded along the shallow drainage line represented by 6 – OW Open Woodland Flooded Gum. The waterway is the likely vector for this Declared Pest species. It is listed as 'exempt' under the *Biosecurity and Agricultural Management Act 2007*.

Two patches of pine trees **Pinus pinaster* were recorded along the minor drainage channel. These are likely to be self-seeding wildings from adjacent pine plantations along the waterway.

3.2 Dieback

No evidence of dieback was recorded in the form of rapid and recent deaths of *Eucalyptus, Banksia* or *Xanthorrhoea* trees. The survey area is not mapped as possessing a dieback risk and the area is not considered a forest disease risk area, with the closest mapped risk area approximately 18 km to the west.

3.3 Fire

There was no evidence to suggest the presence of a recent fire within the survey area, with the last fire predicted to have occurred onsite over ten years ago.

3.4 Introduced Fauna Species

Evidence of introduced fauna species was noted during the field survey within the Crossman site. Feral Pig (*Sus scrofa*) foraging evidence via ground disturbance was noted as well as the presence of European Red Fox (*Vulpes vulpes*) dens.

Sheep (*Ovis aries*) remains were frequently located within the survey parameters. Carcasses and bones, likely originating from neighbouring farms were scattered throughout the survey area.

3.5 Human Disturbances

Evidence of human disturbance was limited to a few old tracks and some scattered rubbish. There was some evidence of regeneration on the small tracks where compaction does not prevent germination. Rubbish was small and likely a result of wind and water vectors rather than illegal access. Evidence of old logging was present (tree stumps), none of which were recent.

4.0 Hoffman Results

4.1 Fauna Desktop Assessment

A total of 57 significant fauna species were identified in the desktop study as potentially occurring in the survey area (Figure 2b). This included 38 birds, eleven mammals, two invertebrates, three reptiles and three fish presented in Appendix E. Species identified in the desktop that are oceanic species, or strictly marine or coastal were excluded from the desktop assessment as the survey does not include marine or coastal waters.

Of the 57 significant fauna species, seventeen species were evaluated to be either known or highly likely to occur, ten species had a ‘moderate’ likelihood of occurrence, and the remaining 30 species were considered to have a low or negligible likelihood of occurrence due to lack of suitable habitat or historical records. The complete significant species assessment can be found in Figure 2b.

4.2 Black Cockatoos

The Commonwealth’s draft Habitat Quality Scoring Tool supplied by DCCEEW was used to assess Black Cockatoo habitat quality by recording and comparing foliage cover and any threats or potential impacts that may degrade the quality of habitat over time. Foliage cover of suitable foraging species was calculated for each relevé and averaged across the site, as shown in Table 7.

Table 7 Black Cockatoo foraging species foliage cover across recorded relevé

Hoffman Site	Black Cockatoo Foraging Species Foliage (%)		
	Carnaby’s Cockatoo	Baudin’s Cockatoo	FRTBC
Relevé 1	70	70	65
Relevé 2	100	100	100
Relevé 3	47.2	47.2	45.1
Relevé 4	8	5	0
Relevé 5	32	32	30
Relevé 6	50	0	50

Hoffman Site	Black Cockatoo Foraging Species Foliage (%)		
	Carnaby's Cockatoo	Baudin's Cockatoo	FRTBC
Relevé 7	45	15	45
Relevé 8	70	25	65
Relevé 9	33	33	25
Relevé 10	58	53	45
Relevé 11	60	60	50
Average Total	**52.11**	**40.02**	**47.28**

The scores using the HQS Tool have been summarised in Table 8 and explained in greater detail below. Evidence of Black Cockatoo's including foraging evidence, opportunistic sightings, and other methods (feathers or remains) are mapped in Figure 6.

Table 8 Hoffman Black Cockatoo Habitat Scores

Black Cockatoo Species	Vegetation condition and structure score	Proximity of the site in relation to other habitat score	Confirmed presence	Total Score (0-10)
Carnaby's Cockatoo	6	0	No	6
Baudin's Cockatoo	5	3	Yes	8
FRTBC	6	3	Yes	9

DCCEEW (2022) high quality Black Cockatoo foraging habitat quality score.

Suitable foraging habitat has been identified separately in Table 12, based on the presence of foraging species in each vegetation community. This assessment is supplementary to the HQS scoring tool.

The vegetation field survey found the site to be dominated by small Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) with some large Marri and Blackbutt (*Eucalyptus patens*). Only a handful of mature trees that had survived the recently documented fire were noted. Foliage cover of suitable Black Cockatoo foraging trees ranged from 0 to 100 percent, depending on the relevé and Black Cockatoo species. Average foliage cover of suitable Black Cockatoo foraging trees across the 11 relevé was 52, 40, and 47 percent for Carnaby's Cockatoo, Baudin's Cockatoo, and FRTBC respectively.

Threats and potential impacts were mostly the same for all three Black Cockatoo species, excluding the availability of preferred foraging food. Threats that were the same for all three species included:

- Feral animals including cats, kangaroos, goats, pigs, and foxes and dogs. Notably, the remains of a Baudin's Cockatoo were identified on site which may have been attacked by a feral cat or other predator.
- Direct evidence (sighting) of the site being used recreationally for the purpose of riding motorbikes.
- Overhead powerlines which reduce opportunities for natural regrowth by maintaining access tracks and trimming trees that grow too close to powerlines.
- Recent evidence of fire damage. As the understorey improves over time, more proteaceous species suitable for both Carnaby's and Baudin's Cockatoos are expected to occur.
- Weeds, although they pose a minimal threat generally comprising less than 1% of the foliage cover for recorded relevés.
- Introduction of dieback from illegal access, i.e. motorbikes and hikers.

Given the average foliage cover percentages for suitable foraging trees, and potential threats identified, a score of 5 (moderate to high) for Baudin's Cockatoo, and 6 (high) for Carnaby's Cockatoo and FRTBC was given for vegetation condition and structure. Carnaby's and Baudin's Cockatoo scores were reduced by a score of 1 due to identified threats, particularly the limited availability of Proteaceous species, which are a primary food source for these cockatoo species.

Baudin's Cockatoo and FRTBC each received a score of 3 for proximity of the site in relation to other habitat as there was substantial foraging evidence collected for both species and similar foraging habitat in the surrounding bush adjust to the boundary of the offset site. Carnaby's Cockatoo received a score of 0 for proximity of the site in relation to other habitat as there was no confirmed foraging evidence collected. No confirmed Black Cockatoo Breeding sites were identified within a 15km radius of the site based on publicly available information (DBCA-054). Overall, this resulted in a total habitat quality score of 6 for Carnaby's Cockatoo, 8 for Baudin's Cockatoo, and 9 for FRTBC.

Due to deterioration, some evidence of foraging was unable to be narrowed down to a species of Black Cockatoo. In instances where this occurred the foraging evidence was identified as 'Black Cockatoo' in the results.

4.3 Threatened and Priority Ecological Communities

Two communities listed under both the EPBC Act and the BC Act were identified during the desktop search within 30 km of the survey area: *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain and *Banksia woodlands* of the Swan Coastal Plain**,** described in Table 9. Both communities were considered unlikely to occur within the survey area due to the lack of suitable habitat. No PECs or TECs included a known buffer area that overlapped the survey area.

Both significant communities are associated with the Swan Coastal Plain, noting the survey area is situated in the Jarrah Forest.

Table 9 PEC and TEC likelihood assessment for the Hoffman Site

Community Name and Description	Cons. Status[3,4]		Distance from Survey Area	Likelihood of Occurrence
	EPBC	WA		
***Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. 1994)[2]** The community is found on a range of soil and landform units at the base of the Darling Scarp on the Forrestfield unit (Ridge Hill Shelf), Guildford unit or at the confluence of Guildford with Forrestfield, but also occurs on the Southern River unit. The community is generally very species rich. Most occurrences of this community type are *Eucalyptus marginata—Banksia attenuata* woodlands but Banksia woodlands and heaths are also found, with *Mesomelaena pseudostygia, Morelotia octandra, Banksia dallanneyi* (couch honeypot), *Desmocladus fasciculatus*, and *Chamaescilla corymbosa* (blue squill) being common in the understorey.	E	CR	11.53 km northwest of the survey area	Unlikely
Banksia woodlands of the Swan Coastal Plain[1] Canopy is most commonly dominated or co-dominated by Banksia attenuata and/or B. menziesii. It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands.	E	P3	9.24 km northwest of the survey area	Unlikely

1: Description from DBCA (2023) Version 35 of PEC for Western Australia
2: Description from BC (TEC) (2023) Order 2023
3: WA Conservation Category: P Priority, CR Critically Endangered
4: EPBC Conservation Category: E Endangered

4.4 Flora Desktop Assessment

A total of 51 conservation significant flora species were identified from the database search undertaken during the desktop study. Of these, seven species are listed under the EPBC and BC Act. The remaining 44 species are listed as Priority Flora by DBCA.

Based on desktop assessment of specimen records and preferred habitat, one species was considered to have a 'high' likelihood of occurrence (*Senecio leucoglossus,* P4). A further 21 species were considered to have a 'moderate' likelihood of occurrence, 17 species a 'low' likelihood and ten a 'negligible' likelihood of occurrence. All desktop results are presented in Appendix D, which includes a post-survey likelihood assessment.

4.4.1 Vegetation Communities

The survey area was characterised by Jarrah/Marri forest on hills with some riparian vegetation and some granite/heath vegetation. Four vegetation communities were defined and mapped, described in Table 10 and mapped in Figure 7.Commentary is also provided regarding the communities suitability as Black Cockatoo foraging habitat. The flora species list is presented in Appendix F.

Table 10 Vegetation communities of the Hoffman Site

Description	Photograph
1 – OF Open Forest *Eucalyptus patens* and *Eucalyptus rudis* Represents riparian vegetation along a permanent or semi-permanent water channel. Includes stands of *Trymalium odoratissimum.* Survey effort: relevés 6, 7 and 8 Extent: 17.78 ha *Contains foraging species for Forest Red-tailed Black-cockatoo (Calyptorhynchus banksii naso) and Carnaby's Cockatoo (Zanda latirostris).*	
2 – CF Closed Forest *Eucalyptus marginata* and *Corymbia calophylla* Forest on steep slopes, laterite outcrops and gravel soils. Includes stands of *Trymalium odoratissimum.* Survey effort: relevé 2 and 3 Extent: 8.01 ha *Contains foraging species for all three Western Australian Black Cockatoo species.*	

Description	Photograph
3 – OS Open Shrubland *Acacia pulchella* and *Xanthorrhoea preissii* Rock heath with exposed granite outcrop. Survey effort: relevé 4 Extent: 5.98 ha *Contains foraging for Baudin's Cockatoo (Zanda baudinii) and Carnaby's Cockatoo (Zanda latirostris).*	
4 – OF Open Forest *Corymbia calophylla* Steep slopes of forest with granite outcrops throughout. Density of understorey varies. Partly burnt in past 10 years. Survey effort: relevé 1, 5, 9, 10, and 11 Extent: 51.57 ha *Contains foraging species for all three Western Australian Black Cockatoo species.*	

Note: cleared represents 1.71 ha

4.4.2 Vegetation Condition

Vegetation condition varied from Excellent to Completely Degraded, described in Table 11 and mapped in Figure 8. Vegetation condition was affected by clearing for the Western Power transmission corridor. There were isolated pockets of rubbish, weeds, and escaped garden plants. These occurrences were small and did not warrant a reduction in vegetation condition class.

An introduced (escaped garden) *Eucalyptus saligna* has started spreading near a shallow drainage line near relevé 1. This area is marked as 'Good' condition. Some other small infestations of *Acacia longifolia* and *Portulaca octandra* were observed.

Table 11 Vegetation condition extents of the Hoffman Site

Condition Rating	Extent (ha)	Proportion
Excellent	79.43	95
Very Good	0.24	0
Good	0.56	1
Completely Degraded	3.11	4
Total (Cleared not included)	**83.34**	**100**
Cleared	1.71	-

5.0 Existing Threats at Hoffman Site

5.1 Weeds and Introduced Flora Species

Twelve weed species were recorded. None of these species are considered invasive or Weeds of National Significance (WONS). Weed foliage was generally low and restricted to the edge of tracks. One area it was evident that the escaped garden species **Eucalyptus saligna* was displacing native vegetation. There is a small stand of this species in the center east of the survey area, denoted in the vegetation condition figure as 'Good' condition (Figure 8).

5.2 Introduced Fauna Species

Evidence of the following introduced fauna species were located within the Hoffman site:

- Dog (*Canis lupus*),
- Cat (*Felis catus*),
- Feral Pig (*Sus scrofa*),
- Feral Goats (*Capra hircus)* and,
- European Red Fox (*Vulpes vulpes*).

These species were identified through evidence such as scat, tracks, foraging patterns and burrows.

5.3 Dieback

The vegetation within the survey area is predominantly mapped as "medium' risk and the area is not considered a forest disease risk area, with the closest mapped risk area approximately 90 km to the east. Parts of the survey area had been burnt in the past 10 years, thereby reducing canopy vigour and growth. No evidence of recent *Eucalyptus*, *Banksia* or *Xanthorrhoea* trees were recorded.

5.4 Fire

Approximately one-third (33%) of the eastern and northern extent of the survey area has been burnt in a hot fire 5 to 10 years prior. Charred tree bark and reduced canopy vigour was prevalent. Some of the steep slopes were devoid of mature trees and supported only saplings that had regenerated since fire.

5.5 Human Disturbances

Human disturbance was recorded throughout the survey area in the form of tracks, rubbish, planted trees/shrubs, and old fencing. All human disturbance showed signs of weathering, suggesting it was not recently dumped. The abandoned dwelling and associated infrastructure are likely remnants of previous private ownership (Plate 1).

The area is currently used for recreational motorbiking and four-wheel driving. Motorbikes were present and could be heard for several hours during the first day of the field survey. Logging was noted near the river. This could have been from previous private owners or illegal access.

Plate 1 Human Disturbances found within Hoffman

6.0 Assessment of offset parameters

Main Roads is seeking to identify areas of foraging habitat for Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo to provide offsets for major road projects. A summary of extent for each parameter across the two sites is presented in Table 12, indicating the vegetation communities that contain foraging species.

Black Cockatoo parameters were calculated using foraging tree species presence based on the vegetation condition mapping.

Table 12 Summary of foraging utilisation for Black Cockatoo (in hectares) for Crossman and Hoffman Site

Parameter	Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*)	Baudin's Cockatoo (*Zanda baudinii*)	Carnaby's Cockatoo (*Zanda latirostris*)
Crossman			
Closed Forest Sheoak *Allocasuarina huegeliana with Eucalyptus wandoo*	77.36	77.36	77.36
Open Woodland Jarrah *Eucalyptus marginata and Corymbia calophylla*	69.84	69.84	69.84
Open Woodland Wandoo *Eucalyptus wandoo*	56.59	56.59	56.59
Open Woodland *Eucalyptus accedens*	-	-	-
Shrubland *Calothamnus sp.*	-	-	-
Open Woodland - Flooded Gum *Eucalyptus rudis*	-	-	-
Pine	-	1.15	1.15
Cleared	-	-	-
Total	**203.79**	**204.94**	**204.94**
Hoffman			
Open Forest *Eucalyptus patens and Eucalyptus rudis*	17.78	-	17.78
Closed Forest *Eucalyptus marginata and Corymbia calophylla*	8.01	8.01	8.01
Open Shrubland *Acacia pulchella and Xanthorrhoea preissii*	-	5.98	5.98
Open Forest *Corymbia calophylla*	51.57	51.57	51.57
Cleared	-	-	-
Total	**77.36**	**65.56**	**83.34**

7.0 Limitations

The flora and vegetation assessment was limited to species being identified in the field as no time was allowed for obtaining a regulation 4 permit from DBCA. This has not influenced the ability to define and map vegetation communities or condition and is therefore not considered a significant limitation to meet the objective of this scope.

8.0 Conclusion

The reconnaissance flora and vegetation assessment and targeted Black Cockatoo foraging assessment were successfully completed at the Hoffman and Crossman sites. Both areas provide suitable habitats for all three Black Cockatoo Species. Native vegetation at both sites was predominantly in Excellent condition. Both sites show potential to improve foraging habitat, as indicated by the existing threats.

Yours sincerely

Alix Chinnery
Principal Environmental Consultant, ANZ NWA
alix.chinnery@aecom.com

Mobile: +61 466 297 301

References

Atlas of Living Australia (ALA), 2023. Species Search. Accessed from: https://www.ala.org.au/

Australian Museum (2020). Western False Pipistrelle, accessed 2023. Available from: https://australian.museum/learn/animals/bats/western-false-pipistrelle/

Australasian Virtual Herbarium (AVH), 2023. Occurrence Records. *Department of Biodiversity, Conservation and Attractions* (DBCA), Western Australia. Accessed from: https://avh.ala.org.au/search/#tab_simpleSearch

Bamford, M, Watkins, D, Bancroft, w, Tischler G and J Wahl, 2008. Migratory Shorebirds of the East Asian – Australasian Flyway: Population estimates and internationally important sites. Canberra, ACT: Department of the Environment,

Benshemesh, J, 2007. National Recovery Plan for Malleefowl. Department for Environment and Heritage, South Australia.

Bradley, K., Lees, C., Lundie-Jenkins, G., Copley, P., Paltridge, R., Dziminski, M., Southgate, R., Nally, S. & Kemp, L. (Eds.), 2015. 2015 Greater Bilby Conservation Summit and Interim Conservation Plan; an initiative of the Save the Bilby Fund. Minnesota, USA: IUCN SSC Conservation Breeding Specialist Group.

BirdLife Australia, 2023. Species profiles, accessed 2023. Available from: https://birdlife.org.au/bird-profile/

BirdLife Australia (2022). Species profiles, accessed 2021. Available from: https://birdlife.org.au/bird-profile/

BirdLife Australia, 2021. Species profiles, accessed 2021. Available from: https://birdlife.org.au/bird-profile/

Bray DJ &Gomon, MF, 2020. Geotria australis in Fishes of Australia. Accessed May 2022.

Bush B, Maryan B, Browne-Cooper R and Robinson D (2010). Field Guide to Reptiles and Frogs of the Perth Region. Western Australian Museum, Welshpool. 183pp.

Wilson S, & Swan G, 2010. A Complete Guide to Reptiles of Australia. New Holland Publishers: Sydney NSW

Department of Biodiversity, Conservation and Attractions, 2021. Fauna Profile Numbat Mymecobius fasciatus. Available at: https://www.dpaw.wa.gov.au/images/documents/plants-animals/animals/animal_profiles/Numbat_Fauna%20Profile_2021.pdf.

Department of Climate Change, Energy, and the Environment and Water (DCCEEW), 2023. Species Profile and Threats Database. Available online at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

DCCEEW. 2022. Referral guideline for 3 WA threatened Black Cockatoo species. Department of Climate Change, Energy, the Environment, and Water.

Department of the Environment, 2015. Consultation Document on Listing Eligibility and Conservation Actions - Limosa lapponica baueri (bar-tailed godwit (western Alaskan))Department of the Environment and Energy, Canberra, Australia

Fulton GR, 2017. Owl survey of the Peel-Harvey estuary in south-western Australia. Australian Journal of Zoology 65(2) 71-76

Henwood, Murray, 2013. *Actinotus repens* Keighery ex Henwood (Apiaceae): A new species from south-west Western Australia. *Telopea Journal of Plant Systematics*. DOI: 10.7751/telopea201302

Higgins, P.J. & S.J.J.F. Davies, eds. 1996. Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons. Melbourne, Victoria: Oxford University Press.

Kay, Geoffrey M. & J. Scott Keogh. Molecular phylogeny and morphological revision of the Ctenotus labillardieri (Reptilia: Squamata: Scincidae) species group and a new species of immediate conservation concern in the southwestern Australian biodiversity hotspot. source: The Reptile Database

Kitchener, D.J., 1981. Breeding, diet and habitat preference of Phascogale calura (Gould, 1844) (Marsupialia: Dasyuridae) in the southern wheat belt, Western Australia. Records of the Western Australian Museum. 9:173-186.

Kirkby, T., 2023.Preliminary Black Cockatoo Survey Lot 3, Albany Highway Crossman. Unpublished. ;

Klunzinger MW., 2012. Ecology, life history and conservation status of *Westralunio carteri Iredale* 1934, an endemic freshwater mussel of south-western Australia. PhD Thesis, Murdoch University: Perth, Western Australia.

MainRoads, 2015. NLWA-03-EN-RP-0025 / Rev 4,Chapter 8 Flora and Vegetation. Pages 8-1. Accessed from: https://www.mainroads.wa.gov.au/contentassets/323725ded03d477995ec533893d1de64/public-environment-report-perthdarwin-national-highway-04-pdnh_per_ch08-part1.pdf

Marchant, S. & P.J. Higgins (eds) 1990. Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks. Oxford University Press, Melbourne. ISBN 0-19-553244-9 (volume 1 set)

Morgan et al., 2011. A Field Guide to Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL, Western Australia.

NSW Government, 2018. Rough Eyebright - Profile. Office of Environment & Heritage, NSW. Accessed from: https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10329

Pizzey G, & Knight F, 2007. The field guide to the birds of Australia. Harper Collins Publishers: Sydney, Australia.

Rix, M. G., Huey, J. A., Cooper, S. J., Austin, A. D., & Harvey, M. S. (2018). Conservation systematics of the shield-backed trapdoor spiders of the nigrum-group (Mygalomorphae, Idiopidae, Idiosoma): integrative taxonomy reveals a diverse and threatened fauna from south-western

South Metro Connect, 2011. Roe Highway Extension Public Environmental Review. Prepared for Main Roads Western Australia. June 2011.

Thiele, K.R., 2009. Banksia recurvistylis (Proteaceae), a new species from Western Australia. Nuytsia. Accessed from: https://florabase.dpaw.wa.gov.au/nuytsia/article/575#:~:text=Banksia%20recurvistylis%20K.R.Thiele%20is%20described%20to%20accommodate%20anomalous,flower%20and%20leaf%20dimensions%2C%20and%20is%20geographically%20disjunct.

Thiele, K.R., 2020. Holotype of Hibbertia ambita K.R.Thiele [family DILLENIACEAE]. JSTOR Global Plants. Accessed from: https://plants.jstor.org/stable/10.5555/al.ap.specimen.perth08804745

Threatened Species Scientific Committee (TSSC), 2020. Conservation Advice *Falco hypoleucos*. Accessed from: https://environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf

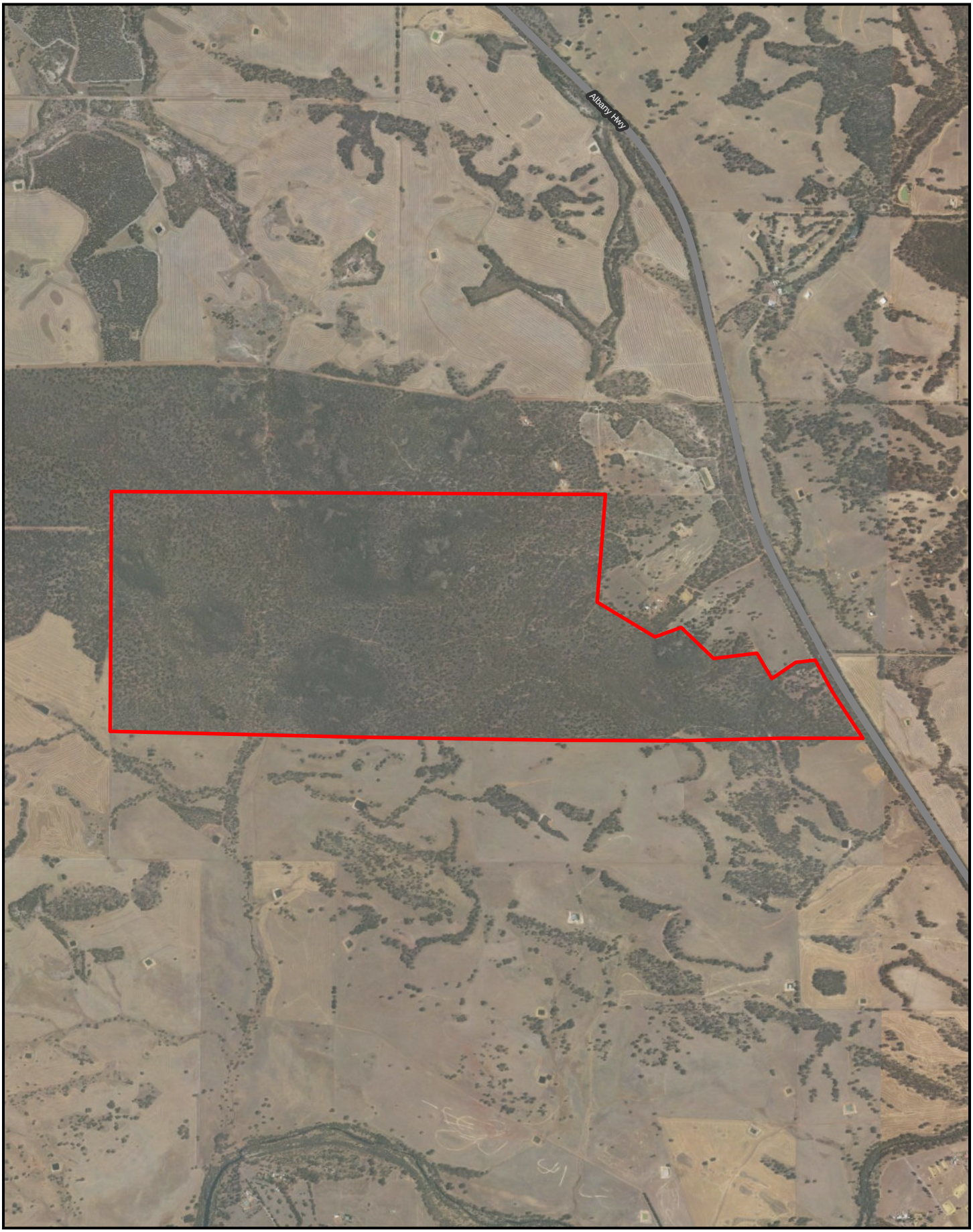
Threatened Species Scientific Committee (TSSC), 2019. Conservation Advice Botaurus poiciloptilus Australasian Bittern. Canberra, ACT: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1001-conservation-advice-18012019.pdf.

Threatened Species Scientific Committee (TSSC), 2018. Conservation Advice Austrostipa bronwenae. Accessed from: https://www.environment.gov.au/biodiversity/threatened/species/pubs/87808-conservation-advice-15022018.pdf

Threatened Species Scientific Committee (TSSC), 2018. Conservation Advice Calyptorhynchus baudinii Baudin's cockatoo. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/769-conservation-advice-15022018.pdf.

Threatened Species Scientific Committee (TSSC), 2009. Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo). Available online at https://environment.gov.au/biodiversity/threatened/species/pubs/67034-conservation-advice.

Van Dyck S, & Strahan R, 2008. The Mammals of Australia Third Edition. Reed New Holland: Chatswood, New South Wales.



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:25,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area

Survey Area - Crossman

MAIN ROADS WA

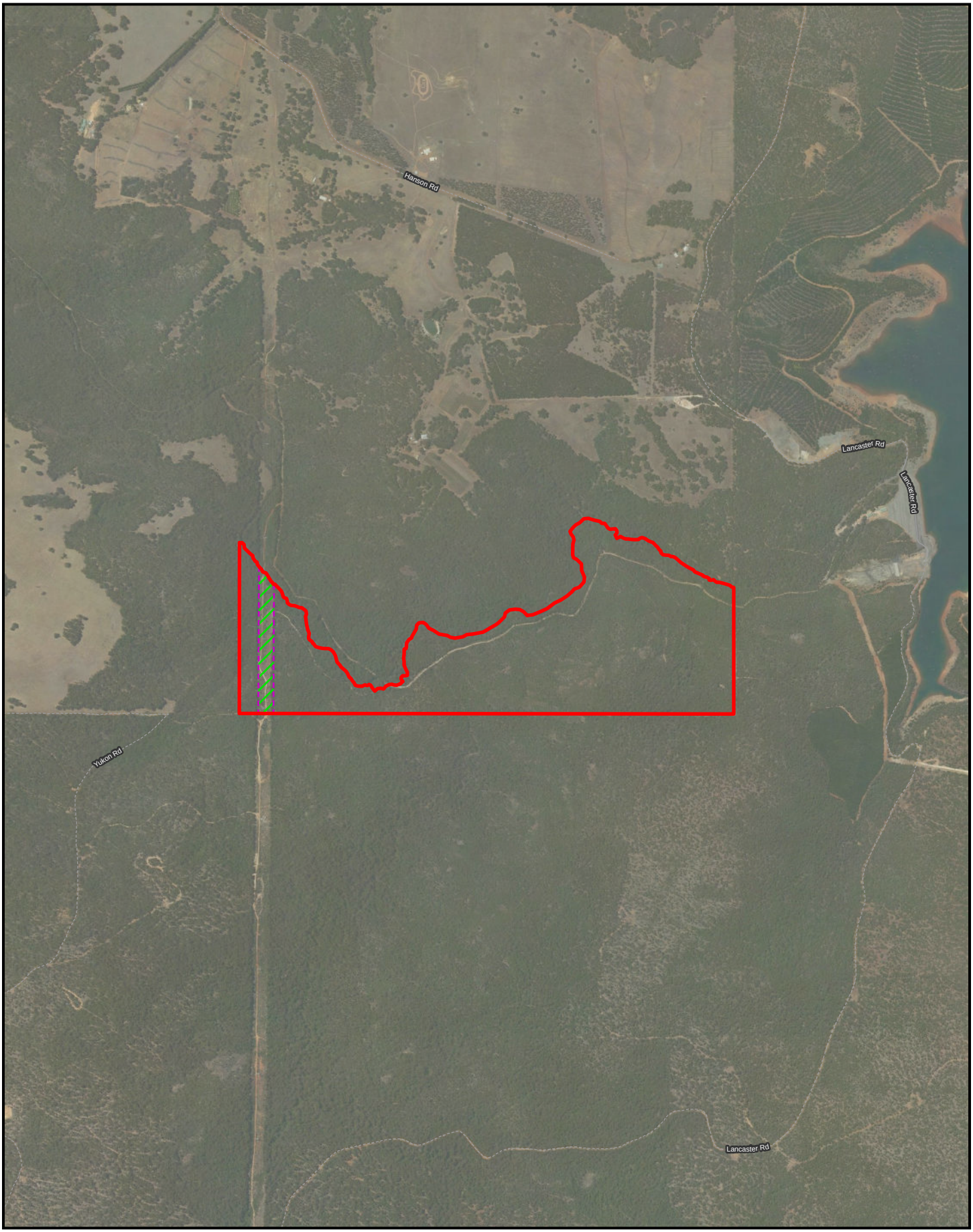
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT - POTENTIAL ENVIRONMENTAL OFFSETS

Figure

1A

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_001A_WP1_SurveyArea_Crossman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:20,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

- Survey Area
- Western Power Easement

Survey Area - Hoffman

MAIN ROADS WA

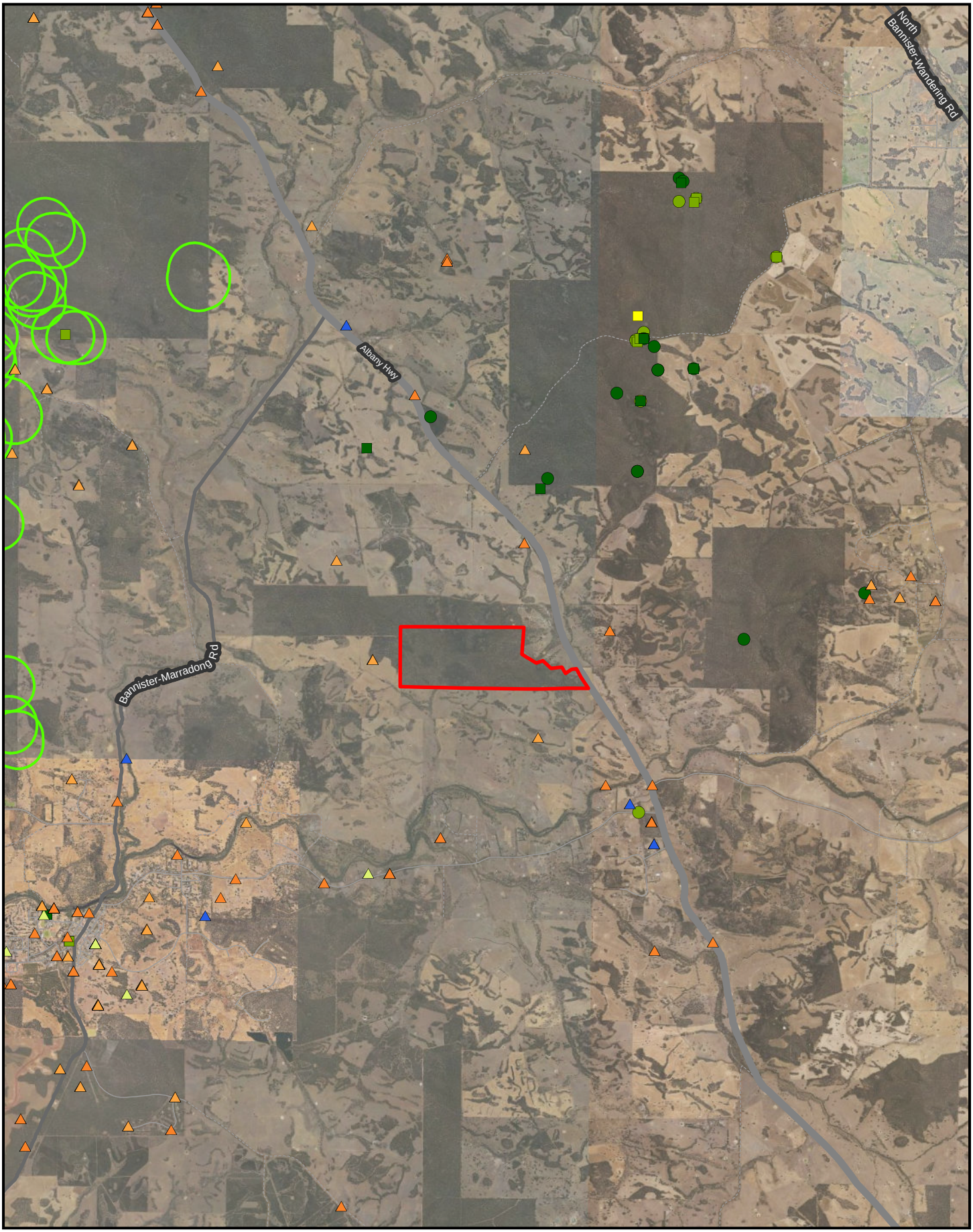
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT - 'POTENTIAL ENVIRONMENTAL OFFSETS

Figure

1B

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_001B_WP1_SurveyArea_Hoffman_Ver2_A4_P



PROJECT ID	60710683
CREATED BY	MCDONNELLG
APPROVED BY	HS
LAST MODIFIED	19 SEP 2023

Greater Connect ALLIANCE

N

1:100,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 0.5 1 1.5 2
Kilometers

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area

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

TEC / PEC
- Priority 1

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

Threatened Fauna database (DBCA)
- Endangered
- Vulnerable
- Conservation Dependant
- Specially Protected
- Priority 4

Spatial Distribution Of Significant Flora and Fauna Species – Crossman

MAIN ROADS WA

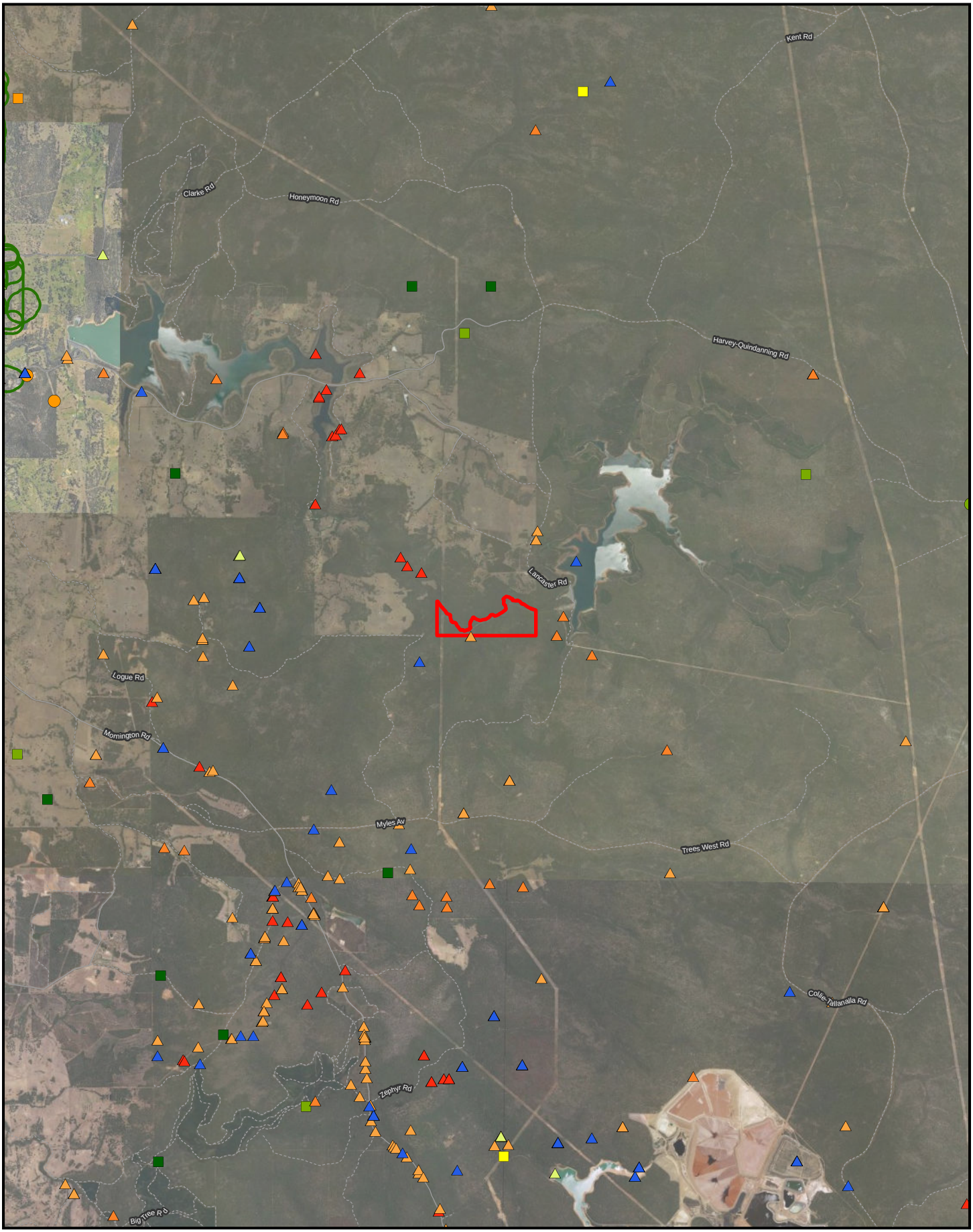
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

2A

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_002A_WP1_SigFloraFauna_Crossman_Ver2_A4_P



PROJECT ID	60710683
CREATED BY	MCDONNELLG
APPROVED BY	HS
LAST MODIFIED	19 SEP 2023

Greater Connect ALLIANCE

N

1:100,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 0.5 1 1.5 2

Kilometers

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area

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

Threatened Fauna database (DBCA)
- Critically Endangered
- Endangered
- Vulnerable
- Migratory Species
- Conservation Dependant
- Specially Protected
- Priority 4

Threatened and Priority Flora database (TPFL)
- P1
- P3

TEC / PEC
- Priority 3

Spatial Distribution Of Significant Flora and Fauna Species – Hoffman

MAIN ROADS WA

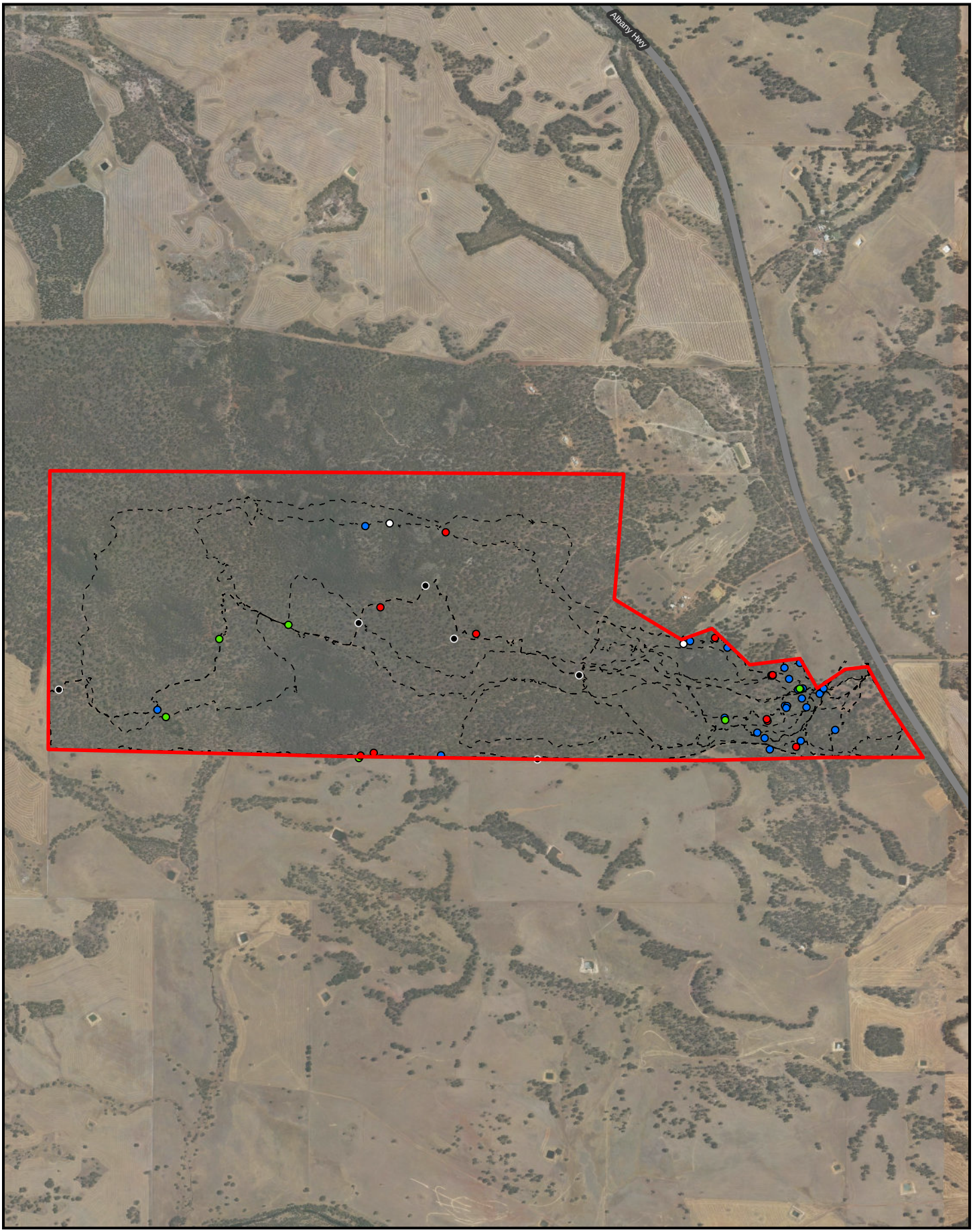
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

2B

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_002B_WP1_SigFloraFauna_Hoffman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:21,508
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area
Tracklog

Species
- Baudin's Cockatoo
- Black Cockatoo
- Carnaby's Cockatoo
- Forest Red-tailed Black-cockatoo
- Introduced

Black Cockatoo Evidence - Crossman

MAIN ROADS WA

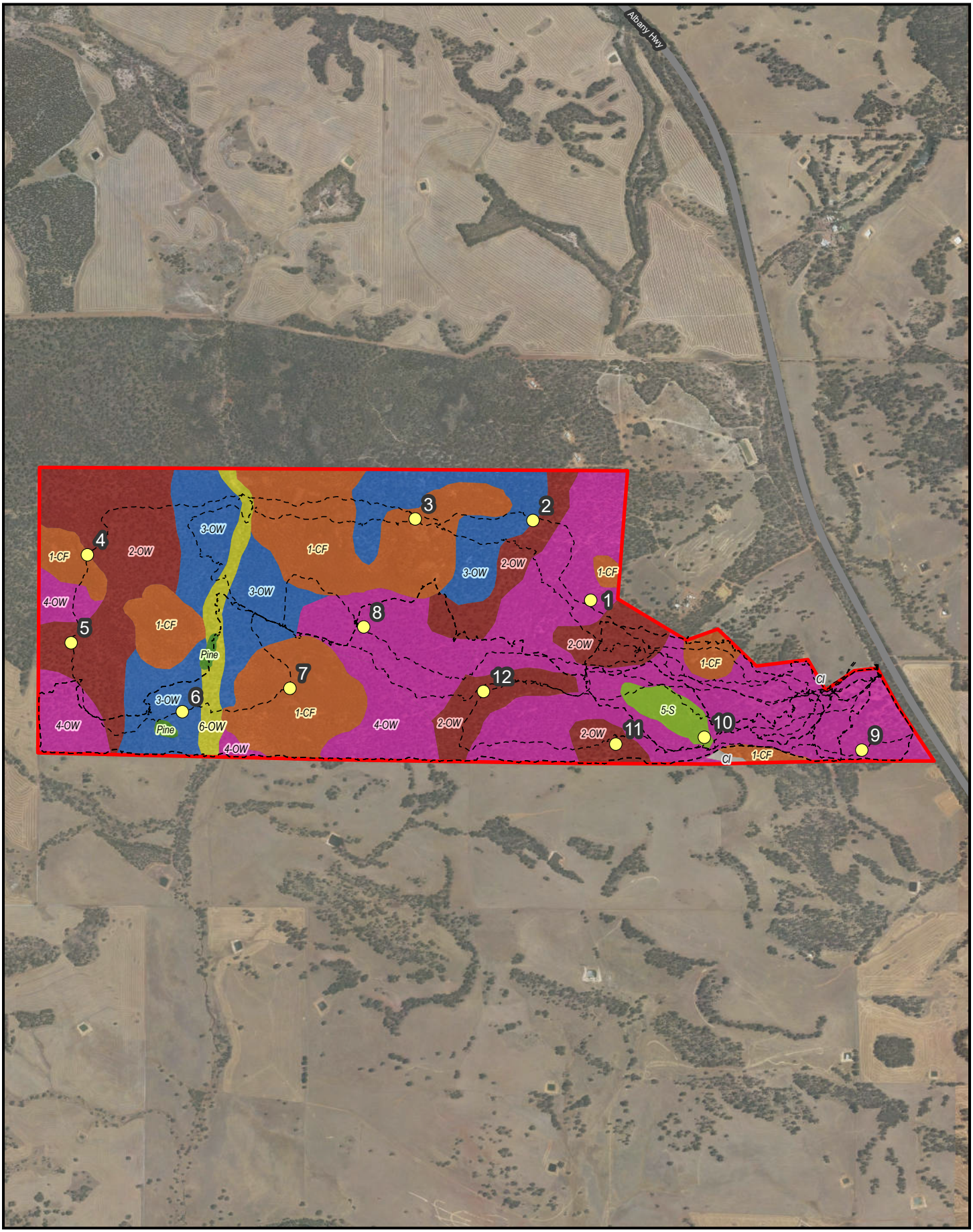
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

3

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_003_WP1_BCE_Crossman_Ver2_A4_P



PROJECT ID	60710683
CREATED BY	WYATTK2
APPROVED BY	HS
LAST MODIFIED	11 APR 2024

Greater Connect ALLIANCE

N

1:21,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

- Survey Area
- Sample Site
- Relevé
- Tracklog

Black Cockatoo Vegetation
- Closed Forest Sheoak *Allocasuarina huegeliana* with *Eucalyptus* wandoo
- Open Woodland Jarrah *Eucalyptus marginata* and Corymbia calophylla
- Open Woodland Wandoo *Eucalyptus* wandoo
- Pine

Other Vegetation
- Cleared
- Open Woodland *Eucalyptus accedens*
- Open Woodland - Flooded Gum *Eucalyptus rudis*
- Shrubland *Calothamnus* sp.

Vegetation Communities - Crossman

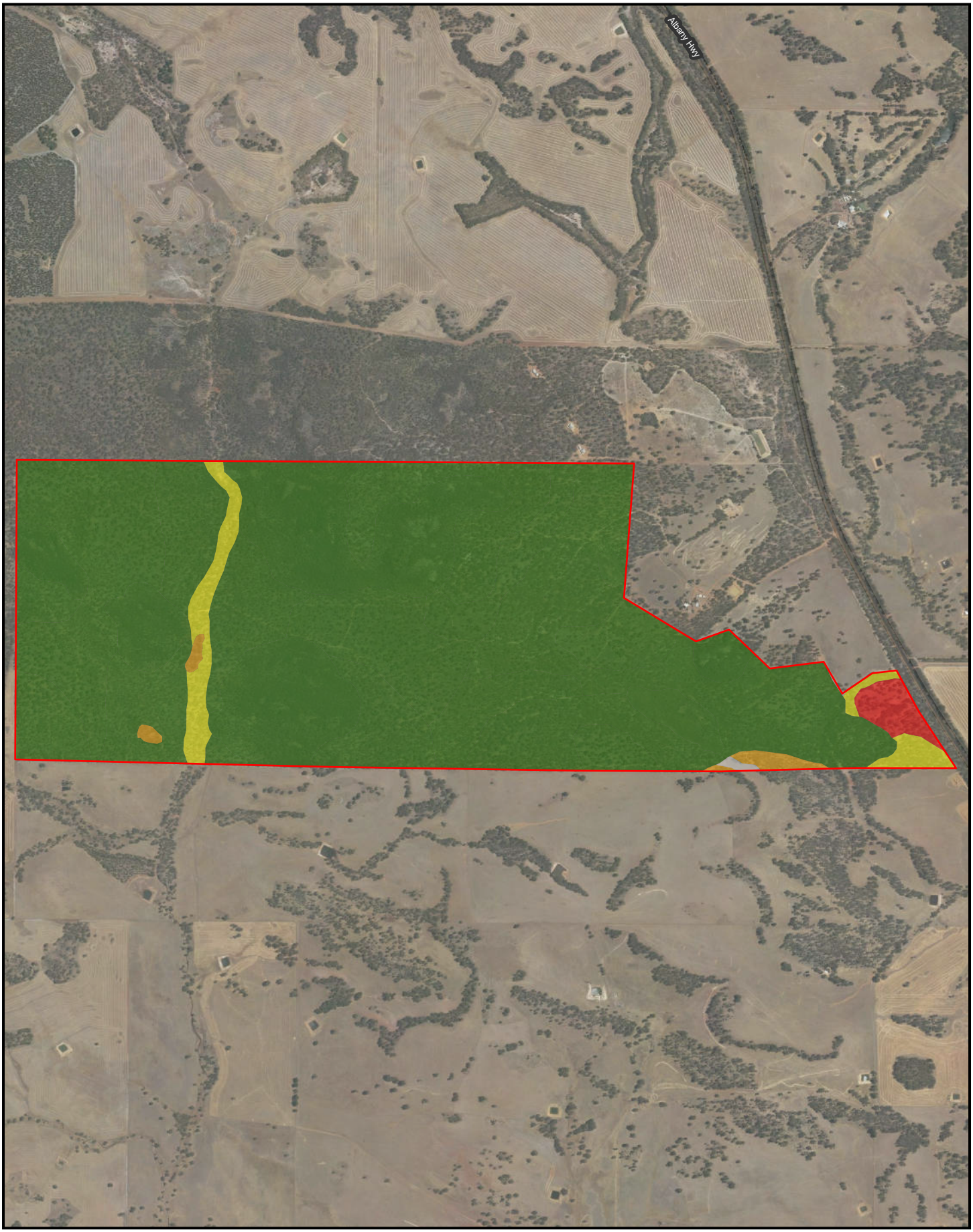
MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure 4

A4 size

Project File: \\na.aecomnet.com\lfs\APAC\Perth-AUPER1\Legacy\Projects\607x\60710683_MRWACrossmanHoffmanOffset\900_CAD_GIS\920_GIS\02_MXD_APRX\Figures\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (WyattK2)
Layout: GEHBI_004_WP1_VegCommunities_Crossman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY WYATTK2
APPROVED BY HS
LAST MODIFIED 07 MAY 2024

Greater Connect ALLIANCE

N

1:20,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 100 200 300 400
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area

Vegetation Condition
- Excellent
- Good
- Degraded
- Completely Degraded
- Cleared

Vegetation Condition - Crossman

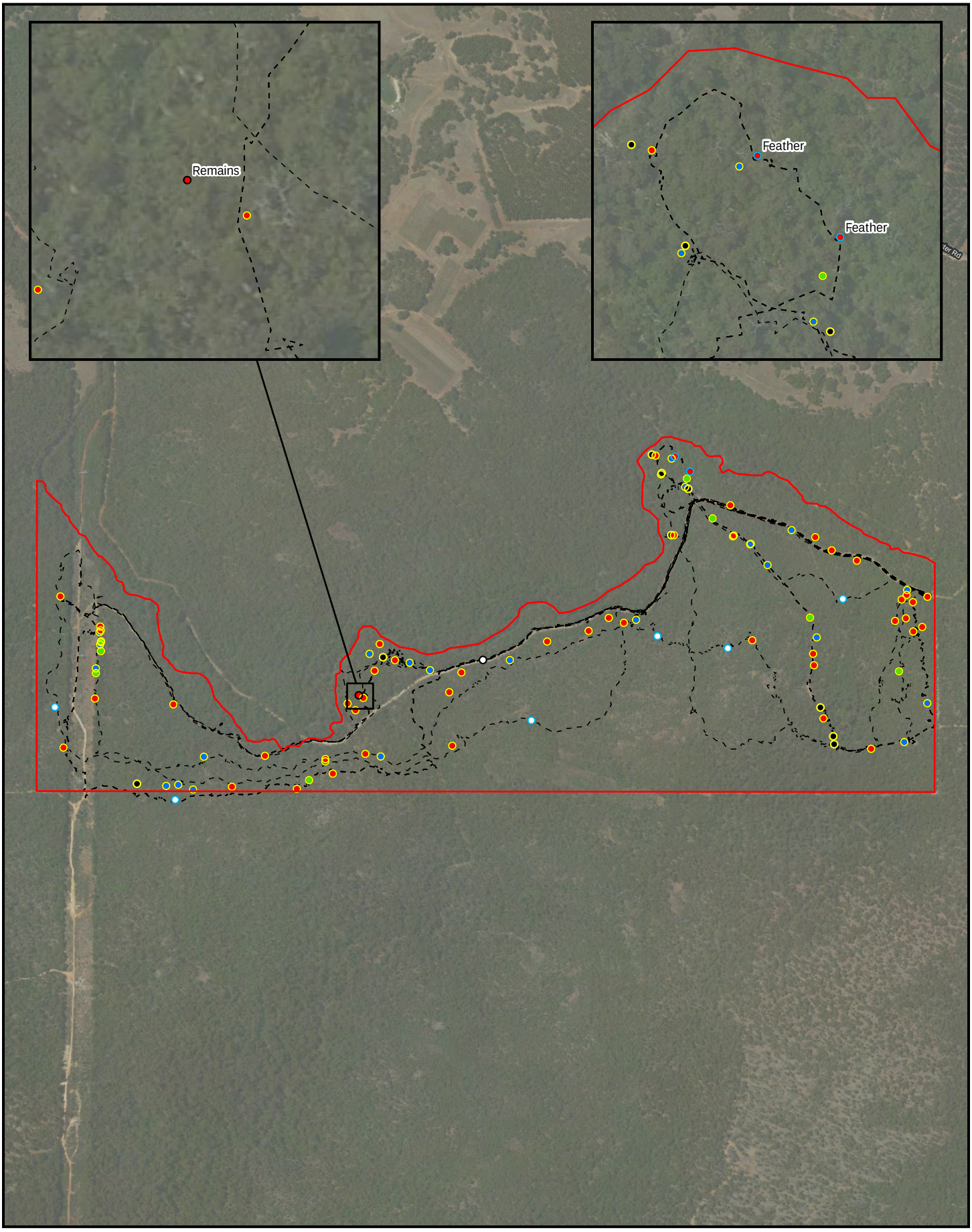
MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure 5

A4 size

Project File: \\na.aecomnet.com\lfs\APAC\Perth-AUPER1\Legacy\Projects\607x\60710683_MRWACrossmanHoffmanOffset\900_CAD_GIS\920_GIS\02_MXD_APRX\Figures\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (WyattK2)
Layout: GEHBI_005_WP1_VegCon_Crossman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:11,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 50 100 150 200
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

Survey Area
Tracklog

Species
- Baudin's Cockatoo
- Black Cockatoo
- Carnaby's Cockatoo
- Forest Red-tailed Black-cockatoo
- Introduced

Forest Red-tailed Black-cockatoo - Types of Observation
- Foraging Evidence
- Feather
- Remains

Black Cockatoo Evidence - Hoffman

MAIN ROADS WA

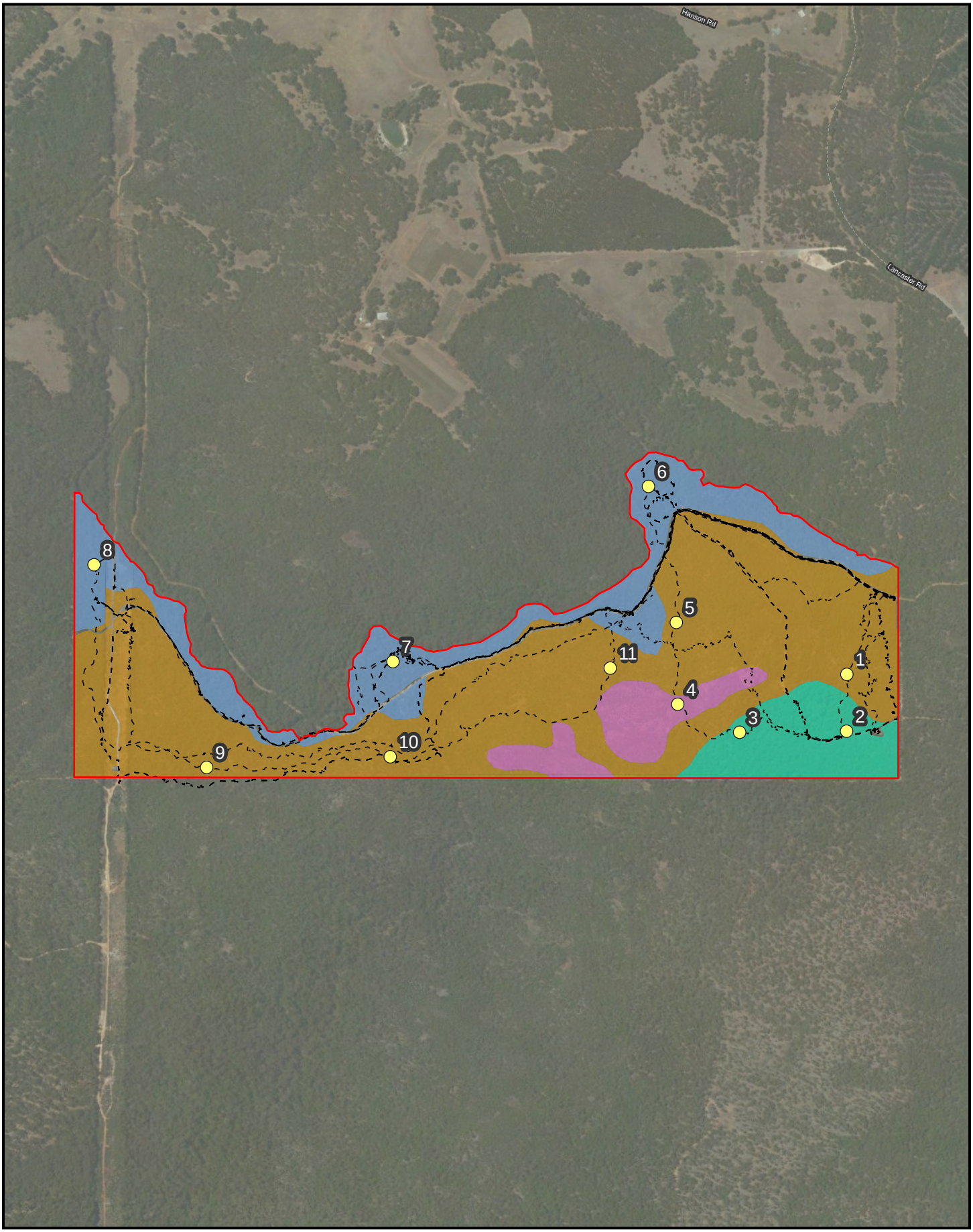
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

6

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_006_WP1_BCE_Hoffman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:12,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 50 100 150 200
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

- Survey Area
- Sample Site
- Relevé
- Tracklog
- Black Cockatoo Vegetation
- Closed Forest *Eucalyptus marginata* and *Corymbia calophylla*
- Open Forest *Corymbia calophylla*
- Open Forest *Eucalyptus patens* and *Eucalyptus rudis*
- Open Shrubland *Acacia pulchella* and *Xanthorrhoea preissii*

Vegetation Communities - Hoffman

MAIN ROADS WA

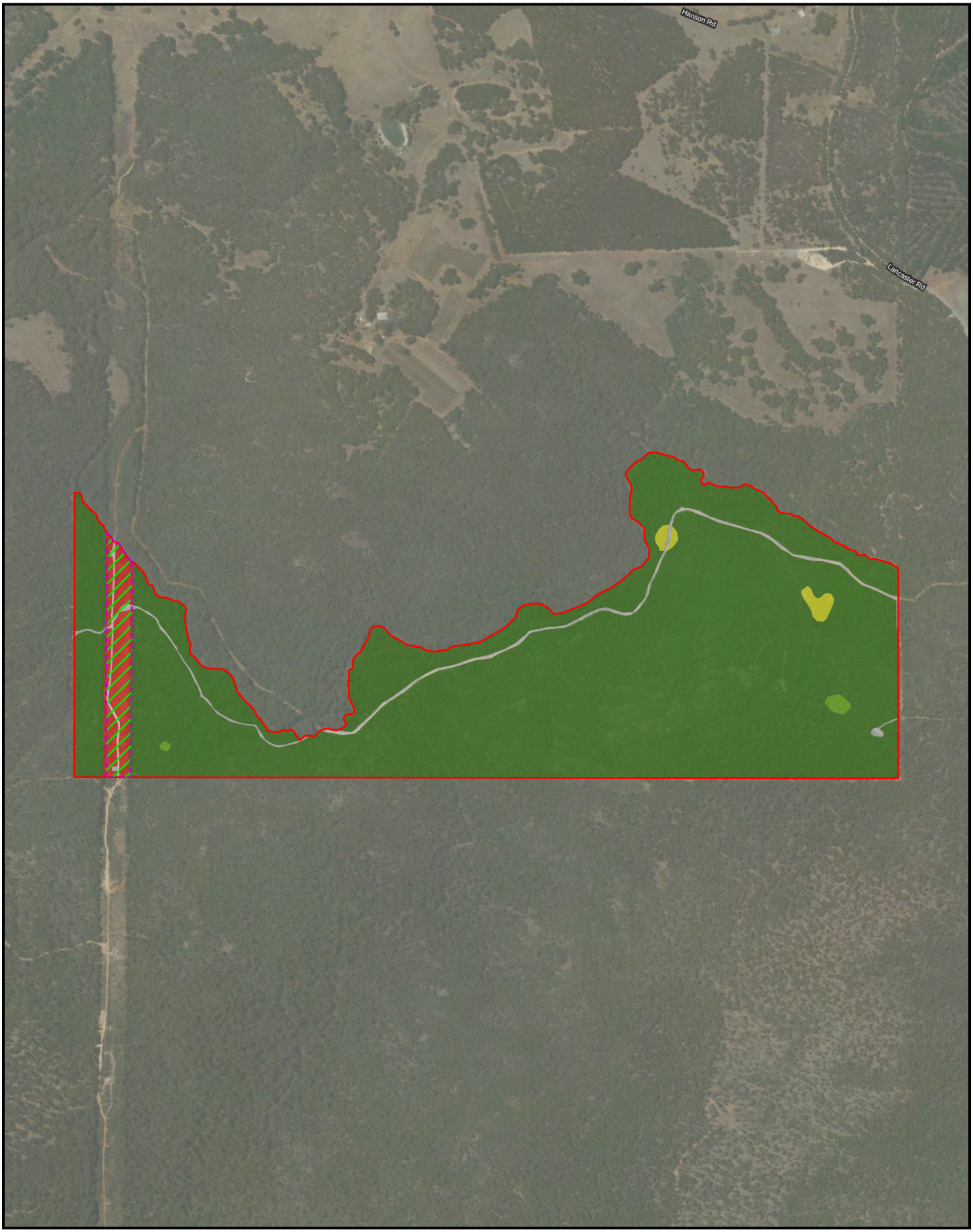
GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

7

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_007_WP1_VegCommunities _Hoffman_Ver2_A4_P



PROJECT ID 60710683
CREATED BY MCDONNELLG
APPROVED BY HS
LAST MODIFIED 19 SEP 2023

Greater Connect ALLIANCE

N

1:12,000
(when printed at A4)

Datum: GDA 1994 Perth Coastal Grid 1994

0 50 100 150 200
metres

Data sources: Main Roads WA
Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021); Geoscience Australia; Streetpro

LEGEND

- Survey Area
- Western Power Easement

Vegetation Condition

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

Vegetation Condition - Hoffman

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS INTERCHANGE PROJECT

Figure

8

A4 size

Project File: L:\Legacy\Projects\606X\60657311\900_CAD_GIS\930_ENV_GIS\APPS\FIGURES\ENVIRONMENT\87_ENV_Hoffman_Crossman_Offsets\PRO\G60657311_87_ENV_Hoffman_Crossman_Offsets_v2.aprx (McDonnellG)
Layout: GEHBI_008_WP1_VegCon_Hoffman_Ver2_A4_P

Appendix A: Crossman Flora Desktop Study

Appendix A Crossman Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance (km)		Date		PMST	Likelihood Assessment					Total Score	Likelihood
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known nearby (5km)	Recent record (<20 years)	Known within LGA	Suitable habitat present (0,1,2)		
Andersonia gracilis	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	E	EN					May	0	0	0	0	2	2	Low
Anthocercis gracilis	Sandy or loamy soils. Granite outcrops.	V	VU					May	0	0	0	0	2	2	Low
Banksia recurvistylis	Heath patches on shallow, lateritic soils with granite outcrops in Jarrah-Marri forest (Thiele, 2009).	-	P2	6.54		2003			0	0	1	0	2	3	Moderate
Banksia subpinnatifida var. *imberbis*	Laterite.	-	P3	8.24		1982			0	0	0	1	1	2	Low
Boronia capitata subsp. *capitata*	Sand, often over laterite and laterite breakaways. White sandplains.	E	VU					May	0	0	0	0	1	1	Negligible
Caladenia hopperiana	Low lying, winter wet impassable swampland.	E	EN					Known	0	0	0	0	0	0	Negligible
Caladenia integra	Clayey loam. Granite outcrops, rocky slopes.	-	P4	3.58	4.14	1987	2009		0	1	1	1	2	5	High
Caladenia x triangularis	Boyup Brook, Cranbrook, Kojonup, Narrogin, Pingelly. Avon Wheatbelt, Jarrah Forest.	-	P4		3.22		2022		0	1	1	0	2	4	Moderate
Darwinia carnea	Lateritic loam and gravel. Brown or dark yellow loamy to sandy loam soils.	E	CR					May	0	0	0	0	2	2	Low
Darwinia thymoides subsp. *St Ronans* (J.J. Alford & G.J. Keighery 64)	Low shrub, sandy or gravely clay-loam soils. Slopes or flats. Granite outcrops.	-	P4	6.11	6.11	1999	1999		0	0	0	0	2	2	Low
Diuris micrantha	Brown loamy clay. Winter-wet swamps, in shallow water.	V	VU					Likely	0	0	0	0	1	1	Negligible
Diuris purdiei	Grey-black sand, moist. Winter-wet swamps.	-	P4					May	0	0	0	0	0	0	Negligible
Eleocharis keigheryi	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	V	VU					May	0	0	0	0	2	2	Low
Eucalyptus exilis	Grey sand, gravelly loam. Lateritic ridges.	-	P4	9.30	9.38	2007	1989		0	0	1	0	2	3	Moderate
Gastrolobium sp. *Asperum* (F. Hort 2864)	Yellow/brown loam, red brown clay loam, gravel, laterite. Gentle slopes, ridges, breakaways, along graded tracks.	-	P3	8.24		1960			0	0	0	1	2	3	Moderate
Gastrolobium sp. Prostrate Boddington (M. Hislop 2130)	Litteres brown loam, clay, laterite. Lower slopes and rises, valley bottoms.	-	P1	8.42		2009			0	0	1	1	2	4	Moderate
Goodenia arthrotricha	Gravel. Granite rocks, slopes.	E	EN					Known	0	0	0	0	2	2	Low
Goodenia katabudjar	Sandy gravel, Upland area of open wandoo woodland.	-	P3	5.03	5.03	2009	2003		0	0	1	1	2	4	Moderate
Halgania corymbosa	Gravelly soils, soils over granite.	-	P3	8.77	2.64	2012	1997		0	1	1	1	2	5	High
Hibbertia ambita	Gentle hills, brown loam over laterite (Thiele, 2020).	-	P1	8.24		1983			0	0	0	1	1	2	Low
Lasiopetalum cardiophyllum	Lateritic gravelly soils, sandy clay. Flats, hillslopes.	-	P4	2.75	2.97	1996	1996		0	1	0	0	2	3	Moderate
Leucopogon florulentus	White/grey or yellow sand, sandy clay, gravelly lateritic soils. Sandplains, gentle slopes.	-	P3		6.28		1995		0	0	0	0	1	1	Negligible
Pultenaea pauciflora	Sandy (white) and clay lateritic soils over laterite or granite. Upper slopes and plateaus of undulating country.	V	VU					Known	0	0	0	0	2	2	Low

Appendix A Crossman Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance (km)		Date		PMST	Likelihood Assessment					Total Score	Likelihood
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known nearby (5km)	Recent record (<20 years)	Known within LGA	Suitable habitat present (0,1,2)		
Senecio leucoglossus	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	-	P4	8.29		2005			0	0	1	1	2	4	Moderate
Thomasia montana	Loamy soils, Rocky granite knolls, lateritic hills.	V	VU					Likely	0	0	0	0	2	2	Low
Verticordia fimbrilepis subsp. *fimbrilepis*	Gravelly sandy or clayey soils. Flats, road verges.	E	EN					Likely	0	0	0	0	2	2	Low

Appendix B: Crossman Fauna Desktop Study

Crossman Fauna Desktop Assessment

Type	Taxon	Common Name	Habitat	Cons. Code WA	Cons. Code EPBC	Date (DBCA)	Records (DBCA)	Distance (m) [DBCA]	PMST	Recorded in Survey Area	Known from Vicinity (<20km)	Recent Record (Last 20 years)	Potential presence of suitable habitat within the Survey Area (0,1,2)	Total Score	Likelihood
Bird	*Actitis hypoleucos*	*Common Sandpiper*	Wide range of coastal wetlands, around muddy margins or rocky shores, some inland wetlands and rarely on mudflats (DCCEEW, 2023)	IA	MI					0	0	1	0	1	Negligible
Bird	*Aphelocephala leucopsis*	*Southern Whiteface*	Dry open forests and woodland and inland scrubs of mallee, mulga and saltbush are the preferred habitat of Southern Whiteface, especially areas with fallen timber or dead trees and stumps (Higgins & Davies, 1996).		VU					0	0	1	0	1	Negligible
Bird	*Apus pacificus*	*Fork-tailed Swift*	Over inland plains, sometimes boave foothills or in coastal areas (DCCEEW, 2023).	IA	MI					0	0	1	0	1	Negligible
Mammal	*Bettongia penicillata ogilbyi*	Woylie	Dry sclerophyllous forest with a dense understory (ALA, 2023).	EN	CE	2019	17	8793.560198		0	1	1	1	3	Moderate
Bird	*Calidris acuminata*	*Sharp-tailed Sandpiper*	Occurs along muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DCCEEW, 2023).	IA	MI					0	0	1	0	1	Negligible
Bird	*Calidris ferruginea*	*Curlew Sandpiper*	Intertidal mudflats in sheltered coastal areas and inland around ephemeral and permanent lakes, dams, waterholes and bore drains with bare edges of mud and sand (DCCEEW, 2023).	CR & IA	CR & MI					0	0	1	0	1	Negligible
Bird	*Calidris melanotos*	*Pectoral Sandpiper*	Occupies shallow, fresh waters often containing low grass or other small herbs, swamp margins, flooded pastures and saltmarshes (Pizzey & Knight, 2007;DCCEEW, 2023).	IA	MI					0	0	1	0	1	Negligible
Bird	*Calyptorhynchus banksii naso*	*Forest Red-tailed Black Cockatoo*	Inhabits dense Eucalyptus marginata (Jarrah), E. diversicolor (Karri) and Corymbia calophylla (Marri) forests (TSSC, 2009).		VU	2019	201	547.310354		0	1	1	2	4	High
Reptile	*Ctenotus delli*	*Darling Range Heath Ctenotus*	Darling Range, inhabiting shrubby understory on lateritic, sandy and clay soils in Jarrah and Marri woodlands (DCCEEW, 2023).	P4		2012	2	13955.9792		0	1	1	1	3	Moderate
Mammal	*Dasyurus geoffroii*	*Western Quoll, Chuditch*	Currently restricted to south-west Western Australia, in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008).	VU		2020	189	3526.757813		0	1	1	2	4	High
Bird	*Falco hypoleucos*	*Grey Falcon*	Timered lowland plains, including acacia shrublands)particularly with tree-lined watercourses), tussock grassland and open woodland (TSSC, 2020).	VU	0					0	0	1	2	3	High
Bird	*Falco peregrinus*	*Peregrine Falcon*	Rainforests, arid zones and coastal to alpine areas (BirdLife, 2021).	S		2009	4	7792.507215		0	1	1	1	3	Moderate
Bird	*Falsistrellus mackenziei*	*Western False Pipistrelle, Western Falsistrelle*	Wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts in the hollows of tree branches and stumps (Australian Museum, 2020).	P4	0	2018	5	2431.733352		0	1	1	2	4	High
Mammal	*Hydromys chrysogaster*	*Water Rat*	Tnear permanent bodies of fresh or brackish water (Van Dyck & Strahan, 2008).	P4		2017	3	5959.835244		0	1	1	1	3	Moderate
Mammal	*Isoodon fusciventer*	*Quenda, Southern Brown Bandicoot*	Forest, woodland, heath and shrub communities, with sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	P4		2022	53	6068.272979		0	1	1	2	4	High
Bird	*Leipoa ocellata*	*Malleefowl*	Semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as such as Broombush (Melaleuca uncinata) and Scrub Pine (Callitris verrucosa) (Benshemesh, 2007).		VU	2001	3	960.324647		0	1	0	0	1	Negligible
Bird	*Motacilla cinerea*	*Grey Wagtail*	Found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (DCCEEW, 2023).	IA	MI					0	0	1	1	2	Low
Mammal	*Myrmecobius fasciatus*	*Numbat*	Mulga woodland, spinifex sandplains and Eucalypt forests and woodlands. In WA, their habitat is generally woodland dominated by Eucalyptus species, with abundant hollow logs and branches (DBCA, 2021)	EN	EN	2021	22	7244.390415		0	1	1	1	3	Moderate
Mammal	*Notamacropus irma*	*Western Brush Wallaby*	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets (DCCEEW, 2023).	P4		2018	39	5607.476963		0	1	1	1	3	Moderate
Bird	*Numenius madagascariensis*	*Eastern Curlew*	Intertidal mudflats. The southern most important international site in Western Australia is Eighty Mile Beach (Bamford et al., 2008).	CR & IA	CR & MI					0	0	1	0	1	Negligible
Mammal	*Phascogale calura*	*Red-tailed Phascogale*	Restricted to remnant native vegetation throughout the wheat belt of south-western Western Australia (Kitchener 1981) in allocasuarina woodlands with hollow-containing eucalypts (e.g. Eucalyptus wandoo) and Gastrolobium spp. (Kitchener 1981). It prefers older, vegetation that is unburnt with ample canopy cover	EN	VU	2021	17	3751.761308		0	1	1	2	4	High
Mammal	*Phascogale tapoatafa wambenger*	*Southern Brush-tailed Phascogale*	Largely restricted to Jarrah dominated forests (Eucalyptus marginata) (DCCEEW, 2023).	CD		2021	32	8383.289507		0	1	1	1	3	Moderate
Bird	*Platycercus icterotis xanthogenys*	*Western Rosella*	Western Rosellas are found in open eucalypt forests and timbered areas, including cultivated land and orchards. The nominate icterotis is found in high rainfall areas and the other subspecies, xanthogenys, in drier woodland, with a heath understorey (Birdlife, 2023).	P4		2004	2	3342.793484		0	1	1	2	4	High
Mammal	*Pseudocheirus occidentalis*	*Western Ringtail Possum*	Peppermint (Agonis flexuosa) forest and woodland and Tuart (Eucalyptus gomphocephala) with a peppermint mid-story. Inland, the species is found in Jarrah (Eucalyptus marginata), Wandoo (Eucalyptus wandoo) and Marri (Corymbia calophylla) forest (Van Dyck & Strahan, 2008).	CR						0	0	1	1	2	Low
Bird	*Rostratula australis*	*Australian Painted Snipe*	Shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DCCEEW, 2023).		EN					0	0	1	0	1	Negligible
Mammal	*Setonix brachyurus*	*Quokka*	Jarrah forest south-east of Perth, extending south through southern Jarrah, Marri and Karri forests onward to the south coast. It is now thought to be absent from the Swan Coastal Plain. Rottnest Island (DCCEEW, 2023).	VU	VU					0	0	1	0	1	Negligible
Invertebrate	*Westralunio carteri*	*Carter's Freshwater Mussel*	Freshwaters of south-west Western Australia, greatest in abundance in slower flowing waters with stable, soft sediments and low salinity (>3 g /L is lethal) (Klunzinger et al., 2012).	VU	VU					0	0	1	2	3	High
Bird	*Zanda baudinii*	*Baudin's Cockatoo*	Temperate forest and woodland dominated by Eucalyptus marginata (jarrah), Corymbia calophylla (marri) and E. diversicolor (karri) (TSSC, 2018).	EN	EN	2017	21	1671.507545		0	1	1	2	4	High
Bird	*Zanda latirostris*	*Carnaby's Cockatoo*	Uncleared or remnant native eucalypt woodlands containing salmon gum and wandoo, and in shrubland or kwongan heathland dominated by hakea, dryandra, banksia and grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. Forages seasonally in pine plantations (DCCEEW, 2023)	EN	EN	2018	114	1945.009165		0	1	1	2	4	High

Appendix C: Crossman Flora Species List

Appendix C Crossman Flora Species List

Family	Taxon	Weed
Apiaceae		
	Xanthosia huegelii	
Asparagaceae		
	Lomandra sericea	
	Lomandra sonderi	
	Lomandra sp.	
	Lomandra spartea	
	Thysanotus dichotomus	
	Thysanotus manglesianus	
Asteraceae		
	Craspedia variabilis	
	Hypochaeris glabra	*
	Lagenophora huegelii	
	Trichocline spathulata	
	Trymalium odoratissimum	
	Ursinia anthemoides	*
Casuarinaceae		
	Allocasuarina huegeliana	
	Allocasuarina humilis	
Cyperaceae		
	Lepidosperma apricola	
	Lepidosperma coastale	
	Lepidosperma leptostachyum	
	Lepidosperma pubisquameum	
	Lepidosperma sp.	
	Morelotia octandra	
	Netrostylis capillaris	
Dilleniaceae		
	Hibbertia commutata	
	Hibbertia hypericoides	
Droseraceae		
	Drosera erythrorhiza	
	Drosera macrantha/micrantha	
Elaeocarpaceae		
	Tetratheca hirsuta	
Ericaceae		
	Leucopogon pulchellus	
	Leucopogon sp.	
	Styphelia discolor	
	Styphelia pallida	
	Styphelia propinqua	
	Styphelia sp.	
Euphorbiaceae		
	Monotaxis grandiflora	
	Monotaxis sp.	
Fabaceae		
	Acacia browniana	
	Acacia celastrifolia	
	Acacia drummondii subsp. candolleana	
	Acacia pulchella	
	Bossiaea eriocarpa	
	Bossiaea pulchella	
	Daviesia decurrens	

Appendix C Crossman Flora Species List

	Daviesia preissii	
	Gompholobium marginatum	
	Hovea pungens	
	Oxalis pres-caprae	*
Geraniaceae		
	Erodium cygnorum	
Goodeniaceae		
	Dampiera alata	
	Dampiera lavandulacea	
	Lechenaultia biloba?	
	Scaevola sp.	
Haemodoraceae		
	Conostylis setosa	
	Haemodorum sp.	
Haloragaceae		
	Gonocarpus pithyoidea	
	Gonocarpus sp.	
Hemerocallidaceae		
	Chamaescilla corymbosa	
	Dianella revoluta	
Iridaceae		
	Moraea flaccida	* DP
	Romulea rosea	*
Lamiaceae		
	Hemiandra pungens	
	Hemiandra sp.	
Myrtaceae		
	Babingtonia camphorosmae	
	Calothamnus sp.	
	Corymbia calophylla	
	Eucalyptus accedens	
	Eucalyptus marginata	
	Eucalyptus wandoo	
	Leptospermim erubescens	
	Melaleuca sp.	
Pinaceae		
	Pinus pinaster	*
Poaceae		
	Amphipogon amphipogonoides	
	Austrostipa elegantissima	
	Avena barbata	*
	Briza maxima	*
	Chrysopogon fallax	
	Tetrarrhena laevis	
Polygalaceae		
	Comesperma sp.	
Primulaceae		
	Lysimachia arvensis	*
Proteaceae		
	Adenanthos cygnorum	
	Banksia dallanneyi	
	Banksia fraseri	
	Banksia grandis	
	Banksia sessilis	

Appendix C Crossman Flora Species List

	Banksia sphaerocarpa var. *sphaerocarpa*
	Banksia squarrosa
	Grevillea bipinnatifida
	Grevillea sp.
	Hakea cyclocarpa
	Hakea lissocarpha
	Hakea ruscifolia
	Hakea trifurcata
	Hakea undulata
	Pertrophile sp.
	Pertrophile striata
Pteridaceae	
	Cheilanthes sp.
Ranunculaceae	
	Clematis pubescens
Restionaceae	
	Alexgeorgea nitens
	Desmocladus flexuosus
	Desmocladus sp.
Rhamnaceae	
	Cryptandra arbutiflora
	Spyridium globulosum
	Trymalium ledifolium
	Trymalium odoratissimum
Rubiaceae	
	Opercularia vaginata
Rutaceae	
	Phebalium sp.
Santalaceae	
	Santalum acuminatum
Sapindaceae	
	Dodonea viscosa
Stylidiaceae	
	Stylidium amoenum
	Stylidium piliferum
	Stylidium repens
Xanthorrhoeaceae	
	Xanthorrhoea preissii
Zamiaceae	
	Macrozamia riedlei

Appendix D: Hoffman Flora Desktop Study

Hoffman Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance (km)		Date		PMST	Likelihood Assessment					Total Score	Likelihood
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known occurrence nearby (5km)	Recent Record (Last 20 years)	Known within LGA	Suitable habitat present (0,1,2)		
Acacia flagelliformis	Sandy soils, winter wet areas.	NA	P4	21.20	28.72	2003	1961		0	0	1	1	1	3	Low
Acacia horridula	Gravelly soils over granite, sand. Rocky hillsides.	NA	P3	23.49	35.05	1995	1964		0	0	0	1	2	3	Moderate
Acacia oncinophylla subsp. patulifolia	Granitic soils, occasionally on laterite.	NA	P4	21.46	-	1992			0	0	0	1	2	3	Moderate
Acacia semitrullata	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	NA	P4	5.75	28.10	2008	1959		0	0	1	1	0	2	Negligible
Acacia sp. *Binningup* (G. Cockerton et al. WB 37784)	Grey sandy soil AVH, 2022).	NA	P1	23.86	-	2022			0	0	1	1	0	2	Negligible
Actinotus repens	Sandy clay and mud in valleys along creek-lines and edges of water channels from Waroona to Walpole, amongst Eucalyptus or Melaleuca dominated woondlands (Henwood, 2013).	NA	P3	16.27	-	2020			0	0	1	1	2	4	Moderate
Angianthus drummondii	Grey or brown clay soils, ironstone. Seasonally wet flats.	NA	P3	11.88	-	1997			0	0	0	1	2	3	Moderate
Austrostipa bronwenae	Flat low-lying calcareous winter wet habitat type on the extensively cleared Swan Coastal Plain (TSSC, 2018).	E	EN	-	-				0	0	0	0	1	1	Low
Boronia capitata subsp. *gracilis*	White/grey or black sand. Winter-wet swamps, hillslopes.	NA	P3	20.79	38.34	2014	1957		0	0	1	1	1	3	Low
Boronia juncea subsp. *juncea*	Sand. Low scrub.	NA	P1	19.35	-	2014			0	0	1	1	0	2	Negligible
Caladenia procera	Rich clay loam. Alluvial loamy flats, Jarrah/Marri/Peppermint woodland, dense heath, sedges.	CE	CR	-	40.44		1956	Known	0	0	0	1	1	2	Low
Caladenia speciosa	White, grey or black sand.	NA	P4	10.48	43.00	2003	1956		0	0	1	1	0	2	Negligible
Caladenia uliginosa subsp. *patulens*	Clay loam and gravel. Well drained soils amongst dense shrubs.	NA	P1	10.15	44.83	2006	1923		0	0	1	1	2	4	Moderate
Cardamine paucijuga	Rich soils, moist to dry habitats.	NA	P2	19.93	-	2016			0	0	1	1	2	4	Moderate
Carex tereticaulis	Black peaty sand.	NA	P3	11.74	-	1949			0	0	0	1	0	1	Negligible
Chamaescilla gibsonii	Clay to sandy clay, winter-wet flats, shallow water-filled clay pans	NA	P3	20.73	-	1967			0	0	0	1	1	2	Low
Cyanothamnus tenuis	Laterite stony soils and granite. Darling Scarp between Dwellingup and Wannamal in the Jarrah Forest and SCP.	NA	P4	6.23	-	2008			0	0	1	1	2	4	Moderate
Cyathochaeta teretifolia	Brown, grey sand. Sandy clay. Swamps, creek edges.	NA	P3	19.40	-	2005			0	0	1	1	2	4	Moderate
Dillwynia dillwynioides	Sandy soils, winter wet depressions.	NA	P3	10.76	37.91	2004	1959		0	0	1	1	1	3	Low
Dillwynia sp. *Capel* (P.A. Jurjevich 1771)	Littered grey loamy sand, rocky soils, valleys rangelands.	NA	P3	8.61	-	1932			0	0	0	1	2	3	Moderate
Diuris drummondii	Low-lying depressions, swamps.	V	VU	11.64	41.24	1900	1957	Known	0	0	0	1	1	2	Low
Diuris micrantha	Brown loamy clay. Winter-wet swamps, in shallow water.	V	VU	-	40.84		1962	Known	0	0	0	1	1	2	Low
Diuris purdiei	Grey-black sand, moist. Winter-wet swamps.	NA	P4	-	38.00		1968	Known	0	0	0	1	2	3	Moderate

Hoffman Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance (km)		Date		PMST	Likelihood Assessment					Total Score	Likelihood
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known occurrence nearby (5km)	Recent Record (Last 20 years)	Known within LGA	Suitable habitat present (0,1,2)		
Drakaea elastica	White or grey sand. Low-lying situations adjoining winter wet swamps.	E	CR	20.85	41.50	1979	1959	Known	0	0	0	1	1	2	Low
Drakaea micrantha	Cleared firebreaks or open sandy patches that have been disturbed. In infertile white-grey sands, in Jarrah and sheoak forest.	V	EN	21.67	43.39	1987	1958	Known	0	0	0	1	0	1	Negligible
Eucalyptus rudis subsp. *cratyantha*	Loam, flats and or hillsides. Jarrah forest. SCP.	NA	P4	13.92	-	2000			0	0	0	1	2	3	Moderate
Euphrasia scabra	Margins of swampy grassland, in peaty wet soil (NSW Government).	NA	P2	14.57	-	1900			0	0	0	1	0	1	Negligible
Grevillea bipinnatifida subsp. *pagna*	Grey sandy clay and loam, ironstone. Seasonal wetlands, swamps and roadsides.	NA	P1	13.51	-	1979			0	0	0	1	2	3	Moderate
Grevillea prominens	Gravelly loam. Along creeklines. .	NA	P3	5.96	35.73	1996	1924		0	0	0	1	2	3	Moderate
Grevillea rara	Lateritic loam, creeklines, collie harvey. Harris River.	E	EN	14.66	44.21	2021	1939	Known	0	0	1	1	2	4	Moderate
Hemigenia microphylla	Sandy clay, peaty clay, granite. Winter wet depressions.	NA	P3	11.74	34.26	1993	1953		0	0	0	1	2	3	Moderate
Juncus meianthus	Black sand, sandy clay. Creeks, seepage areas.	NA	P3	9.65	-	2008			0	0	1	1	1	3	Low
Lasiopetalum membranaceum	Sand over limestone.	NA	P3	23.59	39.38	1999	1962		0	0	0	1	0	1	Negligible
Meionectes tenuifolia	Granite flats, shallow soils at margins, inundated. Grey clay (Mainroads, 2015).	NA	P3	19.37	35.67	1994	1953		0	0	0	1	1	2	Low
Myriophyllum echinatum	Clay, winter wet flats.	NA	P3	-	34.50		1950		0	0	0	1	1	2	Low
Netrostylis sp. *Blackwood River* (A.R. Annels 3043)	Permanently wet creekline (AVH, 2020)	NA	P3	16.27	-	2020			0	0	1	1	1	3	Low
Netrostylis sp. *Nannup* (P.A. Jurjevich 1133)	Lowland creekline, clay loam (AVH, 1997).	NA	P1	19.40	-	1997			0	0	0	1	2	3	Moderate
Olearia strigosa	Sandy loam, open forest.	NA	P3	20.35	-	2022			0	0	1	1	2	4	Moderate
Pterostylis frenchii	Calcareous sand with limestone and laterite. Flat lands and gentle slopes.	NA	P2	24.79	44.87	2004	1967		0	0	1	1	1	3	Low
Pultenaea skinneri	Sandy or clayey soils, winter wet depressions.	NA	P4	12.81	32.45	2006	1940		0	0	1	1	2	4	Moderate
Schizaea rupestris	Gullies, creek banks, shaded moist rock faces.	NA	P2	10.07	35.64	2000	1953		0	0	0	1	2	3	Moderate
Schoenus sp. *Waroona* (G.J. Keighery 12235)	Clay or sandy clay. Winter wet flats.	NA	P3	18.33	-	1993			0	0	0	1	2	3	Moderate
Senecio leucoglossus	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	NA	P4	4.78	35.64	2008	1935		0	1	1	1	2	5	High
Stylidium acuminatum subsp. Acuminatum	Jarrah forest, lateritic soils on hillslopes and valleys in Marri/Jarrah forest.	NA	P2	10.27	-	1991			0	0	0	1	2	3	Moderate
Stylidium korijekup	Well-drained grey-brown sandy loam with laterite. Upland ridges.	NA	P2	10.13	-	2006			0	0	1	1	2	4	Moderate
Stylidium paludicola	Peaty sand over clay. Winter wet, Marri and Melaleuca woodland, Melaleuca shrubland.	NA	P3	22.53	-	2014			0	0	1	1	1	3	Low

Hoffman Flora Desktop Results

Taxon	Habitat	Cons. Code		Distance (km)		Date		PMST	Likelihood Assessment					Total Score	Likelihood
		EPBC Act	BC Act / DBCA	WA Herb	TPFL	WA Herb	TPFL		Recorded in survey area	Known occurrence nearby (5km)	Recent Record (Last 20 years)	Known within LGA	Suitable habitat present (0,1,2)		
Stylidium trudgenii	Grey sand, dark grey to black sandy peat. Margins of winter-wet swamps, depressions.	NA	P3	24.33	-	1997			0	0	0	1	0	1	Negligible
Styphelia filifolia	Swamp, grey sand (AVH, 1996).	NA	P3	19.82	-	1996			0	0	0	1	0	1	Negligible
Synaphea odocoileops	Brown-orange loam and sandy clay, granite. Swamps, winter wet areas.	NA	P1	17.32	37.92	2003	1947		0	0	1	1	2	4	Moderate
Tetratheca parvifolia	Dry gravelly red soil, grainte.	NA	P3	5.26	-	2005			0	0	1	1	1	3	Low
Tripterococcus sp. *Brachylobus* (A.S. George 14234)	Winter damp flats, grey sand.	NA	P4	20.91	-	2014			0	0	1	1	1	3	Low

Appendix E: Hoffman Fauna Desktop Study

Hoffman Fauna Desktop Assessment

Type	Taxon	Common Name	Habitat	Cons. Code WA	Cons. Code EPBC	Date (DBCA)	Records (DBCA)	Distance (m) [DBCA]	PMST	Recorded in Survey Area	Known from Vicinity (<20km)	Recent Record (Last 20 years)	Potential presence of suitable habitat within the Survey Area (0,1,2)	Total Score	Likelihood	Comments
Bird	*Actitis hypoleucos*	Common Sandpiper	Wide range of coastal wetlands, around muddy margins or rocky shores, some inland wetlands and rarely on mudflats (DCCEEW, 2023)	IA	MI	2013	2	20168		0	0	1	0	1	Negligible	
Bird	*Aphelocephala leucopsis*	Southern Whiteface	Dry open forests and woodland and inland scrubs of mallee, mulga and saltbush are the preferred habitat of Southern Whiteface, especially areas with fallen timber or dead trees and stumps (Higgins & Davies, 1996).		VU				May	0	0	0	0	0	Negligible	
Bird	*Apus pacificus*	Fork-tailed Swift	Over inland plains, sometimes boave foothills or in coastal areas (DCCEEW, 2023).	IA	MI	1978	2	27302		0	0	0	0	0	Negligible	
Bird	*Arenaria interpres*	Ruddy Turnstone	Coastal regions with exposed rock coast lines or coral reefs (DCCEEW, 2023).	IA	MI	1979	1	27302		0	0	0	0	0	Negligible	
Bird	*Atrichornis clamosus*	Noisy Shrub-bird	Ecological communities that support a dense understorey or lower stratum of sedges and shrubs, a dense accumulation of leaf litter and an abundant population of litter-dwelling invertebrates. It mainly occurs in low closed forests dominated by Eucalyptus or Agonis and Banksia littoralis and steep and wetter gullies, and drainage lines of hills and granite mountains , and on the margins of freshwater lakes (DCCEEW, 2023).	EN	EN	2007	39	9272	May	0	1	1	2	4	High	
Bird	*Botaurus poiciloptilus*	Australasian Bittern	Freshwater wetlands and, rarely, estuaries or tidal wetlands, favouring tall dense vegetation (TSSC, 2019).	EN	EN	2017	14	9349	Known	0	1	1	1	3	Moderate	
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	Occurs along muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DCCEEW, 2023).	IA	MI	2011	10	15678		0	1	1	0	2	Low	
Bird	*Calidris canutus*	Red Knot	Intertidal mudflats, sandflats and sandy beaches of sheltered coasts (DCCEEW, 2023).	EN & IA	EN & MI	1980	3	27302		0	0	0	0	0	Negligible	
Bird	*Calidris ferruginea*	Curlew Sandpiper	Intertidal mudflats in sheltered coastal areas and inland around ephemeral and permanent lakes, dams, waterholes and bore drains with bare edges of mud and sand (DCCEEW, 2023).	CR & IA	CR & MI	2008	10	15678		0	1	1	0	2	Low	
Bird	*Calidris ruficollis*	Red-necked Stint	Coastal sheltered areas and exposed or ocean beaches, sometimes on stony or rocky shores, reefs or shoals (DCCEEW, 2023).	IA	MI	2012	19	24248		0	0	1	0	1	Negligible	
Bird	*Calidris tenuirostris*	Great Knot	Sheltered coastal habitats with large intertidal mudflats or sandflats (DCCEEW, 2023).	CR & IA	CR & MI	1980	2	27302		0	0	0	0	0	Negligible	
Bird	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	Inhabits dense Eucalyptus marginata (Jarrah), E. diversicolor (Karri) and Corymbia calophylla (Marri) forests (TSSC, 2009).		VU	2022	122	6000	Known	0	1	1	2	4	High	
Bird	*Charadrius leschenaultii*	Greater Sand Plover, Large Sand Plover	Beaches, tidal mudflats, reefs, dunes and is seldom observed far inland (Pizzey & Knight, 2007).	VU & IA	VU	2008	7	27302		0	0	1	0	1	Negligible	
Bird	*Charadrius mongolus*	Lesser Sand Plover	Open intertidal flats of sheltered bays, lagoons or estuaries (Pizzey & Knight, 2007).	EN & IA	EN	1980	1	27302		0	0	0	0	0	Negligible	
Bird	*Falco hypoleucos*	Grey Falcon	Timered lowland plains, including acacia shrublands)particularly with tree-lined watercourses), tussock grassland and open woodland (TSSC, 2020).	VU					May	0	0	1	0	1	Negligible	
Bird	*Falco peregrinus*	Peregrine Falcon	Rainforests, arid zones and coastal to alpine areas (BirdLife, 2021).	S		2009	7	9349		0	1	1	1	3	Moderate	
Bird	*Falsistrellus mackenziei*	Western False Pipistrelle, Western Falsistrelle	Wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts in the hollows of tree branches and stumps (Australian Museum, 2020).	P4		2017	14	1263		0	1	1	2	4	High	
Bird	*Leipoa ocellata*	Malleefowl	Semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as such as Broombush (Melaleuca uncinata) and Scrub Pine (Callitris verrucosa) (Benshemesh, 2007).		VU	2010	1	13816	Likely	0	1	1	1	3	Moderate	
Bird	*Limicola falcinellus*	Broad-billed Sandpiper	Sheletered areas of the coast, particularly estuarine mudflats but also saltmarshes, shallow freshwater lagoons, saltworks and sewage farms (DCCEEW, 2023).	IA	MI	1979	1	27302		0	0	0	0	0	Negligible	
Bird	*Limosa lapponica*	Bar-tailed Godwit	Widespread around the coast of Western Australia from Eyre to Derby (DotE, 2015).	IA (& VU or CR at subsp. level)	MI (& VU or CR at subsp. level)	1981	16	27302		0	0	0	0	0	Negligible	
Bird	*Limosa limosa*	Black-tailed Godwit	Coastal habitat including sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (DCCEEW, 2023)	IA	MI	1980	5	15678		0	1	0	0	1	Negligible	
Bird	*Motacilla cinerea*	Grey Wagtail	Found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (DCCEEW, 2023).	IA	MI				May	0	0	0	1	1	Low	
Bird	*Numenius madagascariensis*	Eastern Curlew	Intertidal mudflats. The southern most important international site in Western Australia is Eighty Mile Beach (Bamford et al., 2008).	CR & IA	CR & MI	2009	7	27302		0	0	1	0	1	Negligible	
Bird	*Numenius phaeopus*	Whimbrel	Along the Australian coast, inhabiting estuaries, mangroves, tidal flats, flooded paddocks, and bare grasslands (Pizzey & Knight, 2007)	IA	MI	1981	5	27302		0	0	0	0	0	Negligible	
Bird	*Oxyura australis*	Blue-billed duck	Deep water in large permanent wetlands and swamps with aquatic vegetation (Marchant & Higgins, 1990).	P4		2013	31	9349		0	1	1	1	3	Moderate	
Bird	*Plegadis falcinellus*	Glossy Ibis	Well vegetated wetlands, wet pastures, floodwaters, brackish wetlands and mudflats (Pizzey & Knight, 2007).	IA	MI	2005	6	15678		0	1	1	0	2	Low	
Bird	*Pluvialis fulva*	Pacific Golden Plover	Coastal habitats, found occassionally around inland wetlands (DCCEEW, 2023).		MI	2001	5	27302		0	0	0	0	0	Negligible	
Bird	*Pluvialis squatarola*	Grey Plover	Coastal, marine shores, inlets, estuaries and lagoons with large tidal mudflats or sandflats, sandy beachesand rocky coasts. It is occasionally found inland (Birdlife Australia, 2021).		MI	2001	11	27302		0	0	0	0	0	Negligible	
Bird	*Rostratula australis*	Australian Painted Snipe	Shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DCCEEW, 2023).		EN				Likely	0	0	0	0	0	Negligible	
Bird	*Sternula nereis nereis*	Fairy Tern	It is most common in Western Australia, found on coastal beaches, inshore and offshore islands, sheltered inlets, sewage farms, harbours, estuaries and lagoons, favouring both fresh and saline wetlands and near-coastal terrestial wetlands, including lakes and salt-ponds. (BirdLife Australia, 2021)	VU	VU				Known	0	0	0	0	0	Negligible	
Bird	*Thalasseus bergii*	Crested Tern	A strictly coastal species. Occasional records in the arid interior of Australia (BirdLife Australia, 2022).	IA	MI	2007	30	24248		0	0	1	0	1	Negligible	
Bird	*Thinornis rubricollis*	Hooded Plover	West of the Nullarbor Plain. Additionally recorded on ocean beaches and salt lakes,sometimes hundreds of kilometres from the coast (Birdlife, 2019).		VU	2004	8	28708		0	0	1	0	1	Negligible	
Bird	*Tringa glareola*	Wood Sandpiper	Common in Northern Australia, a casual visitor to southern parts, occuping wetland margins, saltmarshes and sewage ponds (Pizzey & Knight, 2007).	IA	MI	2010	10	9349		0	1	1	0	2	Low	
Bird	*Tringa nebularia*	Common Greenshank	Inland wetlands and sheltered coastal habitats In shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh (DCCEEW, 2023).	IA		2009	43	9349		0	1	1	0	2	Low	
Bird	*Tringa stagnatilis*	Marsh Sandpiper	Wetlands of varying salinity including fresh, sewage ponds and estuaries (Pizzey & Knight, 2007).	IA		1978	1	27302		0	0	0	0	0	Negligible	
Bird	*Tyto novaehollandiae novaehollandiae*	Masked Owl (Southern Subspecies)	Forests, open woodlands, farmlands with large trees, paperbark woodlands and caves (Fulton, 2017)	P3		1971	1	11634		0	1	0	2	3	High	
Bird	*Zanda baudinii*	Baudin's Cockatoo	Temperate forest and woodland dominated by Eucalyptus marginata (jarrah), Corymbia calophylla (marri) and E. diversicolor (karri) (TSSC, 2018).	EN	EN	2019	185	411	Known	0	1	1	2	4	High	
Bird	*Zanda latirostris*	Carnaby's Cockatoo	Uncleared or remnant native eucalypt woodlands containing salmon gum and wandoo, and in shrubland or kwongan heathland dominated by hakea, dryandra, banksia and grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. Forages seasonally in pine plantations (DCCEEW, 2023)	EN	EN	2018	197	4539	Known	0	1	1	2	4	High	
Fish	*Galaxiella nigrostriata*	Black-stripe Minnow	Acidic ephemeral bodies of water in peat flats located in the south west corner of Western Australia. The major populations occur from Augusta to Albany and near Bunbury and Gingin (Morgan et al, 2011). Generally prefer sandy, moist soil when ephemeral pools dry out.	EN		2001	76	19267	Known	0	1	0	2	3	High	

Hoffman Fauna Desktop Assessment

Type	Taxon	Common Name	Habitat	Cons. Code WA	Cons. Code EPBC	Date (DBCA)	Records (DBCA)	Distance (m) [DBCA]	PMST	Recorded in Survey Area	Known from Vicinity (<20km)	Recent Record (Last 20 years)	Potential presence of suitable habitat within the Survey Area (0,1,2)	Total Score	Likelihood	Comments
Fish	*Geotria australis*	Pouched Lamprey	Headwaters of freshwater rivers and streams, with soft muddy sediments (Bray, 2020).	P3		1915	2	28933		0	0	0	2	2	Moderate	
Fish	*Nannatherina balstoni*	Balston's Pygmy Perch	Acidic tannin-stained freshwater pools, streams and lakes in peat flats within 30km of the coast, preferring shallow water and inundated riparian vegetation (DCCEEW 2023).	VU	VU				Likely	0	0	0	2	2	Moderate	
Invertebrate	*Idiosoma sigillatum*	Swan Coastal Plain shield-backed trapdoor spider	Remnant habitats in Banksia woodland and heathland on sandy soils (Rix et al., 2018).	P3		1999	5	20008		0	0	0	0	0	Negligible	
Invertebrate	*Westralunio carteri*	Carter's Freshwater Mussel	Freshwaters of south-west Western Australia, greatest in abundance in slower flowing waters with stable, soft sediments and low salinity (>3 g /L is lethal) (Klunzinger et al., 2012).	VU	VU	2016	41	7165	Known	0	1	1	2	4	High	
Mammal	*Bettongia penicillata ogilbyi*	Woylie	Dry sclerophyllous forest with a dense understory (ALA, 2023).	EN	CE	2020	127	5803	Known	0	1	1	1	3	Moderate	
Mammal	*Dasyurus geoffroii*	Western Quoll, Chuditch	Currently restricted to south-west Western Australia, in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008).	VU		2020	228	3519	Known	0	1	1	2	4	High	
Mammal	*Hydromys chrysogaster*	Water Rat	Tnear permanent bodies of fresh or brackish water (Van Dyck & Strahan, 2008).	P4		2017	16	8731		0	1	1	2	4	High	
Mammal	*Isoodon fusciventer*	Quenda, Southern Brown Bandicoot	Forest, woodland, heath and shrub communities, with sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	P4		2022	276	624		0	1	1	2	4	High	
Mammal	*Macrotis lagotis*	Bilby	Arid to semi-arid woodlands and hummock grasslands in the north of Australia, restricted to the Gibson, Little Sandy and Great Sandy Deserts, and parts of the Pilbara, Dampierland, Central Kimberley and Ord-Victoria Plains bioregions in Western Asutralia (Bradley et al. 2015).	VU	VU	1971	1	26267		0	0	0	0	0	Negligible	
Mammal	*Myrmecobius fasciatus*	Numbat	Mulga woodland, spinifex sandplains and Eucalypt forests and woodlands. In WA, their habitat is generally woodland dominated by Eucalyptus species, with abundant hollow logs and branches (DBCA, 2021)	EN	EN	1981	11	6577	Likely	0	1	0	2	3	High	
Mammal	*Notamacropus eugenii derbianus*	Tammar Wallaby	South-western Western Australia and five offshore islands, in dense low vegetation, open grassy areas, coastal scrub, heath, dry sclerophyll forest, and thickets in mallee and woodland (DCCEEW, 2023).	P4		2007	1	14804		0	1	1	1	3	Moderate	
Mammal	*Notamacropus irma*	Western Brush Wallaby	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets (DCCEEW, 2023).	P4		2020	142	4549		0	1	1	1	3	Moderate	
Mammal	*Phascogale tapoatafa wambenger*	Southern Brush-tailed Phascogale	Largely restricted to Jarrah dominated forests (Eucalyptus marginata) (DCCEEW, 2023).	CD		2022	122	3519		0	1	1	2	4	High	
Mammal	*Pseudocheirus occidentalis*	Western Ringtail Possum	Peppermint (Agonis flexuosa) forest and woodland and Tuart (Eucalyptus gomphocephala) with a peppermint mid-story. Inland, the species is found in Jarrah (Eucalyptus marginata), Wandoo (Eucalyptus wandoo) and Marri (Corymbia calophylla) forest (Van Dyck & Strahan, 2008).	CR		2022	345	651	Known	0	1	1	2	4	High	
Mammal	*Setonix brachyurus*	Quokka	Jarrah forest south-east of Perth, extending south through southern Jarrah, Marri and Karri forests onward to the south coast. It is now thought to be absent from the Swan Coastal Plain. Rottnest Island (DCCEEW, 2023).	VU	VU	2023	623	16	Known	0	1	1	2	4	High	
Reptile	*Ctenotus delli*	Darling Range Heath Ctenotus	Darling Range, inhabiting shrubby understory on lateritic, sandy and clay soils in Jarrah and Marri woodlands (DCCEEW, 2023).	P4		1981	3	11605		0	1	0	2	3	High	
Reptile	*Ctenotus ora*	Coastal Plain Skink	Sandy substrates with low vegetation with open Eucalyptus woodland over Banksia and is restricted to the SCP west of the Darling Ranges and South of Perth from Gosnells to Yallingup Brook. (Kay & Keogh, 2012)	P3		2014	4	20564		0	0	1	2	3	High	
Reptile	*Lerista lineata*	Perth Slider	Leaf litter and upper layers of loose soil, typically found at the bases of shrubs, spoil heaps and stick ant nests, sandy soils supporting Eucalypt/Banksia woodland, coastal heath and low shrubland (Bush et al., 2010; Wilson & Swan, 2010). No records north of the Swan River on the Swan Coastal Plain (South Metro Connect, 2011).	P3		2009	6	22321		0	0	1	1	2	Moderate	

Appendix F: Hoffman Flora Species List

Appendix F Hoffman Flora Species List

Family	Taxon	Weed
Apiaceae		
	Daucus glochidiatus	
	Xanthosia candida	
	Xanthosia sp.	
Araliaceae		
	Trachymene pilosa	
Asparagaceae		
	Lomandra drummondii	
	Lomandra sonderi	
	Thysanotus dichotomus	
Asteraceae		
	Arctotheca calendula	*
	Conyza bonariensis	*
	Craspedia variabilis	
	Hypochaeris glabra	*
	Lagenophora huegelii	
	Senecio sp.	
	Trichocline spathulata	
Boraginaceae		
	Unknown	
Colchicaceae		
	Wurmbea tenella	
Cyperaceae		
	Lepidosperma tetraquetrum	
	Morelotia octandra	
	Sedges	
Dennstaedtiaceae		
	Pteridium esculentum	
Dilleniaceae		
	Hibbertia commutata	
	Hibbertia hypericoides	
	Hibbertia perfoliata	
	Hibbertia semipilosa	
Droseraceae		
	Drosera macrantha/micrantha	
Ericaceae		
	Leucopogon capitellatus	
Fabaceae		
	Acacia alata	
	Acacia baarbinervis	
	Acacia celastrifolia	
	Acacia decurrens	*
	Acacia extensa	
	Acacia longifolia	*
	Acacia pulchella	
	Bossiaea aquifolium	
	Daviesia divaricata	
	Gompholobium marginatum	
	Hovea chorizemifolia	
	Hovea elliptica	
	Kennedia prostrata	
	Neltuma glanduosa x velutina	*
	Oxalis pres-caprae	*

Appendix F Hoffman Flora Species List

Family	Taxon	Weed
Geraniaceae		
	Geranium molle	*
Goodeniaceae		
	Dampiera linearis	
Haemodoraceae		
	Conostylis setosa	
Iridaceae		
	Freesia alba x leichtlinii	*
	Patersonia rudis	
	Persoonia longifolia	
Lamiaceae		
	Hemiandra pungens	
Lauraceae		
	Cassytha sp.	
Malvaceae		
	Lasiopetalum floribundum	
Myrtaceae		
	Agonis flexuosa	
	Astartea scoparia	
	Calytrix sp.	
	Corymbia calophylla	
	Eucalyptus marginata	
	Eucalyptus patens	
	Eucalyptus rudis	
	Eucalyptus saligna	* PL
	Hypocalymma angustifolium	
	Taxandria linearifolia	
Orchidaceae		
	Eriochilus sp.	
	Pterostylis sp.	
Phyllanthaceae		
	Lysiandra calycinus	
Phytolaccaceae		
	Phytolacca octandra	*
Pittosporaceae		
	Billardiera fusiformis	
Poaceae		
	Tetrarrhena laevis	
Portulacaceae		
	Portulaca oleracea	
Primulaceae		
	Lysimachia arvensis	*
Proteaceae		
	Banksia dallanneyi	
	Banksia grandis	
	Banksia littoralis	
	Grevillea bipinnatifida	
	Grevillea diversifolia	
	Hakea amplexicaulis	
	Hakea lissocarpha	
	Hakea varia	
Pteridaceae		
	Cheilanthes austrotenuifolia	

Appendix F Hoffman Flora Species List

Family	Taxon	Weed
Ranunculaceae		
	Clematis pubescens	
Rhamnaceae		
	Rhamnacea sp.	
	Spyridium globulosum	
	Trymalium ledifolium	
	Trymalium odoratissimum	
Rubiaceae		
	Opercularia echinocephala	
Stylidiaceae		
	Stylidium dichotomum	
Thymelaeaceae		
	Pimelea sp.	
	Pimelea suaveolens	
	Pimelea sylvestris	
Xanthorrhoeaceae		
	Xanthorrhoea preissii	
Zamiaceae		
	Macrozamia riedlei	