Public Transport Authority

Thornlie Cockburn Link
Biological Assessment of Additional Areas

July 2020

Executive summary

The Public Transport Authority (PTA) is in the planning stage for the extension of the southern suburbs passenger railway, the Thornlie - Cockburn Link (TCL). The TCL will connect the Thornlie train station to the Cockburn Central Station on the Mandurah Line to address the 'southern services gap'. Two new stations and park and ride facilities will be constructed at Ranford Road and Nicholson Road in Canning Vale.

Extensive vegetation surveys have been completed, however additional areas of vegetation have been identified as requiring potential clearing. As part of the environmental assessment process, the PTA commissioned GHD to complete additional biological surveys for these additional areas. This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

The vegetation, flora and focused fauna survey was completed between 1-3 October 2019.

Survey results

- The survey area comprises four areas that are mostly modified through previous clearing, possible dieback infestation and weed invasion
- Seven vegetation types as well as planted, non-native vegetation and cleared areas were identified within the survey area. Three of the vegetation types represent remnant native vegetation upland communities; with the remaining four vegetation types are in varied states of degradation due to previous modifications to the landscape and are not considered remnant native vegetation
- No vegetation growing in association with wetlands or watercourses was identified during the field survey
- The vegetation within the survey area was rated from Good to Completely Degraded in condition, with majority of the vegetated areas in Degraded or worse condition
- Vegetation type *Banksia menziesii* and *B. attenuata* woodland (VT01) was assessed as meeting the key diagnostic characteristics for the *Banksia* Woodlands of the SCP Threatened Ecological Community and Priority Ecological Community (0.12 ha)
- Ninety seven (97) native and 50 introduced flora taxa were recorded from the survey area during the field survey, with none of these listed as conservation significant under the EPBC Act, BC Act or as a Priority by DBCA
- One introduced taxa, **Asparagus asparagoides* (Bridal Creeper) was recorded from one location in the survey area, which is listed as a Declared Pest under the Biosecurity and Agriculture Management Act 2007 and as a Weed of National Significance
- Seven potential breeding trees were recorded within the survey area (i.e. meet the criteria of having trunk diameter greater than 500 mm), although no potential nest hollows were detected in these trees, and no black cockatoo spring breeding behaviour was observed within the survey area
- Small areas of mixed Jarrah *Banksia* woodlands and remnant Marri trees occur in the survey area and provide high quality foraging habitat for black cockatoos. Recent signs of Forest Red-tailed Black Cockatoo include chewed Marri and Jarrah pods, and Carnaby's Cockatoo foraging signs were found in the *Banksia* woodland patches
- The Quenda or Southern Brown Bandicoot was also recorded within the survey area based on extensive diggings and scats.

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1. Introduction

1.1 Background

The Thornlie Cockburn Link (TCL) forms part of METRONET, a state government program of projects to increase the size of Perth's railway network. The project aims to support the planning of integrated station precincts and the growth of the Perth metropolitan region. The TCL project will connect the Thornlie train station to the Cockburn Central Station on the Mandurah Line to address the 'southern services gap'. The project includes two new stations and park and ride facilities at Ranford Road and Nicholson Road in Canning Vale.

The Public Transport Authority (PTA) has commissioned a number of biological surveys for the TCL project, including a reconnaissance flora, vegetation and fauna survey (GHD 2013), a detailed vegetation and flora survey, reconnaissance fauna survey, black cockatoo habitat assessment and targeted flora surveys (GHD 2019). During the environmental assessment process, additional areas have been identified as requiring assessment. Consequently, further ecological surveys of these additional areas are required to support environmental approvals.

1.2 Purpose of this report

GHD Pty Ltd (GHD) was engaged by the PTA to undertake an ecological survey of additional areas for the TCL project. The purpose of the survey was to delineate key flora, vegetation and fauna values within the additional areas. This report summarises the ecological survey results. The results will be used to identify and assess the ecological impacts of the projects and inform the environmental assessment approvals process.

1.3 Project location

The additional areas are located adjacent to the TCL development envelope (DE), which extends from south of Beckenham Station to Thornlie Station, and through to Cockburn Central Station. The additional areas include four separate areas located at the western and central parts of the TCL DE. The additional areas are collectively referred to as the survey area and cover 10.75 hectares (ha). The survey area is mapped in Figure 1, Appendix A.

A study area was defined for the desktop assessment and includes a 5 kilometre (km) buffer of the survey area for the purpose of flora and fauna database searches.

1.4 Scope of works

The scope of works for the ecological survey included:

- A desktop review of publically available databases and relevant reports provided by the PTA to determine the ecological values of the survey area
- An ecological survey of the survey area to identify and map:
  - Vegetation community types present in the survey area, including presence of any Threatened or Priority Ecological Communities (TECs or PECs).
  - Vegetation condition, including the locations of any Weeds of National Significance (WoNS) or Declared Weeds
  - Vegetation that would be classified as foraging habitat for black cockatoo
  - Threatened and/or Priority Flora, and potential (or confirmed) breeding trees for black cockatoo
  - Vegetation growing in association with wetlands or watercourses

- Preparation of an ecological survey report (this document) that includes the results and findings of the survey, including a justification of the survey methodology, and supporting maps and figures
- Provision of spatial data in GIS format.

1.5 Relevant legislation, conservation codes and background information

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

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

1.6 Limitation and assumptions

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

GHD otherwise disclaims responsibility to any person other than PTA arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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

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

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

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

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

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

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant ecological information pertaining to the study area and to assist in survey design. The desktop assessment involved a review of:

- Previous reports relevant to the project, including:
  - Thornlie Cockburn Link Project, Flora and Fauna Survey (GHD 2019a)
  - Thornlie Cockburn Link Project, Additional Targeted Flora Survey (GHD 2019b)
- The Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area
- The Department of Biodiversity, Conservation and Attractions (DBCA) TEC and PEC database to determine conservation significant ecological communities previously recorded within the study area (as provided by PTA)
- The DBCA *NatureMap* database for conservation significant flora and fauna species previously recorded within the study area
- The DBCA Threatened (Declared Rare) and Priority Flora database (TPFL) and the WA herbarium database (WAHERB) for Threatened and Priority flora species listed under the *Biodiversity Conservation Act 2016* (BC Act) and or as Priority by DBCA, previously recorded within the study area (as provided by PTA).

2.2 Field survey

2.2.1 Vegetation and flora

GHD botanist Anna Napier (flora licence no. SL012292) completed a vegetation and flora assessment, a targeted flora survey of the survey area on 1-3 October 2019. The field survey was undertaken to verify the results of the desktop assessment, identify and describe the dominant vegetation units, assess vegetation condition, and identify and record vascular flora taxa present at the time of survey. Searches for conservation significant flora taxa were also undertaken during the survey.

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

Data collection

Field survey methods involved a combination of sampling quadrats and relevés located in identified vegetation units and traversing the survey area by foot. Non-permanent quadrats (measuring 10 m x 10 m – area of 100 m^2) were located within identified vegetation units and throughout the survey area to cover geographic range. The quadrat and relevé data was supplemented by previous survey effort in adjacent areas (as part of the TCL project). Field data at each quadrat was recorded on a pro-forma data sheet and included the parameters detailed in Table 1.

Table 1 Quadrat data collection

Aspect	Measurement
Collection attributes	Site code, personnel/recorder, quadrat dimensions and photograph of the quadrat
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, leaf and wood litter
Location	Coordinate recorded in GDA94 using a hand-held Global Positioning System (GPS) tool to an accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition using the condition rating scale adapted by EPA (2016a) for the South West Botanical Province.
Disturbance	Level and nature of disturbance (e.g. weed presence, fire and time since last fire, impacts from grazing, anthropogenic impacts)
Flora	List of dominant flora from each structural layer, list of all species within the quadrat including stratum, average height and cover (using National Vegetation Information System (NVIS))

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

Vegetation units and mapping

Vegetation units were identified and boundaries mapped using a combination of aerial photography, field data/observations and previous vegetation mapping. The vegetation units were aligned to previously described vegetation units (e.g. GHD 2019a) where possible. The vegetation units were described based on structure, dominant taxa and cover characteristics as defined by quadrat data and field observations. Vegetation unit descriptions followed NVIS and were consistent with NVIS level V (Association) (NVIS Technical Working Group 2017).

Identification of vegetation growing in association with wetlands or watercourses

Vegetation growing in association with wetlands or watercourses was identified based on field observations (e.g. vegetation structure, typical and common species, soils and landforms).

Vegetation condition

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

Targeted flora searches

Targeted searches for conservation significant flora were undertake during the field survey. Within the survey area, and in line with previous survey efforts for the TCL project, GHD undertook systematic searches via walking traverses spaced approximately 5 metres (m) apart in areas of native vegetation in Degraded or better condition. This traverse spacing equates to a 2.5 m search area either side of the walked traverse, which is deemed sufficient intensity for the taxa to be targeted, notably *Caladenia huegelii* which is listed as Endangered under the EPBC Act and BC Act.

Where individuals were identified, the location and number of plants present was recorded using a handheld GPS. Additional data was also recorded to support the lodgement of a Threatened and Priority Flora Report Form.

Flora identification and nomenclature

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

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

2.2.2 Fauna

GHD zoologist Robert Browne-Cooper undertook a black cockatoo habitat assessment of the survey area from 1-3 October 2019. The survey area was traversed on foot to identify and map suitable black cockatoo habitat. An assessment of the likelihood of occurrence of conservation significant fauna was also undertaken based on the database searches and previous local studies, with consideration of fauna habitats occurring within the survey area.

Where relevant, the survey methodology employed by GHD was undertaken with reference to the EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016b).

Black cockatoo assessment

The black cockatoo habitat assessment was undertaken in accordance with the EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (vulnerable) *Calyptorhynchus baundinii*, Forest Red Tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksii naso* (Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) 2012). The assessment included:

- The identification and recording (via GPS) of the locations of potential and actual breeding habitat within the survey area (relevant tree species with a diameter at breast height (DBH) of >500 millimetres (mm) for Jarrah, Marri and Tuart or DBH of >300 mm for Wandoo or Salmon Gum)
- Identifying, describing and recording the size of existing tree hollows and any evidence of use by black cockatoos within the survey area
- Identifying, recording and describing the locations of potential night roosting habitat
- Identifying, recording and describing the locations of foraging habitat.

The survey distinguished between actual and potential breeding habitat as per the following:

- Actual nest trees: Evidenced as currently being used or have been used in the past
- Potential breeding habitat: trees with available hollows that do not show evidence of use now or in the past. Trees with hollows that do not show evidence of use now or in the past where the hollow is not available (e.g. hollows are occupied by bees or galahs); and those trees without hollows but which have the potential to develop hollows in the future, and which have DBH >500 mm or 300 mm for different species. This was a ground based assessment using binoculars to identify potential and/or actual breeding hollows.

Fauna species identification

Identification of fauna species was made in the field using available field guides and electronic guides (e.g. Morcombe 2004). Nomenclature used in this report follows that used by the WA

Museum and the DBCA *NatureMap* database (DBCA 2007–) with the exception of birds, where by Christidis and Boles (2008) was used.

2.3 Limitations

2.3.1 Desktop limitations

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the DBCA searches of threatened flora and fauna provide more accurate information for the general area. However, some records of collections, sightings or trappings cannot be dated and often misrepresent the current range of threatened species.

2.3.2 Field survey limitations

The EPA (2016a) Technical Guide states flora and vegetation survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2 Field survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area, this includes: • Thornlie-Cockburn Link Project, Flora and Fauna Survey (GHD 2019a) • Thornlie-Cockburn Link Project, Additional Targeted Flora Survey (GHD 2019b).
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The vegetation and flora survey and targeted flora searches were undertaken in spring 2019. The flora recorded from the field survey is detailed in 4.4 and a full flora species list is provided in Appendix D. The portion of flora collected and identified was considered high. As with any biological survey, ephemeral species such as orchids are not always present in each year/season or at the particular time a single botanical survey is conducted. The black cockatoo habitat assessment was undertaken in spring 2019. The assessment was limited to identifying habitat types for black cockatoos and other conservation significant fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred.
Flora determination	Minor	Flora determination was undertaken by the GHD botanist in the field and at the WA Herbarium. Six taxa could be identified to genus level only and three taxa tentatively identified to species level due to lack of flowering and/or fruiting material required for identification. These collections showed no similarity with known, likely or possibly occurring conservation significant flora identified in the desktop searches. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Nil	All areas were fully surveyed during the field survey.
Mapping reliability	Minor	The vegetation was mapped using high-resolution ESRI aerial imagery obtained from Landgate, topographical features, previous broad scale mapping (GHD 2019a) and field data. Data was recorded in the field using hand-held GPS tools (e.g. Samsung S2 Tablets and Garmin GPS). Certain atmospheric factors and other sources can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ±5 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/ season/cycle	Minor	The flora and vegetation field survey and the black cockatoo habitat assessment were conducted during spring (1-3 October 2019).

Aspect	Constraint	Comment
		In the three months prior to the ecological survey (July - September), the Gosnells City weather recording station recorded a total of 230 mm of rainfall. This total is lower than the average for this period, which is 365.2 mm (BoM 2019). The weather conditions recorded during the survey periods are considered unlikely to have impacted upon the flora and fauna survey. The survey timings were considered appropriate for the flora and fauna field survey.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	Much of the survey area has been subjected to historical disturbance events (e.g. clearing, dumping); however, these disturbances did not impact the survey.
Intensity (in retrospect, was the intensity adequate)	Minor	The vascular flora of the survey area was sampled based on EPA (2016a); where possible a minimum of two quadrats per vegetation type were established along with relevés to supplement the data. The quadrat and relevé data was supplemented by previous survey effort in adjacent areas (as part of the TCL project). The survey area was sufficiently covered by the GHD zoologists and botanists during the survey.
Resources	Nil	Adequate resources were employed during the field survey: 5 person days were spent undertaking the surveys using a dedicated zoologist and botanist.
Access restrictions	Nil	The survey area was accessed on foot and traversed by vehicle. No access issues were encountered during the field survey.
Experience levels	Nil	The botanist and zoologist who executed the survey are practitioners suitably qualified and experienced in their respective fields. Anna Napier (Principal botanist) has over 30 years' experience undertaking flora surveys within WA. Robert Browne-Cooper (Senior zoologist) has over 20 years' experience undertaking fauna surveys within WA.

3. Desktop assessment

3.1 Literature review

A biological assessment (GHD 2019a) and targeted flora survey (GHD 2019b) have been previously completed for the TCL project. A summary of the methods and results from both scopes of work is provided below.

Thornlie Cockburn Link Project, Flora and Fauna Survey (GHD 2019a)

GHD completed a detailed vegetation and flora assessment, a targeted *Caladenia huegelii* survey, Level 1 fauna survey (reconnaissance survey) and black cockatoo habitat assessment of the TCL survey area which covered 157.90 ha. Multiple surveys were undertaken with survey effort in September and October 2017, and February, March, September, October and December 2018. The survey area was extensively traversed on foot during the surveys.

Eleven vegetation types were described from 12 non-permanent quadrats and nine relevés sampled within the survey area. There were seven types representing remnant native vegetation communities including two dryland types and five dampland types. The remaining four types vary between drylands and damplands and were in varied states of degradation due to previous modifications to the landscape. The vegetation condition within the survey area was rated from Excellent to Degraded – Completely Degraded in condition. Cleared areas associated with roads, rail and infrastructure made up nearly half (48 %) of the survey area. The majority of the remaining vegetated areas of the survey area were in Degraded to Completely Degraded condition (70 %).

Field observations and statistical analysis determined the presence of two conservation significant ecological communities within the survey area, the Banksia Woodlands of the Swan Coastal Plain TEC (listed as Endangered under the EPBC Act) and the Low lying Banksia attenuata woodlands or shrublands (FCT 21c) PEC (listed as Priority 3 by DBCA).

The survey area intersected the Canning River and 18 geomorphic wetlands including seven Conservation Category Wetlands, six Resource Enhancement Wetlands and five Multiple Use Wetlands. Of the 18 wetlands intersecting the survey area, seven supported native dampland vegetation. The remaining 11 wetlands had either been cleared or landscaped.

One hundred and eighty seven (187) flora taxa representing 52 families and 140 genera were recorded from the survey area during the field survey. This total comprised 119 native taxa and 68 introduced flora taxa. Of the introduced taxa, six were listed as Declared Pests and/or as a WoNS.

Other than *Caladenia huegelii*, no EPBC Act or BC Act listed flora were recorded within the survey area during the GHD survey. *Caladenia huegelii* is listed as Endangered under the EPBC Act and Threatened under the BC Act and has been previously recorded in the Caladenia Grove Wetland Reserve. Individuals of *C. huegelii* were recorded within the Reserve growing in *Banksia* woodland and also outside, but adjacent to the survey area within the northern section of Ken Hurst Park. Within the survey area several vegetation types meet the habitat requirements of *C. huegelii*. However, these areas have been extensively searched with no additional *C. huegelii* individuals located.

Dodonaea hackettiana listed as a Priority 4 by DBCA has previously been recorded within the survey area near the Ranford Road Waste Transfer Station. This location was revisited during the field surveys, but no individuals of *D. hackettiana* were observed. A likelihood of occurrence assessment conducted post-field surveys concluded that two taxa are known to occur, *Caladenia huegelii* and *Dodonaea hackettiana*. The remaining conservation significant taxa

were considered unlikely to occur within the survey area. Although the survey area has some suitable habitat for conservation significant species, the survey area has been subject to intensive targeted flora searches/effort (see GHD 2019b).

Eight broad fauna habitats were recorded within the survey area, with four of these habitat types providing high value habitat for fauna. All of the habitat types identified are represented at a local and regional scale in reserves, regional parks and conservation parks. Overall the survey area retains moderate local and regional connectivity to remnant vegetation in the region, in what is otherwise a fragmented environment.

The fauna survey recorded 66 species (native and introduced) comprising 45 birds, 11 reptiles, seven mammals and three frogs. Three species of conservation significance were recorded during the survey, Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*). A further possible six conservation significant species were considered likely to occur within the survey area.

A Black Cockatoo assessment identified suitable foraging habitat and potential breeding trees within the survey area. Of these, none had evidence of being previously used for nesting and none had suitable hollows for current breeding.

Thornlie Cockburn Link Project, Additional Targeted Flora Survey (GHD 2019b)

GHD completed additional targeted surveys for conservation significant flora. The surveys focused on conservation significant flora that were known or considered likely to occur (based on initial survey effort between September 2017 and March 2018). The targeted surveys assessed a 174.29 ha area that included the TCL survey area (as described above) as well as adjacent areas of native vegetation. Survey effort included 15.5 person days between 19 September 2018 and 11 October 2018, and 12 December 2018. The sampling method involved walking traverses spaced approximately 5 m apart in areas of native vegetation (vegetation condition rating Degraded or better).

Two significant flora species were recorded during the survey, *Caladenia huegelii* (T) and *Jacksonia gracillima* (P3). A number of plants of *C. huegelii* were recorded within the Caladenia Grove Wetland Reserve and within the northern section of Ken Hurst Park. Individuals of *Jacksonia gracillima* were recorded in in Tom Bateman Reserve, outside of the TCL survey area assessed as part of GHD (2019a). A review of available habitats, species habit and form, and survey effort concluded that with the exception of the two recorded species (*Caladenia huegelii* and *Jacksonia gracillima*) all other species were considered unlikely to occur in the survey area.

3.2 Conservation significant ecological communities

The EPBC Act PMST identified four EPBC Act-listed TECs potentially occurring within the study area. Three of these TECs and a further four PECs were also identified in a search of the DBCA TEC/PEC database. Details for these communities are provided in Table 3. The DBCA TEC/PEC database search results are shown on Figure 2, Appendix A.

The majority of the survey area overlays occurrences of the Banksia woodlands of the Swan Coastal Plain TEC/PEC.

Table 3 Threatened and Priority Ecological Communities identified in the desktop searches

Community type	EPBC Act	DBCA	Description	Location
Shrublands on dry clay flats – SCP10a (TEC)	Critically Endangered	Endangered	This is the most rapidly drying of the clay flats vegetation community types. The microtopography is generally shallower and they have thin skeletal soils. This vegetation community type has a high species richness and includes the aquatic annuals and geophytes typical of other clay pan and clay flat vegetation community types (e.g. *Schoenus natans*, *Crassula natans, Eryngium pinnatifidum* subsp. *palustre* ms*, Wurmbea dioica* subsp. *alba* and *Amphibromus nervosus*). There are many species of herbs in this vegetation community type in spring. The shrub layer is dominated by species of Hakea (*H. varia* and *H. sulcata*) which, along with *Pericalymma ellipticum*, is indicative of a short inundation period.	One occurrence of the community, 3.8 km east of the survey area
Herb rich shrublands in clay pans – SCP08 (TEC)	Critically Endangered	Vulnerable	This vegetation community type occurs in low lying flats with a clay impeding layer allowing seasonal inundation. While aquatic annuals are common, the pools are probably not inundated to the same depth or for the same length of time as in the Herb rich saline shrublands in clay pans TEC (SCP07). This vegetation community type is dominated by one or more of the shrubs: *Viminaria juncea, Melaleuca viminea, M. lateritia* (robin redbreast bush), broom bush, *Kunzea micrantha* or *K. recurva* with occasional emergent of *Eucalyptus wandoo*. Species such as *Hypocalymma angustifolium*, *Acacia lasiocarpa* var. *bracteolata* long peduncle variant (G. J. Keighery 5026) and *Verticordia huegelii* occur at moderate frequencies. This vegetation community type has a high percentage of weeds and appears to be the clay pan vegetation community type that has the greatest disturbance.	Three occurrences of this community; the closest is 3.8 km east of the survey area
Banksia woodlands of the Swan Coastal Plain (TEC and PEC)	Endangered	Priority 3	The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia. A key diagnostic feature is a prominent tree layer of *Banksia*, with scattered eucalypts and other tree species often present among or emerging above the *Banksia* canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range.	806 occurrences of this community occur within and around the survey area.

Community type	EPBC Act	DBCA	Description	Location
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (TEC) Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain IBRA region (PEC)	Critically Endangered	Priority 3	Mostly confined to Quindalup Dunes and Spearwood Dunes from Jurien Bay to the Sabina River, with outliers along some rivers. Tuart is the key dominant canopy species however Tuart communities comprise a variety of flora and fauna assemblages. Flora commonly occurring with Tuart include Peppermint (*Agonis flexuosa*), *Banksia attenuata, Banksia grandis, Allocasuarina fraseriana, Xylomelum occidentale, Macrozamia riedlei, Xanthorrhoea preissii, Spyridium globulosum, Templetonia retusa* and *Diplolaena dampieri*.	No occurrences. Identified in the EPBC Act Protected Matters search
Subtropical and Temperate Coastal Saltmarsh (TEC)	Vulnerable	Priority 3	The Subtropical and Temperate Coastal Saltmarsh consists of an assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23 ºS latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5 m tall with the exception of some reeds and sedges. Many species of nonvascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. *Tecticornia*) • dominance by grasses (e.g. *Sporobolus virginicus*) • dominance by sedges and grasses (e.g. *Juncus kraussii*, *Gahnia trifida*) • dominance by herbs (e.g. low-growing creeping plants such as *Wilsonia backhousei*, *Samolus repens*, *Schoenus nitens*).	Seven occurrences of this community; the closest is 3.6 km north of the survey area

Community type	EPBC Act	DBCA	Description	Location
Wooded wetlands which support colonial waterbird nesting areas (PEC)		Priority 2	Chandala, Booragoon Lake, unnamed wetland near Pinjarra, McCarleys Swamp. This type differs from the listed 'Perched wetlands of the Wheatbelt region with extensive stands of *Casuarina obesa* and *Melaleuca strobophylla'* ('Toolibin-type' wetlands) in that the Wheatbelt type is *Casuarina*, rather than *Melaleuca* dominated. Also, Toolobin Lake type is now brackish-saline (formerly fresh-brackish), whereas this type are currently fresh-brackish.	One occurrence of this community, 3.2 km north of the survey area
Banksia ilicifolia woodlands –SCP22 (PEC)*	Endangered TEC (part)	Priority 2	Low lying sites generally consisting of *Banksia ilicifolia – B. attenuata* woodlands, but *Melaleuca preissiana* woodlands and scrubs are also recorded. Occurs on Bassendean and Spearwood systems in the central Swan Coastal Plain north of Rockingham. Typically has very open understorey, and sites are likely to be seasonally waterlogged.	Four occurrences of this community; the closest is 850 m south of the survey area
Northern Spearwood shrublands and woodlands – SCP24 (PEC)*	Endangered TEC (part)	Priority 3	Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra sessilis, Calothamnus quadrifidus* and *Schoenus grandiflorus.*	One occurrence; 3.8 km south of the survey area
Low lying *Banksia attenuata* woodlands or shrublands – SCP21c (PEC)*	Endangered TEC (part)	Priority 3	This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana, Banksia attenuata, B. menziesii, Regelia ciliata, Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland.	Three occurrences of this community; the closest is 850 m south of the survey area

* Can be a component of the Endangered Banksia woodlands of the SCP EPBC listed TEC

3.3 Conservation significant flora

Desktop searches of the EPBC Act PMST database, *NatureMap* database and DBCA TPFL and WAHERB databases identified the presence/potential presence of 36 conservation significant flora taxa within the study area. The desktop searches recorded:

- 15 taxa listed under the EPBC Act and/or as Threatened under the BC Act
- Two Priority 1 taxa
- Three Priority 2 taxa
- Nine Priority 3 taxa
- Seven Priority 4 taxa.

The locations of conservation significant flora registered on the DBCA databases are mapped in Figure 2, Appendix A.

3.4 Conservation significant fauna

The EPBC Act PMST and *NatureMap* database identified the presence, or potential presence of 47 conservation significant fauna species, excluding those species that are exclusively marine or migratory/marine as no marine habitat was present within the survey area. The desktop searches recorded:

- 16 species listed under the EPBC Act and/or as Threatened under the BC Act
- 19 species listed as Migratory under the EPBC Act and BC Act
- One species listed as Other specially protected fauna under the BC Act
- 11 species listed as Priority by DBCA.

4. Field survey results

4.1 Vegetation types

The survey area comprises four areas that are mostly modified through previous clearing, possible dieback infestation and weed invasion. Seven vegetation types as well as planted, non-native vegetation and cleared areas were identified within the survey area (Table 4 and Figure 3, Appendix A). Three of the vegetation types represent remnant native vegetation communities, all upland communities. The remaining four vegetation types are in varied states of degradation due to previous modifications to the landscape and are not considered remnant native vegetation.

Banksia menziesii and *B. attenuata* woodland (VT01) was recorded from two areas within the survey area. This community was characterised by *Banksia* spp. in the overstorey over a sparse shrubland and diverse heathland. It is possible both mixed vegetation types *Banksia* open woodland) (VT11) and mixed trees and shrubs over introduced herbs (VT12) represent degraded forms of VT01. Both VT11 and VT12 were recorded in the vicinity of VT01 and field observations indicate weed incursion as well as possible dieback present in both types. All three vegetation types, VT01, VT11 and VT12 are considered remnant vegetation.

A large proportion of the survey area have been cleared and contain various aged revegetation (VT10). These revegetated areas largely comprise native species. One area of the survey area contained revegetated dense *Corymbia calophylla* (Marri) woodland estimated to be 20+ years old. This area has been mapped separately as *Corymbia calophylla* open woodland (VT08).

The remaining vegetation types include scattered natives amongst weeds (VT06) and grassland/ Herbland (VT07), with planted, non-native vegetation described as VT13.

No vegetation growing in association with wetlands or watercourses was identified during the field survey.

4.2 Vegetation condition

The vegetation within the survey area was rated from Good to Completely Degraded in condition. The extents of the vegetation condition ratings mapped within the survey area are detailed in Table 5 and mapped in Figure 4, Appendix A.

Cleared areas associated with roads, tracks etc. comprise approximately (15 %) of the survey area. The majority of the vegetated areas within the survey area are in Degraded or worse condition. This condition rating is due to historical clearing and the presence weeds and possibly dieback that occurs through the survey area. Small areas of vegetation in Good condition occur scattered throughout the survey area and are associated with VT01 and VT11.

Table 4 Recorded vegetation types

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Banksia menziesii and B. attenuata woodland (VT01)	*Eucalyptus todtiana, Nuytsia floribunda, Banksia ilicifolia* isolated trees over *B. menziesii, B attenuata* woodland over *Xanthorrhoea preissii, Hibbertia spp.* sparse shrubland over diverse heathland	Plain with grey sandy soils.	0.91	Q3, Q4 and Q5 May possibly align with FCT 23a	
Scattered natives amongst weeds (VT06)	*Corymbia calophylla/ Eucalyptus rudis/ E. todtiana/ E. gomphocephala/ *Eucalyptus* spp.* isolated trees over introduced herbland/ grassland	Plain with grey sandy soils.	1.62	No alignment with any FCTs	
Grassland/ Herbland (VT07)	Weedy closed grassland/ herbland with occasional natives	Plains with black clay/ loamy soils.	0.22	No alignment with any FCTs	
Corymbia calophylla open woodland (VT08)	*Corymbia calophylla* open woodland over *Jacksonia furcellata, Acacia pulchella* sparse mid shrubland over *Phlebocarya ciliatum, Dasypogon bromeliifolius* herbland	Plain with grey sandy soils.	0.15	No clear alignment with any FCTs	

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Revegetation (VT10)	*Calothamnus sanguineus, C. quadrifidus, Melaleuca systena, Acacia rostellifera, Chamelaucium uncinatum* shrubland over introduced herbs. **Eucalyptus maculata, E. platypus*, *E. rudis* isolated trees over *Callistemon phoeniceus, Chamelaucium uncinatum, Adenanthos* sp., *Melaleuca nesophila* shrubland over mixed low shrubs, herbs and grasses.	Yellow/grey sand embankment slopes	3.38	No alignment with any FCTs	
Mixed *Banksia* open woodland (VT11)	*Eucalyptus todtiana* isolated trees over *Banksia menziesii, B attenuata* isolated trees over *B. sessilis, Kunzea glabrescens, Xanthorrhoea preissii* sparse shrubland over *Phlebocarya ciliatum, Dasypogon bromeliifolius* and *Hypolaena exsulca* open herbland.	Plain with grey sandy soils.	1.32	Q1 and Q2 No clear alignment with any FCTs	
Mixed trees and shrubs over introduced herbs (VT12)	*Eucalyptus todtiana* woodland over *Melaleuca preissiana*, *Banksia sessilis* isolated shrubs over *Adenanthos cygnorum, *Acacia longifolia, *Acacia iteaphylla*, *Kunzea glabrescens* isolated clumps of shrubs over dense weeds.		0.77	No clear alignment with any FCTs	

Vegetation type	Vegetation type description	Landform and substrate	Extent (ha)	Sample locations and notes	Representative photograph
Planted trees (VT13)	Planted, non-native trees.	Modified landforms	0.50	No alignment with any FCTs	
Road, rail and/ or infrastructure	Cleared of vegetation		1.87	-	

Table 5 Extent of vegetation condition ratings mapped within the survey area

Condition rating	Extent (ha)
Good	2.42
Good – Degraded	0.32
Degraded	4.94
Degraded – Completely Degraded	0.67
Completely Degraded	0.54
Cleared	1.87
Total	10.75

4.3 Conservation significant ecological communities

By assessing the vegetation types described at a broad level, based on dominant species, landform features and field observations one conservation significant ecological community was identified to occur within the survey area. This community is the *Banksia* Woodlands of the SCP which is listed as an Endangered TEC under the EPBC Act and as a Priority 3 PEC by DBCA.

Banksia Woodlands of the SCP

The *Banksia* Woodlands of the SCP TEC is restricted to the SCP IBRA bioregion and immediately adjacent areas, including the Dandaragan Plateau, from Jurien Bay in the north, to Dunsborough in the south, and northwest on the Whicher and Darling escarpments (DEE 2016). The ecological community typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands (DEE 2016).

During the field survey one vegetation type, *Banksia menziesii* and *B. attenuata* woodland (VT01), was assessed as meeting the key diagnostic characteristics for the *Banksia* Woodlands of the SCP TEC, as outlined in DEE (2016). Specifically:

- The survey area occurs in the SCP IBRA bioregion
- The survey area occurs on sandplain landform, notably Bassendean sands
- The vegetation type has a low woodland structure and the upper sclerophyllous layer dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*. The understorey consists of a mid-ground sclerophyllous shrub layer and/or herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs that sometimes includes grasses.

Further assessment of this vegetation type identified one patch within the survey area meets the minimum condition criteria outlined in DEE (2016). The patch within the survey area is part of a larger patch (Patch 2), previously described by GHD (2019a). Details on this patch is provided in Table 6 with the TEC extent mapped in Figure 5, Appendix A.

The Banksia Woodlands of the SCP PEC is analogous with the TEC condition and patch size thresholds. There is 0.12 ha of vegetation in the survey area representative of the *Banksia* Woodlands of the SCP TEC and PEC.

Table 6 Extent of *Banksia* Woodlands of the SCP TEC and PEC within the survey area

Patch ID	Vegetation type	Vegetation condition and extent (ha)	Comments
Patch 2 (as previously described in GHD 2019a)	VT01	Good: 0.12 Total area: 0.12	Areas mapped as TEC and PEC are on the south and eastern boundary of Ken Hurst Park and are part of a larger patch that extends outside of the survey area (to the north and west). Vegetation mapping by 360 Environmental (2012) indicates there is approximately 28 ha of *Banksia* woodland in Good to Very Good condition within Ken Hurst Park. Additional *Banksia* communities also extend west of Ken Hurst Park (on the northern side of the railway line) covering approximately 4 ha. Based on this mapping it is estimated less than 1% of the patch occurs within the survey area.

4.4 Flora diversity

One hundred and forty seven (147) flora taxa (including subspecies and varieties) representing 39 families and 107 genera were recorded from the survey area during the field survey. This total comprised of 97 native and 50 introduced flora taxa, with 18 taxa recorded as planted.

Dominant families recorded from the survey area included:

- Myrtaceae (26 taxa)
- Fabaceae (23 taxa)
- Proteaceae (17 taxa).

A flora list for the survey area is provided in Appendix D.

4.5 Conservation significant flora

No flora listed under the EPBC Act, BC Act or as a Priority by DBCA were recorded in the survey area.

Likelihood of occurrence

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

The likelihood of occurrence assessment post-field survey concluded that all taxa are considered unlikely to occur within the survey area. Although the survey area has some, albeit minimal suitable habitat for conservation significant species, the survey area has been subject to intensive targeted flora searches/effort. Furthermore, the desktop searches identified a number of conservation significant species occurring within 1 km of the survey area which is largely a result of its proximity to the Brixton Street Wetlands. The Brixton Street Wetlands is the most floristically diverse Bush Forever site on the SCP and contains a number of rare and restricted plant species and vegetation communities (DEE 2018). A large proportion of the

significant flora found within this reserve are considered unlikely to be present within the survey area due to the cleared and degraded nature of the survey area and lack of suitable habitat.

4.6 Introduced flora

Fifty (50) introduced flora taxa were recorded in the survey area. The majority of the survey area has been impacted to some degree and has resulted in the establishment of introduced species. Of the introduced taxa, one is listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* and as a WONS, **Asparagus asparagoides* (Bridal Creeper). Bridal Creeper was recorded from one location in the survey area (Figure 4, Appendix A).

4.7 Black cockatoo habitat

Potential Breeding

Seven potential breeding trees were recorded within the survey area (Figure 6, Appendix A). These trees are a non-locally occurring eucalyptus species that meet the criteria of having trunk diameter (DBH) greater than 500 mm. No potential nest hollows were detected in these trees, and no black cockatoo spring breeding behaviour was observed within the survey area. Several native trees: Jarrah and Marri, were noted within the survey area although these had DBH less than 500 mm.

Foraging

Based on the vegetation assemblages present, the survey area has remnant patches of high quality foraging habitat for black cockatoos. These areas include small areas of mixed Jarrah *Banksia* woodlands and remnant Marri trees. Recent signs of Forest Red-tailed Black Cockatoo include chewed Marri and Jarrah pods. Carnaby's Cockatoo foraging signs were found in the *Banksia* woodland patches shown on Figure 6, Appendix A with foraging evidence data provided in Appendix E. There is 2.35 ha of high quality foraging habitat and 4.46 ha of low quality foraging habitat for black cockatoos present within the survey area.

Roosting

No known black cockatoo roost sites are located within the survey area. The closest known roosts in proximity of the survey area include: Bibra Lakes located 0.5 km north; Leeming located 1.7 km west; and Success located 2.4 km south of the survey area.

4.8 Other conservation significant fauna

The Quenda or Southern Brown Bandicoot was recorded within the survey area based on extensive diggings and scats. This species forages within the survey area and is also likely to shelter within the remnant *Banksia* woodland and disturbed areas where adequate density of low strata vegetation provides refuge habitat.

No other conservation significant fauna species were recorded during the survey. The likelihood of occurrence assessment post-field survey (Appendix E) concluded the Peregrine Falcon, Perth Slider (Lined Skink), Black-striped Snake, and Graceful Sunmoth are considered likely to occur within the survey area, with all other fauna considered unlikely or highly unlikely to occur.

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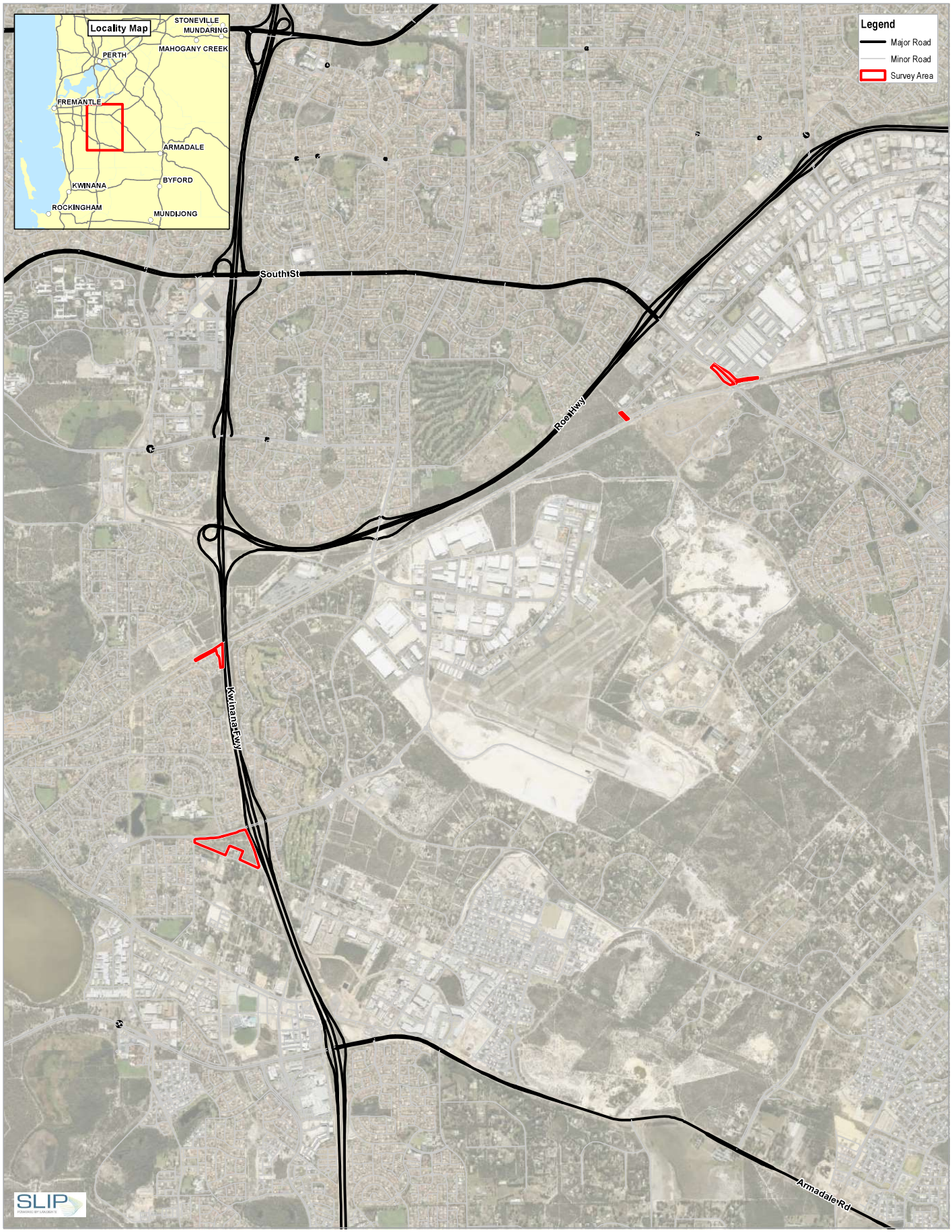
Appendices

Appendix A – Figures



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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Project Location

Project No. 12536120
Revision No. 0
Date 28/07/2020

FIGURE 1

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Biological Constraints

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 2

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Vegetation Types and Sample Locations

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 3-1

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Vegetation Types and Sample Locations

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 3-2

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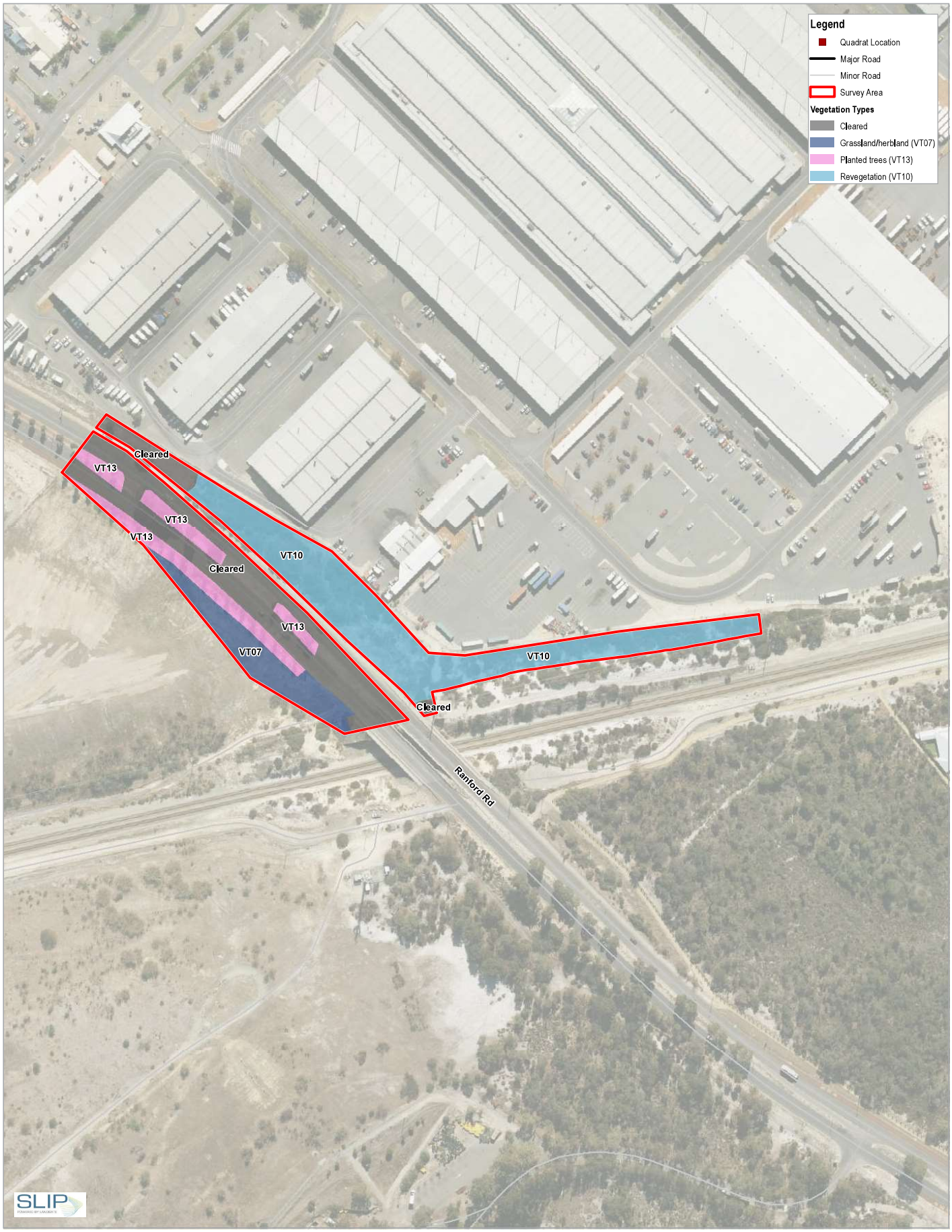

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Vegetation Types and Sample Locations

Project No. 12536120
Revision No. 0
Date 28/07/2020

FIGURE 3-3

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Vegetation Types and Sample Locations

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 3-4

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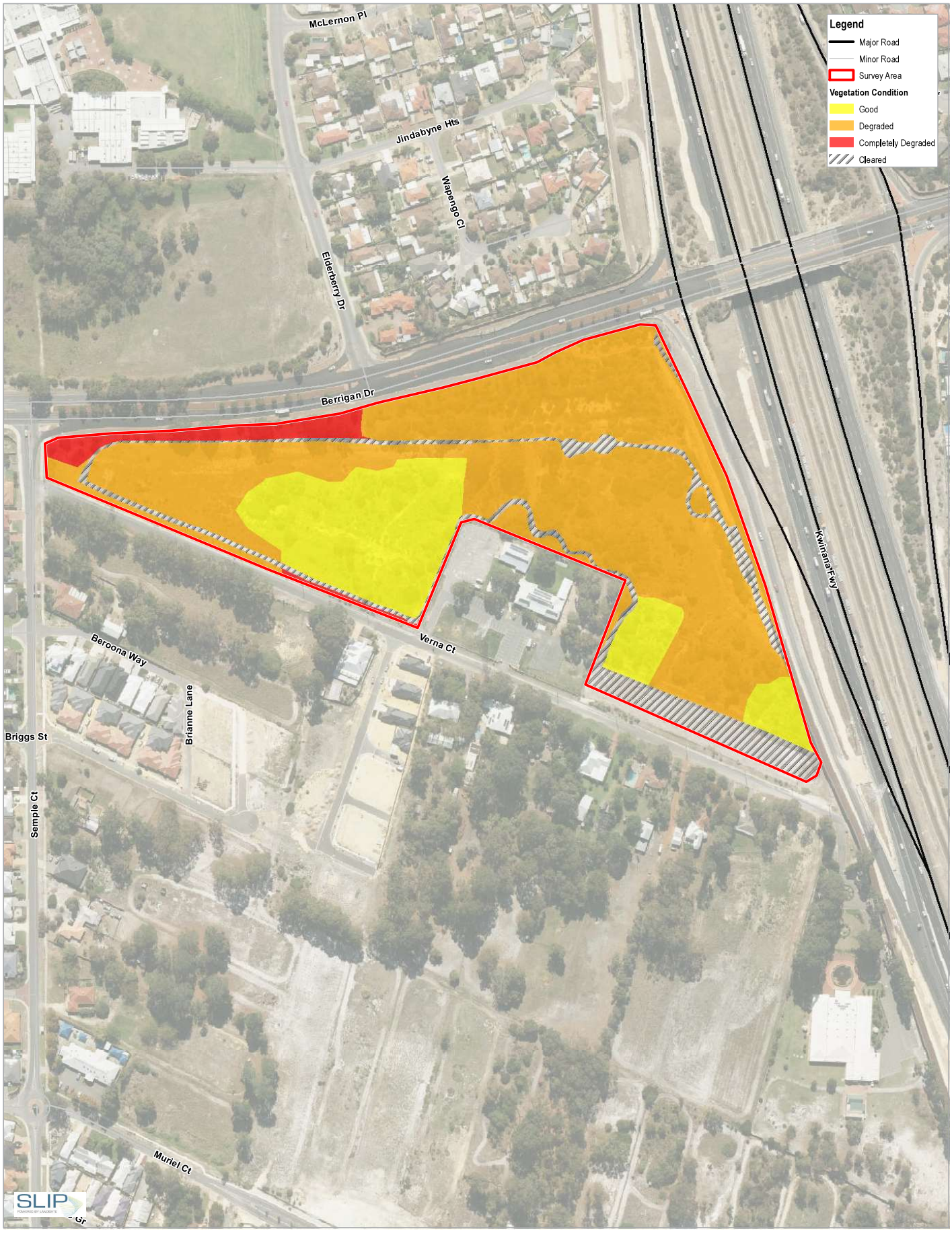

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Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Vegetation Condition

Project No. 12536120
Revision No. 0
Date 28/07/2020

FIGURE 4-1

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Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Vegetation Condition

Project No. 12536120
Revision No. 0
Date 28/07/2020

FIGURE 4-2

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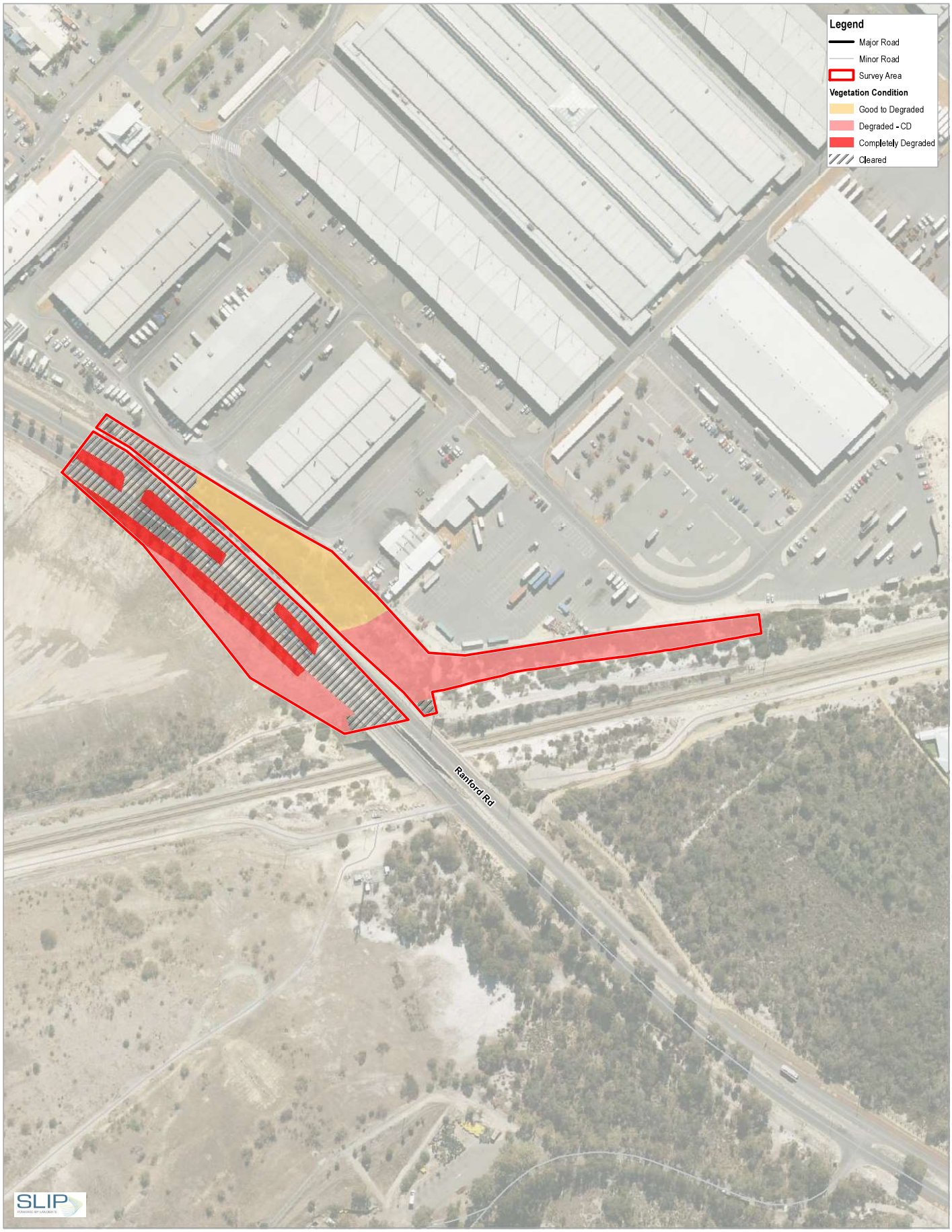

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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Vegetation Condition

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 4-3

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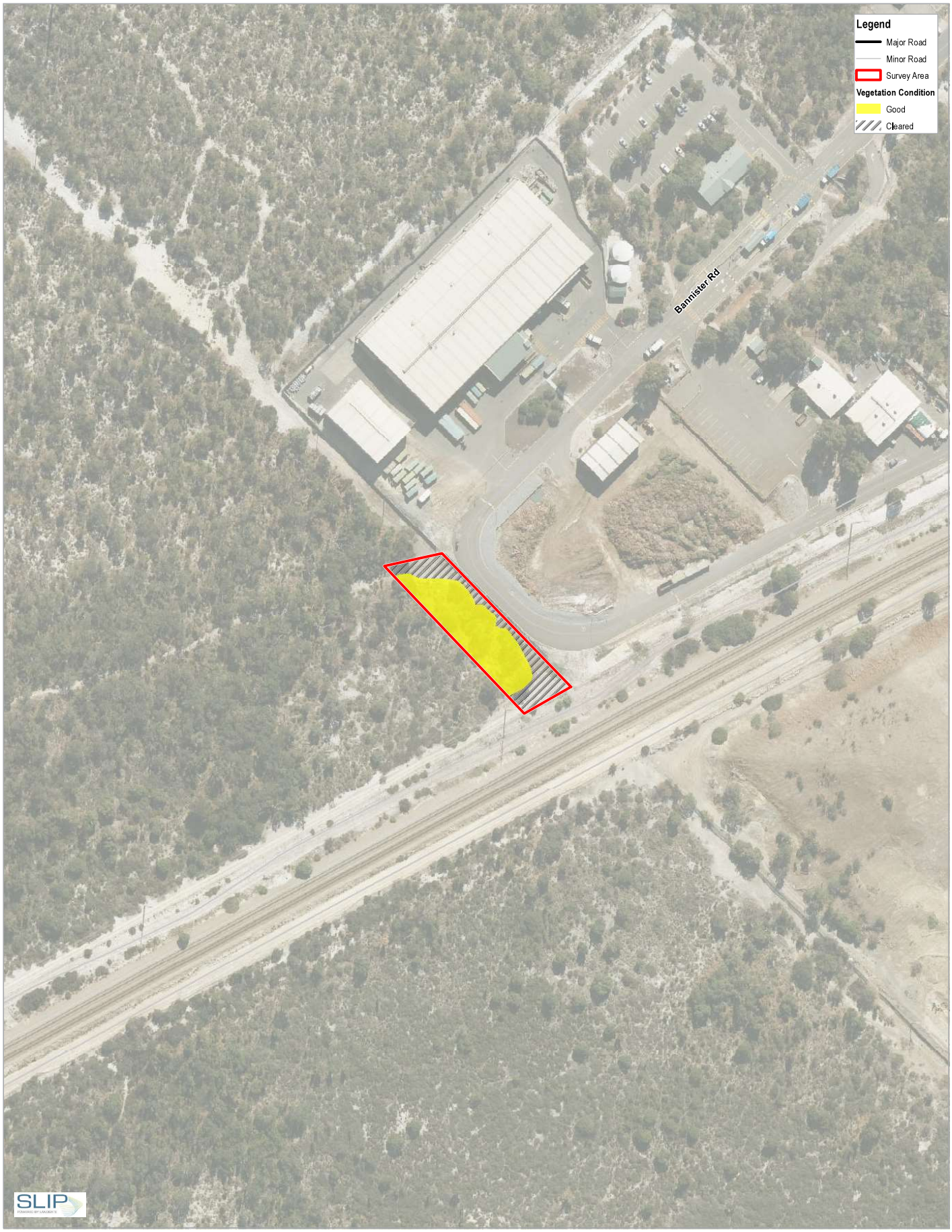

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Metres

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

N

GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Vegetation Condition

Project No. 12536120
Revision No. 0
Date 28/07/2020

FIGURE 4-4

G:\61\12536120\GIS\Maps\Working\12536120_004_VegetationCondition_Rev0.mxd
Print date: 28 Jul 2020 - 10:48

Data source: GHD: Vegetation Condition - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820. Created by: bmorgan

Paper Size ISO A3

0 9.5 19 28.5 38

Metres

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

N

GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Ecological Communities

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 5-1

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantEcologicalCommunities_Rev0.mxd
Print date: 28 Jul 2020 - 10:50

Data source: GHD: Banksia Woodlands of the SCP TEC, Banksia-dominated woodlands of the SCP IBRA region PEC - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820.
Created by: bmorgan

Paper Size ISO A3

0 7.5 15 22.5 30

Metres

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

N

GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Ecological Communities

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 5-2

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantEcologicalCommunities_Rev0.mxd
Print date: 28 Jul 2020 - 10:50

Data source: GHD: Banksia Woodlands of the SCP TEC, Banksia-dominated woodlands of the SCP IBRA region PEC - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820.
Created by: bmorgan

Paper Size ISO A3

0 7.5 15 22.5 30

Metres

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

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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Ecological Communities

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 5-3

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantEcologicalCommunities_Rev0.mxd
Print date: 28 Jul 2020 - 10:50

Data source: GHD: Banksia Woodlands of the SCP TEC, Banksia dominated woodlands of the SCP IBRA region PEC - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820.
Created by: bmorgan

Paper Size ISO A3

0 5.5 11 16.5 22

Metres

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

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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Ecological Communities

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 5-4

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantEcologicalCommunities_Rev0.mxd
Print date: 28 Jul 2020 - 10:50

Data source: GHD: Banksia Woodlands of the SCP TEC, Banksia dominated woodlands of the SCP IBRA region PEC - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820.
Created by: bmorgan

Paper Size ISO A3

0 10 20 30 40

Metres

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

N

GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Fauna

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 6-1

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantFauna_Rev0.mxd
Print date: 28 Jul 2020 - 10:52

Data source: GHD: Carnaby's Cockatoo foraging sign, Forest Red-tailed Black Cockatoo foraging sign, Potential Black Cockatoo breeding tree (DBH >50cm), Quenda foraging sign, Quenda scat - 20191126; Black Cockatoo Foraging Habitat - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820, Created by: bmorgan

Paper Size ISO A3

0 8 16 24 32

Metres

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

N

GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

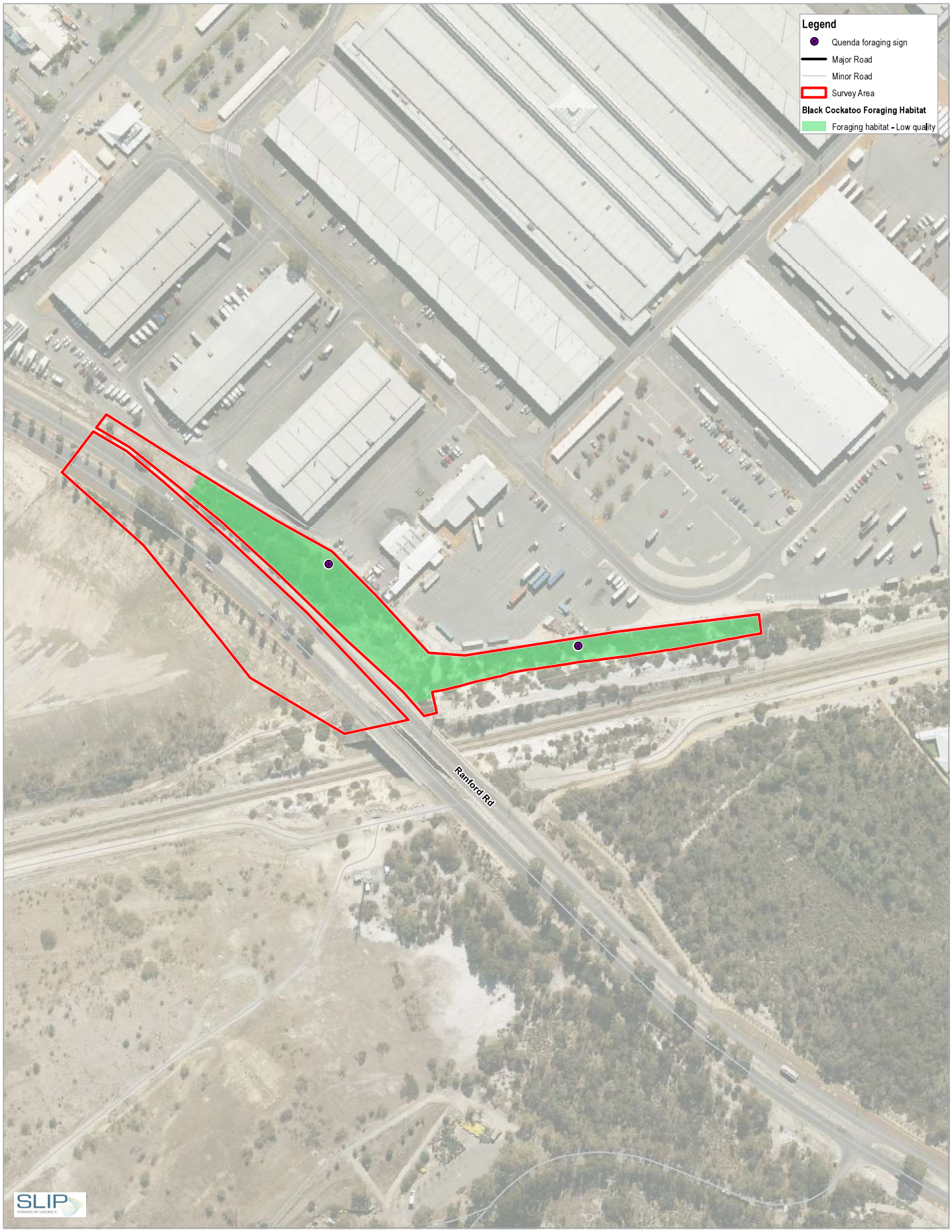
Conservation Significant Fauna

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 6-2

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantFauna_Rev0.mxd
Print date: 28 Jul 2020 - 10:52

Data source: GHD: Carnaby's Cockatoo foraging sign, Forest Red-tailed Black Cockatoo foraging sign, PotentialBlack Cockatoo breeding tree (DBH >50cm), Quenda foraging sign, Quenda scat - 20191126; Black Cockatoo Foraging Habitat - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820, Created by: bmorgan



Paper Size ISO A3

0 8 16 24 32

Metres

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

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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

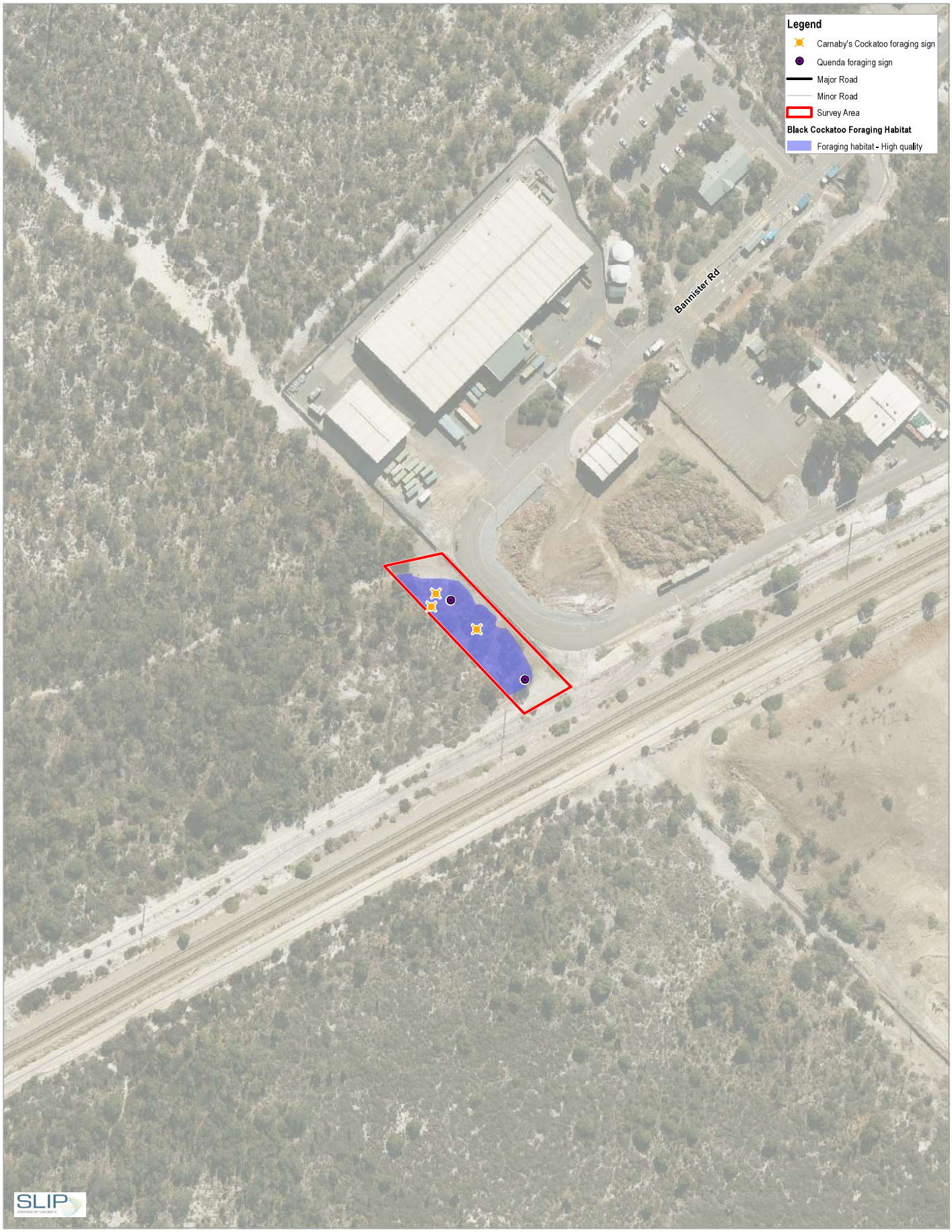
Conservation Significant Fauna

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 6-3

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantFauna_Rev0.mxd
Print date: 28 Jul 2020 - 10:52

Data source: GHD: Carnaby's Cockatoo foraging sign, Forest Red-tailed Black Cockatoo foraging sign, Potential Black Cockatoo breeding tree (DBH >50cm), Quenda foraging sign, Quenda scat - 20191126; Black Cockatoo Foraging Habitat - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820, Created by: bmorgan



Paper Size ISO A3

0 6 12 18 24

Metres

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

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GHD

Public Transport Authority
Ecological Surveys – Thomlie-Cockburn Link and Yanchep Rail Extension

Conservation Significant Fauna

Project No. **12536120**
Revision No. **0**
Date **28/07/2020**

FIGURE 6-4

G:\61\12536120\GIS\Maps\Working\12536120_005_ConservationSignificantFauna_Rev0.mxd
Print date: 28 Jul 2020 - 10:52

Data source: GHD: Carnaby's Cockatoo foraging sign, Forest Red-tailed Black Cockatoo foraging sign, Potential Black Cockatoo breeding tree (DBH >50cm), Quenda foraging sign, Quenda scat - 20191126; Black Cockatoo Foraging Habitat - 20181116, Survey Area - 20190212; LGATE: Imagery - August 2018, Roads - 20190820, Created by: bmorgan

Appendix B – Relevant legislation, conservation codes and background information

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of Agriculture, Water and Environment (DAWE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.

c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.

d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State *Biodiversity and Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration indecision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

State *Biosecurity and Agriculture Management Act 2007*

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976.* The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DPIRD Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State BC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The BC Act provides for the statutory listing of State TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs. Prior to the BC Act, the DBCA has be identifying and listing TECs to one of four categories (Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable) through a non-statutory process.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Conservation codes and definitions for TECs listed under the EPBC Act and/ or BC Act

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: A) is not critically endangered; and B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Vulnerable (VU)	An ecological community if, at that time: A) is not critically endangered or endangered; and B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Western Australia Conservation Categories (BC Act)	
Threatened Ecological Communities	

Categories	Definition
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Collapsed ecological communities	
An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time – (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed); or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover – (i) its species composition or structure; or (ii) its species composition and structure. Section 33 of the BC Act provides for a collapsed ecological community to be regarded as a threatened ecological community if it is discovered in a state that no longer makes it eligible for listing as a collapsed ecological community.	

Conservation categories and definitions for PECS as listed by the DBCA

Category	Description
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Category	Description
Priority 3	Poorly known ecological communities. (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in ‘pristine’ condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Conservation significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to the DAWE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for flora and fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species. The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of flora and fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act flora and fauna can be listed as Threatened, Extinct and as Specially Protected species.

Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act and BC Act listed flora and fauna species

Conservation category	Definition
Threatened species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species	
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).
Specially protected species	
Migratory (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species

Conservation category	Definition
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Conservation codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	Poorly-known taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	Poorly-known taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	Poorly-known taxa Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	Rare, Near Threatened and other taxa in need of monitoring A. Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.

Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016a, b) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007.*

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

References

English, V and Blyth, J 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Perth, Department of Conservation and Land Management.

EPA 2010, *Technical Guide – Terrestrial Fauna Surveys*, EPA, Perth, WA.

EPA 2016a, *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment*, EPA, Perth, WA.

EPA 2016b, *Environmental Factor Guideline - Flora and Vegetation*, EPA, Perth, WA.

Appendix C – Desktop searches

EPBC Act PMST Report (5 km buffer)

NatureMap Flora Report (5 km buffer)

NatureMap Fauna Report (5 km buffer)

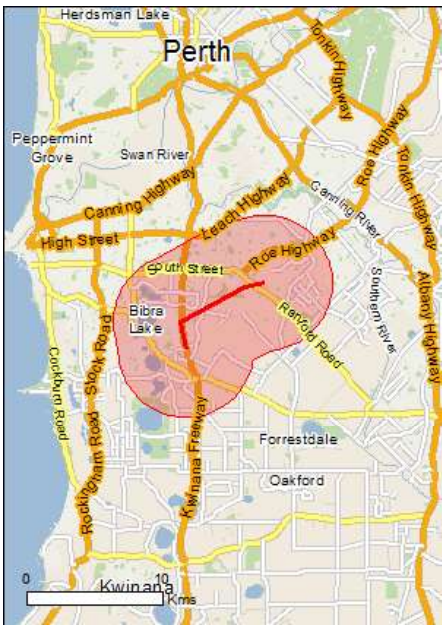
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 05/11/19 18:47:15



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 5.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	45
Listed Migratory Species:	35

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	44
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	41
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat may occur within area
Plants		

Name	Status	Type of Presence
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa jacobsiana [87809]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Mammals		
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Canning River	WA
Thomsons Lake	WA
Unnamed WA49362	WA
Unnamed WA49363	WA
Unnamed WA49561	WA

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Booragoon Swamp	WA
Gibbs Road Swamp System	WA
Swan-Canning Estuary	WA
Thomsons Lake	WA

Caveat

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

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

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

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.110966 115.852112,-32.095407 115.849022,-32.076208 115.891422,-32.073881 115.904125,-32.073881 115.904125

Acknowledgements

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

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

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

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NatureMap
Mapping Western Australia's biodiversity

NatureMap TCL CS Flora Report

Created By Guest user on 05/11/2019

Kingdom	Plantae
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Line'
Vertices	32° 06' 10" S,115° 51' 01" E 32° 05' 35" S,115° 50' 59" E 32° 04' 32" S,115° 53' 41" E 32° 04' 25" S,115° 54' 17" E
Group By	Family

Family	Species	Records
Aponogetonaceae	1	2
Araliaceae	1	1
Asparagaceae	1	1
Byblidaceae	1	4
Celastraceae	1	12
Cyperaceae	3	6
Ericaceae	1	6
Fabaceae	4	6
Goodeniaceae	1	3
Haemodoraceae	1	1
Myrtaceae	1	2
Orchidaceae	7	83
Proteaceae	1	1
Sapindaceae	1	10
Scrophulariaceae	1	1
Stylidiaceae	2	4
TOTAL	**28**	**143**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Aponogetonaceae					
1.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
Araliaceae					
2.	11074	*Hydrocotyle striata*		P1	
Asparagaceae					
3.	13783	*Thysanotus sp. Badgingarra (E.A. Griffin 2511)*		P2	
Byblidaceae					
4.	3178	*Byblis gigantea (Rainbow Plant)*		P3	
Celastraceae					
5.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
Cyperaceae					
6.	16245	*Cyathochaeta teretifolia*		P3	
7.	974	*Schoenus benthamii*		P3	
8.	980	*Schoenus capillifolius*		P3	
Ericaceae					
9.	48297	*Styphelia filifolia*		P3	
Fabaceae					
10.	3237	*Acacia benthamii*		P2	
11.	14932	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	
12.	20462	*Jacksonia gracillima*		P3	
13.	4027	*Jacksonia sericea (Waldjumi)*		P4	
Goodeniaceae					
14.	7485	*Dampiera triloba*		P3	
Haemodoraceae					
15.	11557	*Phlebocarya pilosissima subsp. pilosissima*		P3	
Myrtaceae					
16.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Orchidaceae					
17.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
18.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
19.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
20.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
21.	13635	*Drakaea micrantha*		T	
22.	33742	*Microtis quadrata*		P4	
23.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	
Proteaceae					
24.	18590	*Synaphea sp. Fairbridge Farm (D. Papenfus 696)*		T	
Sapindaceae					
25.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
Scrophulariaceae					
26.	17150	*Eremophila glabra subsp. chlorella*		T	
Stylidiaceae					
27.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
28.	25800	*Stylidium paludicola*		P3	

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

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

NatureMap
Mapping Western Australia's biodiversity

NatureMap TCL CS Fauna Report

Created By Guest user on 05/11/2019

Kingdom	Animalia
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Line'
Vertices	32° 06' 10" S,115° 51' 01" E 32° 05' 35" S,115° 50' 59" E 32° 04' 32" S,115° 53' 41" E 32° 04' 25" S,115° 54' 17" E
Group By	Species Group

Species Group	Species	Records
Bird	33	2345
Invertebrate	5	23
Mammal	6	280
Reptile	2	60
TOTAL	**46**	**2708**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Bird					
1.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
2.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
3.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
4.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
5.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
6.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
7.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
8.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
9.	24790	*Calidris tenuirostris (Great Knot)*		T	
10.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
11.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
12.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
13.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
14.	25574	*Charadrius dubius (Little Ringed Plover)*		IA	
15.	41332	*Chlidonias leucopterus (White-winged Black Tern, white-winged tern)*		IA	
16.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
17.	24791	*Gallinago hardwickii (Latham's Snipe, Japanese snipe)*		IA	
18.	47954	*Gelochelidon nilotica (Gull-billed Tern)*		IA	
19.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
20.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
21.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
22.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
23.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
24.	24802	*Philomachus pugnax (Ruff, reeve)*		IA	
25.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
26.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
27.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
28.	48237	*Rostratula australis (Australian Painted Snipe)*		T	
29.	48597	*Thalasseus bergii (Crested Tern)*		IA	
30.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
31.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
32.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
33.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
Invertebrate					
34.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	
35.	33982	*Leioproctus contrarius (a short-tongued bee)*		P3	
36.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
37.	33994	*Throscodectes xiphos (Stylet Bush Cricket, Stylet Throsco (Jandakot))*		P1	Y

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
38.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Mammal					
39.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
40.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
41.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
42.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
43.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
44.	24145	*Setonix brachyurus (Quokka)*		T	
Reptile					
45.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
46.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	

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

Appendix D – Flora Data

Flora species list

Quadrat data

Flora likelihood of occurrence assessment

Flora species list

Family	*Taxon*	Status	Notes
Fabaceae	*Acacia iteaphylla*	*	
Fabaceae	*Acacia lasiocarpa*		R
Fabaceae	*Acacia longifolia*	*	
Fabaceae	*Acacia pulchella*		
Fabaceae	*Acacia saligna*		
Fabaceae	*Acacia stenoptera*		
Proteaceae	*Adenanthos cygnorum*		
Proteaceae	*Adenanthos obovatus*		
Myrtaceae	*Agonis flexuosa*		R
Casuarinaceae	*Allocasuarina fraseriana*		
Asteraceae	*Arctotheca calendula*	*	
Asparagaceae	*Asparagus asparagoides*	*, DP, WONS	
Poaceae	*Avena barbata*	*	
Proteaceae	*Banksia ?hookeriana*		R
Proteaceae	*Banksia attenuata*		
Proteaceae	*Banksia attenuata*		
Proteaceae	*Banksia baxteri*		R
Proteaceae	*Banksia dallanneyi* subsp. *dallanneyi*		
Proteaceae	*Banksia littoralis*		
Proteaceae	*Banksia menziesii*		
Proteaceae	*Banksia sessilis*		
Restionaceae	*Boronia dichotoma*		
Fabaceae	*Bossiaea eriocarpa*		
Fabaceae	*Bossiaea ornata*		
Brassicaceae	*Brassica* sp.	*	
Brassicaceae	*Brassica tournefortii*	*	
Poaceae	*Briza maxima*	*	
Poaceae	*Briza minor*	*	
Poaceae	*Bromus diandrus*	*	
Colchicaceae	*Burchardia congesta*		
Myrtaceae	*Callistemon phoeniceus*		P
Cupressaceae	*Callitris preissii*		
Myrtaceae	*Calothamnus quadrifidus*		R
Myrtaceae	*Calothamnus sanguineus*		R
Aizoaceae	*Carpobrotus edulis*	*	
Restionaceae	*Chaetanthus ?aristatus*		
Myrtaceae	*Chamelaucium uncinatum*		R
Iridaceae	*Chasmanthe floribunda*		
Proteaceae	*Conospermum stoechadis*		
Ericaceae	*Conostephium pendulum*		
Haemodoraceae	*Conostylis aculeata*		
Haemodoraceae	*Conostylis juncea*		
Asteraceae	*Conyza bonariensis*		

Family	*Taxon*	Status	Notes
Myrtaceae	*Corymbia calophylla*		
Rosaceae	*Cotoneaster pannosus*	*	
Poaceae	*Cynodon dactylon*	*	
Goodeniaceae	*Dampiera linearis*		
Dasypogonaceae	*Dasypogon bromeliifolius*		
Fabaceae	*Daviesia divaricata*		
Fabaceae	*Daviesia physodes*		
Fabaceae	*Daviesia triflora*		
Restionaceae	*Desmocladus flexuosus*		
Poaceae	*Ehrharta calycina*	*	
Poaceae	*Eragrostis curvula*	*	
Myrtaceae	*Eremaea pauciflora*		R
Myrtaceae	*Eucalyptus conferruminata*		P
Myrtaceae	*Eucalyptus maculata*		P
Myrtaceae	*Eucalyptus marginata*		
Myrtaceae	*Eucalyptus platypus*		P
Myrtaceae	*Eucalyptus rudis*		
Myrtaceae	*Eucalyptus* sp.	*	P
Myrtaceae	*Eucalyptus todtiana*		
Euphorbiaceae	*Euphorbia peplus*	*	
Euphorbiaceae	*Euphorbia terracina*	*	
Iridaceae	*Ferraria crispa*	*	
Iridaceae	*Freesia alba x leichtlinii*	*	
Papaveraceae	*Fumaria capreolata*	*	
Fabaceae	*Gastrolobium capitatum*		
Asteraceae	*Gazania linearis*	*	
Iridaceae	*Gladiolus caryophyllaceus*		
Fabaceae	*Gompholobium tomentosum*		
Proteaceae	*Grevillea ?thelemanniana*		R
Proteaceae	*Grevillea vestita*		R
Proteaceae	*Hakea prostrata*		R
Fabaceae	*Hardenbergia comptoniana*		
Dilleniaceae	*Hibbertia huegelii*		R
Dilleniaceae	*Hibbertia hypericoides*		
Dilleniaceae	*Hibbertia subvaginata*		
Fabaceae	*Hovea trisperma*		
Myrtaceae	*Hypocalymma angustifolium*		
Myrtaceae	*Hypocalymma robustum*		
Asteraceae	*Hypochaeris glabra*	*	
Restionaceae	*Hypolaena exsulca*		
Restionaceae	*Hypolaena pubescens*		
Fabaceae	*Jacksonia furcellata*		
Fabaceae	*Kennedia prostrata*		
Myrtaceae	*Kunzea glabrescens*		R

Family	*Taxon*	Status	Notes
Myrtaceae	*Kunzea micrantha* subsp. *micrantha*		
Poaceae	*Lagurus ovatus*	*	
Fabaceae	*Lathyrus tingitanus*	*	
Asparagaceae	*Laxmannia squarrosa*		
Myrtaceae	*Leptospermum laevigatum*	*	
Ericaceae	*Leucopogon conostephioides*		
Ericaceae	*Leucopogon* sp.		
Poaceae	*Lolium* sp.	*	
Asparagaceae	*Lomandra maritima*		
Fabaceae	*Lupinus cosentinii*	*	
Anarthriaceae	*Lyginia barbata*		
Xanthorrhoeaceae	*Macrozamia riedlei*		
Myrtaceae	*Melaleuca nesophila*	*	
Myrtaceae	*Melaleuca preissiana*		
Myrtaceae	*Melaleuca systena*		
Myrtaceae	*Melaleuca thymoides*		
Cyperaceae	*Mesomelaena pseudostygia*		
Orchidaceae	*Microtis media* subsp. *media*		
Asteraceae	*Monoculus monstrosus*	*	
Loranthaceae	*Nuytsia floribunda*		
Asteraceae	*Osteospermum clandestinum*	*	
Asteraceae	*Osteospermum ecklonis*	*	
Oxalidaceae	*Oxalis pes-caprae*	*	
Iridaceae	*Patersonia occidentalis*		
Geraniaceae	*Pelargonium capitatum*	*	
Poaceae	*Cenchrus setaceus*	*	
Myrtaceae	*Pericalymma ellipticum*		
Proteaceae	*Petrophile linearis*		
Caryophyllaceae	*Petrorhagia dubia*	*	
Rutaceae	*Philotheca spicata*		
Haemodoraceae	*Phlebocarya ciliata*		
Thymelaeaceae	*Pimelea rosea*		
Asteraceae	*Podotheca gnaphalioides*		
Amaranthaceae	*Ptilotus polystachyus*		
Myrtaceae	*Regelia inops*		
Fabaceae	*Retama raetam*	*	
Chenopodiaceae	*Rhagodia baccata*		R
Euphorbiaceae	*Ricinus communis*	*	
Iridaceae	*Romulea rosea*	*	
Iridaceae	*Scaevola canescens*		
Myrtaceae	*Scholtzia involucrata*		
Cyperaceae	*Schoenus sp.*		
Asteraceae	*Senecio pinnatifolius* var. *latilobus*		
Solanaceae	*Solanum nigrum*	*	

Family	*Taxon*	Status	Notes
Asteraceae	*Sonchus oleraceus*	*	
Proteaceae	*Stirlingia latifolia*		
Stylidiaceae	*Stylidium schoenoides*		
Proteaceae	*Synaphea spinulosa* subsp. *spinulosa*		
Fabaceae	*Tagasaste palmensis*	*	
Bignoniaceae	*Tecoma* sp.	*	
Asparagaceae	*Thysanotus thyrsoides*		
Asphodelaceae	*Trachyandra divaricata*	*	
Hemerocallidaceae	*Tricoryne elatior*		
Fabaceae	*Trifolium arvense*	*	
Fabaceae	*Trifolium campestre*	*	
Asteraceae	*Ursinia anthemoides*	*	
Campanulaceae	*Wahlenbergia capensis*	*	
Iridaceae	*Watsonia meriana* var. *bulbillifera*	*	
Iridaceae	*Watsonia meriana* var. *meriana*	*	
Xanthorrhoeaceae	*Xanthorrhoea gracilis*		
Xanthorrhoeaceae	*Xanthorrhoea preissii*		

* = introduced taxon, DP = Declared Pest, WONS = Weed of National Significance, R = revegetation

Site ID:	Q01	Project:	12514413
Type:	Quadrat	**Size:**	10 x 10 m
Date:	6/09/2017	**Described by:**	GHD
Co-ordinates:	MGA 50	-32.1115110	115.848984
Landform and slope:	Plain, gentle slope		
Drainage:	Good		
Soil colour & type:	Grey sand		
Surface Component	Loose soil 10%, Humus/litter 20%		
Vegetation type:	Mixed *Banksia* open woodland (VT11)		
Vegetation condition:	Good		
Fire age & intensity:	Old (>5 yr), no damage		
Disturbances:	Weeds, previous clearing		
Leaf litter:	Sparse		
Wood litter:	Sparse		

Species List:

Family	Taxon	Status	Stratum	Cover (%)
Poaceae	*Avena barbata*	*	G	<2N
Fabaceae	*Bossiaea eriocarpa*		G	<2T
Poaceae	*Briza maxima*	*	G	<2N
Colchicaceae	*Burchardia congesta*		G	<2N
Goodeniaceae	*Dampiera linearis*		G	<2T
Dasypogonaceae	*Dasypogon bromeliifolius*		G	<2N
Poaceae	*Ehrharta calycina*	*	G	<2N
Papaveraceae	*Fumaria capreolata*	*	G	<2N
Iridaceae	*Gladiolus caryophyllaceus*	*	G	<2N
Fabaceae	*Gompholobium tomentosum*		G	<2T
Asteraceae	*Hypochaeris glabra*	*	G	<2N
Asteraceae	*Hypolaena exsulca*		G	<2T
Geraniaceae	*Pelargonium capitatum*		G	<2T
Rutaceae	*Philotheca spicata*		G	<2T

Family	Taxon	Status	Stratum	Cover (%)
Haemodoraceae	*Phlebocarya ciliata*		G	70-100
Cyperaceae	*Schoenus* sp.		G	<2T
Myrtaceae	*Scholtzia involucrata*		G	<2T
Hemerocallidaceae	*Tricoryne elatior*		G	<2T
Fabaceae	*Trifolium campestre*	*	G	<2T
Asteraceae	*Ursinia anthemoides*	*	G	<2N
Xanthorrhoeaceae	*Xanthorrhoea preissii*		M	10-30

Site ID:	Q02	Project	12514413
Type:	Quadrat	**Size:**	10 x 10 m
Date:	6/09/2017	**Described by:**	GHD
Co-ordinates:	MGA 50	-32.1114359	115.848121
Landform and slope:	Plain		
Drainage:	Good		
Soil colour & type:	Grey sand		
Surface Component	Loose soil 5% cover		
Vegetation type:	Mixed *Banksia* open woodland (VT11)		
Vegetation condition:	Good		
Fire age & intensity:	Old (>5 yr), no damage		
Disturbances:	Old grazing, past clearing, weeds		
Leaf litter:	Sparse		
Wood litter:	Moderate		

Family	Taxon	Status	Stratum	Cover (%)
Poaceae	*Avena barbata*	*	G	<2N
Poaceae	*Briza maxima*	*	G	<2N
Colchicaceae	*Burchardia congesta*		G	<2N
Dasypogonaceae	*Dasypogon bromeliifolius*		G	<2T
Poaceae	*Ehrharta calycina*	*	G	30-70
Euphorbiaceae	*Euphorbia terracina*	*	G	<2T
Iridaceae	*Gladiolus caryophyllaceus*	*	G	<2N
Fabaceae	*Gompholobium tomentosum*		G	<2T
Haemodoraceae	*Phlebocarya ciliata*		G	<2N
Myrtaceae	*Scholtzia involucrata*		G	10-30
Fabaceae	*Trifolium campestre*	*	G	<2T
Asteraceae	*Ursinia anthemoides*	*	G	<2N

Family	Taxon	Status	Stratum	Cover (%)
Fabaceae	*Jacksonia furcellata*		M	2-10
Myrtaceae	*Kunzea glabrescens*		M	<2T
Xanthorrhoeaceae	*Xanthorrhoea preissii*		M	10-30

Site ID:	Q03	Project	12514413
Type:	Quadrat	**Size:**	10 x 10 m
Date:	6/09/2017	**Described by:**	GHD
Co-ordinates:	MGA 50	-32.1121620	115.85086
Landform and slope:	Plain		
Drainage:	Good		
Soil colour & type:	Grey sand		
Surface Component	Loose soil 2 %, Humus/litter 60 %		
Vegetation type:	*Banksia menziesii* and *B. attenuata* woodland (VT01)		
Vegetation condition:	Good		
Fire age & intensity:	Old (>5 yr), no damage		
Disturbances:	Old grazing, weeds		
Leaf litter:	Moderate		
Wood litter:	Negligible		

Family	Taxon	Status	Stratum	Cover (%)
Poaceae	*Avena barbata*	*	G	<2N
Poaceae	*Briza maxima*	*	G	<2N
Poaceae	*Bromus diandrus*	*	G	<2N
Colchicaceae	*Burchardia congesta*		G	<2N
Dasypogonaceae	*Dasypogon bromeliifolius*		G	2-10
Poaceae	*Ehrharta calycina*	*	G	30-70
Euphorbiaceae	*Euphorbia terracina*	*	G	<2N
Papaveraceae	*Fumaria capreolata*	*	G	<2N
Iridaceae	*Gladiolus caryophyllaceus*	*	G	<2N
Fabaceae	*Lathyrus tingitanus*	*	G	<2N
Poaceae	*Lolium* sp.	*	G	<2N
Haemodoraceae	*Phlebocarya ciliata*		G	30-70

Family	Taxon	Status	Stratum	Cover (%)
Asteraceae	*Sonchus oleraceus*		G	<2T
Fabaceae	*Trifolium campestre*	*	G	<2N
Asteraceae	*Ursinia anthemoides*	*	G	<2N
Xanthorrhoeaceae	*Xanthorrhoea preissii*		M	10-30
Proteaceae	*Banksia attenuata*		U	2-10

Site ID:	Q04	Project:	12514413
Type:	Quadrat	**Size:**	10 x 10 m
Date:	6/09/2017	**Described by:**	GHD
Co-ordinates:	MGA 50	-32.077628	115.887021
Landform and slope:	Plain		
Drainage:	Good		
Soil colour & type:	Grey sand		
Surface Component	Loose soil 10 % Humus/litter 90 %		
Vegetation type:	*Banksia menziesii* and *B. attenuata* woodland (VT01)		
Vegetation condition:	Good		
Fire age & intensity:	Old (>5 yr), no damage		
Disturbances:	Old grazing (roos), clearing at edges		
Leaf litter:	Plentiful		
Wood litter:	Sparse		

Family	Taxon	Status	Stratum	Cover (%)
Dasypogonaceae	*Dasypogon bromeliifolius*		G	2-10
Poaceae	*Ehrharta calycina*	*	G	10-30
Euphorbiaceae	*Euphorbia peplus*	*	G	2-10
Papaveraceae	*Fumaria capreolata*	*	G	2-10
Iridaceae	*Gladiolus caryophyllaceus*	*	G	<2N
Dilleniaceae	*Hibbertia subvaginata*		G	<2T
Asteraceae	*Hypochaeris glabra*	*	G	2-10
Fabaceae	*Lupinus cosentinii*	*	G	<2T
Iridaceae	*Patersonia occidentalis*		G	<2T
Haemodoraceae	*Phlebocarya ciliata*		G	2-10
Asteraceae	*Sonchus oleraceus*		G	<2N
Asphodelaceae	*Trachyandra divaricata*	*	G	<2T

Family	Taxon	Status	Stratum	Cover (%)
Fabaceae	*Trifolium campestre*	*	G	<2N
Asteraceae	*Ursinia anthemoides*	*	G	<2T
Campanulaceae	*Wahlenbergia capensis*		G	<2N
Fabaceae	*Jacksonia furcellata*		M	<2T
Iridaceae	*Watsonia meriana* var. *meriana*	*	M	<2T
Xanthorrhoeaceae	*Xanthorrhoea preissii*		M	10-30
Casuarinaceae	*Allocasuarina fraseriana*		U	10-30
Proteaceae	*Banksia attenuata*		U	2-10

Site ID:	Q05	Project	12514413
Type:	Quadrat	**Size:**	10 x 10 m
Date:	6/09/2017	**Described by:**	GHD
Co-ordinates:	MGA 50	-32.0772779	115.8867710
Landform and slope:	Plain		
Drainage:	Good		
Soil colour & type:	Grey sand		
Surface Component	Loose soil 3 % Humus/litter 70 %		
Vegetation type:	*Banksia menziesii* and *B. attenuata* woodland (VT01)		
Vegetation condition:	Good		
Fire age & intensity:	Old (>5 yr), no damage		
Disturbances:	Clearing, grazing		
Leaf litter:	Plentiful		
Wood litter:	Moderate		

Family	Taxon	Status	Stratum	Cover (%)
Fabaceae	*Acacia pulchella*		G	<2T
Poaceae	*Avena barbata*	*	G	<2N
Brassicaceae	*Brassica tournefortii*	*	G	<2T
Poaceae	*Briza maxima*	*	G	<2N
Colchicaceae	*Burchardia congesta*		G	<2N
Dasypogonaceae	*Dasypogon bromeliifolius*		G	2-10
Poaceae	*Ehrharta calycina*	*	G	<2N
Euphorbiaceae	*Euphorbia peplus*	*	G	<2N
Papaveraceae	*Fumaria capreolata*	*	G	<2N
Asteraceae	*Hypochaeris glabra*	*	G	10-30
Anarthriaceae	*Lyginia barbata*		G	<2N
Iridaceae	*Patersonia occidentalis*		G	<2N

Family	Taxon	Status	Stratum	Cover (%)
Haemodoraceae	*Phlebocarya ciliata*		G	<2N
Iridaceae	*Romulea rosea*	*	G	<2T
Haemodoraceae	*Phlebocarya ciliata*		G	<2N
Iridaceae	*Romulea rosea*	*	G	<2T
Myrtaceae	*Scholtzia involucrata*		G	<2T
Asteraceae	*Sonchus oleraceus*	*	G	<2N
Fabaceae	*Trifolium campestre*	*	G	<2N
Asteraceae	*Ursinia anthemoides*	*	G	<2N
Fabaceae	*Jacksonia furcellata*		M	2-10
Xanthorrhoeaceae	*Xanthorrhoea preissii*		M	10-30
Proteaceae	*Banksia attenuata*		U	10-30

Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within study area from field survey results.
Likely	Species previously recorded within 5 km and large areas of suitable habitat occur in the study area.
Possible	Species previously recorded within 5 km and areas of suitable habitat occur/may occur in the study area.
Unlikely	Species previously recorded within 5 km, but suitable habitat does not occur in the study area.
Highly unlikely	Species not previously recorded within 5 km, suitable habitat does not occur in the study area and/or the study area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

NM – DBCA *NatureMap* (accessed November 2019)

DBCA – DBCA (2007–) records of threatened flora, database search within the study area (provided by PTA, 2018)

EPBC – DEE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area (accessed November 2019)

Flora likelihood of occurrence assessment for conservation significant flora

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Aponogetonaceae	*Aponogeton hexatepalus*	P4		Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans.	**Unlikely –** no suitable habitat present within the survey area.	NM, DBCA
Araliaceae	*Hydrocotyle striata*	P1		Herb. Clay. Springs. Winter wet creek	**Unlikely –** no suitable habitat present within the survey area.	NM, DBCA
Asparagaceae	*Thysanotus* sp. Badgingarra (E.A. Griffin 2511)	P2		Perennial, herb (with tuberous roots), ca 0.35 m high. Fl. blue, Dec. Grey sand with lateritic gravel.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA
Byblidaceae	*Byblis gigantea*	P3		Small, branched perennial, herb (or sub-shrub), to 0.45 m high. Fl. pink-purple/white, Sep to Dec or Jan. Sandy-peat swamps. Seasonally wet areas.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Celastraceae	*Tripterococcus* sp. Brachylobus (A.S. George 14234).	P4		Erect perennial herb 80 cm high and 15 cm wide. Flowers green to yellow, Nov to Dec. Grey sand.	**Unlikely –** suitable habitat was found within the survey area (VT01 and VT08); however if present, was expected to recorded based on extensive survey effort.	NM, DBCA
Cyperaceae	*Cyathochaeta teretifolia*	P3		Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA
Cyperaceae	*Eleocharis keigheryi*	T	Vu	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC
Cyperaceae	*Lepidosperma rostratum*	T	En	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Flowers brown. The species grows in peaty sand and clay amongst low heath, in winter-wet swamps (DEE 2019). Flowering May to June and the distinctive fruits are beaked toward the base of the style, and generally appear between late June and August.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC
Cyperaceae	*Schoenus benthamii*	P3		Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown, Oct to Nov. White, grey sand, sandy clay. Winter-wet flats, swamps.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA
Cyperaceae	*Schoenus capillifolius*	P3		Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov. Brown mud. Claypans.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Ericaceae	*Andersonia gracilis*	T	En	Slender erect or open straggly shrub, 0.1-0.5 m high. Flowers white-pink-purple from September to November. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC
Ericaceae	*Styphelia filifolia*	P3		Shrub, ca 50 cm. Flowers white February-March. Brown-grey sand. Associated with *Banksia* woodland.	**Unlikely –** suitable habitat was found within the survey area (VT01); however if present, was expected to recorded based on extensive survey effort.	NM, DBCA
Fabaceae	*Acacia benthamii*	P2		Shrub, ca 1 m high. Fl. yellow, Aug to Sep. Sand. Typically on limestone breakaways.	**Unlikely –** no suitable habitat found within the survey area.	NM, DBCA
Fabaceae	*Acacia lasiocarpa* var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1		Shrub, 0.4-1.5 m high. Fl. yellow, May or Aug. Grey or black sand over clay. Swampy areas, winter wet lowlands.	**Unlikely –** no suitable habitat found within the survey area.	NM, DBCA
Fabaceae	*Jacksonia gracillima*	P3		Perennial tufted herb with narrow leaves 10-40 cm long, with rose pink flowers, Oct-Nov. Grey sand, winter wet.	**Unlikely –** no suitable habitat found within the survey area.	NM, DBCA
Fabaceae	*Jacksonia sericea*	P4		Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	**Unlikely –** no suitable habitat found within the survey area.	NM
Goodeniaceae	*Dampiera triloba*	P3		Erect perennial, herb or shrub, to 0.5 m high. Fl. blue, Aug to Dec. Loamy sand	**Unlikely –** some suitable habitat was found within the survey area. This species is not cryptic and the survey was undertaken during the reported flowering period.	NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Haemodoraceae	*Phlebocarya pilosissima* subsp. *pilosissima*	P3		Shortly rhizomatous, compactly tufted perennial, grass-like or herb, 0.15-0.4 m high. Fl. cream-white, Aug to Oct. White or grey sand, lateritic gravel. Associated with *Banksia* woodland.	**Unlikely –** some suitable habitat was found within the survey area. However, this species is not cryptic and the survey was undertaken during the reported flowering period.	NM, DBCA
Macarthuriaceae	*Macarthuria keigheryi*	T	En	Erect or spreading perennial, herb or shrub, 0.2-0.4 m high, 0.3-0.6 m wide. Flowers September to December or February to March. White or grey sand. Five of the six known populations occur within a 5 km radius of Welshpool and Kewdale area. These populations are found in low-lying winter-wet damp, grey/white sands and grows in open patches with low tree canopy cover among heathland, Jarrah (*Eucalyptus marginata)* and *Allocasuarina/Banksia* woodland at Welshpool and Kewdale.	**Unlikely –** no suitable habitat was found within the survey area. The survey was undertaken during the reported flowering period, however this species can be cryptic.	EPBC
Myrtaceae	*Verticordia lindleyi* subsp. *lindleyi*	P4		Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.	**Unlikely –** no suitable habitat found within the survey area.	NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Orchidaceae	*Caladenia huegelii*	T	En	Tuberous, perennial, herb, 0.25-0.6 m high. Flowers green & cream & red, September to October. Grey or brown sand, clay loam. The King Spider-orchid grows in well-drained, deep sandy soils in low mixed woodlands of *Banksia attenuata*, *B. menziesii, B. ilicifolia*, *Allocasuarina fraseriana* and *Eucalyptus marginata*. It tends to favour areas of lush undergrowth (DEE 2019). The preferred soil conditions are variable and range from wet to moist to dry. The species is killed by fire when flowers or leaves are present and its growth is suppressed by weed invasion (DEE 2019). The King Spider-orchid flowers from September to October and is thought to fruit in the same season. The species dies back to underground tubers over summer. Plants may not flower each year. However, after disturbance to the canopy, or following summer fire, this species can be found flowering profusely (DEE 2019).	**Unlikely –** suitable habitat is present within the survey area. Targeted surveys were undertaken during the field survey in areas of suitable habitat for the King Spider-orchid. Whilst this species can be cryptic, based on the extensive survey effort, it is expected if present, it would have been.	EPBC, NM, DBCA
Orchidaceae	*Diuris drummondii*	T	Vu	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	**Unlikely –** no suitable habitat found within the survey area.	EPBC, NM

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Orchidaceae	*Diuris micrantha*	T	Vu	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water. This species is known from seven populations, from east of Kwinana and south towards the Frankland area, Western Australia. It is found in small populations, on dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps. The bases of the flowering plants are often covered with shallow water (DEE 2019).	**Unlikely –** no suitable habitat found within the survey area.	EPBC
Orchidaceae	*Diuris purdiei*	T	En	Tuberous, perennial, herb, 0.15-0.35 m high. Flowers yellow, from late September to mid-October, but only after a summer or early autumn fire (Brown et al. 1998). It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent *Melaleuca preissiana, Eucalyptus calophylla, E. marginata* and *Nuytsia floribunda* (DEE 2019).	**Unlikely –** some suitable habitat was found within the survey area (VT08). Targeted searches for this species were undertaken throughout the survey area during the reported flowering period.	EPBC, NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Orchidaceae	*Drakaea elastica*	T	En	Tuberous, perennial, herb, 0.12-0.3 m high. Flowers red and green and yellow. Flowers are first seen in late September and continue flowering until late October or more rarely early November. Individual plants may not flower every year. The plant dies back to a dormant underground tuber over summer. The best time to look for the plant is in July and August when the leaves are relatively conspicuous (DEE 2019). Occurs on bare patches of white or grey sand in low-lying situations adjoining winter-wet swamps. This hammer-orchid species occurs in south-west Western Australia and grows at only 42 locations with a total population size of around 230 plants. To survive, the orchid relies on a specific fungus which assists germination and provides nutrients. It is also dependent on a single species of wasp that pollinates its flowers (DEE 2019).	**Unlikely –** some suitable habitat was found within the survey area. Suitable vegetation types within the survey area include VT01 and VT08. Targeted searches for this species were undertaken during the reported flowering period.	EPBC, NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Orchidaceae	*Drakaea micrantha*	T	Vu	Tuberous, perennial, herb, 0.15-0.3 m high. Flowers red & yellow, September to October. The Dwarf Hammer-orchid is known from 32 small, scattered populations from Perth to Albany, with secure populations in Frankland National Park. The populations are often very difficult to locate from year-to-year, as they do not necessarily flower annually (Brown et al. 1998; Hoffman & Brown 1998). The Dwarf Hammer-orchid is usually found on cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed (Brown et al. 1998; Hearn et al. 2006). This suggests that the plants may need a disturbance event at some point, and that plants regenerate from soil stored seed after such an event. The Dwarf Hammer-orchid occurs in infertile grey sands, in *Eucalyptus marginata* and *Allocasuarina fraseriana* woodland or forest associated with *Banksia* species (DEE 2019).	**Unlikely –** suitable habitat was found within the survey area. Suitable vegetation types within the survey area may include VT01. Targeted searches for this species were undertaken throughout the survey area during the reported flowering period.	EPBC, NM, DBCA
Orchidaceae	*Microtis quadrata*	P4		Erect herb 40 cm, green/cream flowers, Oct to Dec. Swamps. Known to occur in black peaty soil of Lake Jandakot.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA
Orchidaceae	*Thelymitra dedmaniarum*	T	En	Tuberous, perennial, herb, to 0.8 m high. Fl. yellow, Nov to Dec or Jan. Granite.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Orchidaceae	*Thelymitra variegata*	P2		Tuberous, perennial, herb, 0.1-0.35 m high. Fl. orange & red & purple & pink, Jun to Sep. Sandy clay, sand, laterite. Has been recorded in yellow sand associated with *Banksia attenuata, Allocasuarina fraseri* and *Hibbertia hypericoides* in the Jandakot area.	**Unlikely –** some suitable habitat was found within the survey area. Suitable vegetation types within the survey area may include VT01. The targeted searches for this species were undertaken during the reported flowering period.	NM, DBCA
Poaceae	*Austrostipa jacobsiana*	T	Cr	Perennial grass Flowers green. Flowering and seeding October to January. Grey sand. Plains, wet winter flats	**Unlikely –** some suitable habitat was found within the survey area (VT01). However, the survey was undertaken during the optimal flowering period and has been thoroughly surveyed.	EPBC
Proteaceae	*Grevillea curviloba* subsp. *incurva*	T	En	Prostrate to erect shrub, 0.1-2.5 m high. Fl. white-cream, Aug to Sep. Sand, sandy loam. Winter-wet heath.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Proteaceae	*Synaphea* sp. Fairbridge Farm (D. Papenfus 696)	T	Cr	Dense, clumped shrub 25-65 cm tall, to 20-80 cm wide. Flowers yellow, flowering between September to November. Occurs on grey, clayey sand with lateritic pebbles in low woodland areas near winter-wetflats (DEE 2019). Selena's Synaphea is distinguished from other *Synaphea* species by its flattened, nearly symmetrically divided tripartite, leaf lobes with short petioles relative to the leaf blade, short peduncles and straight flowering spikes. Flowers of Selena's Synaphea are larger than related species, hairy externally and held in a very upright position in the flowering spike and the stigma is shallowly emarginate with broad lateral lobes. Stems of this species are green, and the sheaths enclosing the bases of the spikes are usually pale coloured with appressed hairs (WA Herbarium 1998–).	**Unlikely –** no suitable habitat was found within the survey area.	EPBC, NM, DBCA
Sapindaceae	*Dodonaea hackettiana*	P4		Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	**Unlikely –** no suitable habitat was found within the survey area.	DBCA
Scrophulariaceae	*Eremophila glabra* subsp. *chlorella*	T	En	Prostrate & spreading or sprawling shrub, 0.2-1 m high. Fl. green-yellow, Jul to Nov. Sandy clay. Winter-wet depressions.	**Unlikely –** no suitable habitat was found within the survey area.	EPBC, NM, DBCA
Stylidiaceae	*Stylidium longitubum*	P4		Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA

Family	Taxon	Status		Description (if available) (WA Herbarium 1998–)	Likelihood of Occurrence	Source
		BC Act/ WA	EPBC Act			
Stylidiaceae	*Stylidium paludicola*	P3		Reed-like perennial, herb, 0.35-1 m high. Fl. pink, Oct to Dec. Peaty sand over clay. Winter wet habitats.	**Unlikely –** no suitable habitat was found within the survey area.	NM, DBCA

References

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Appendix E – Fauna Data

Fauna likelihood of occurrence assessment

Fauna likelihood of occurrence assessment guidelines

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the survey area.
Likely	Species are **likely** to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the survey area.
Unlikely	Species assessed as **unlikely** include those species previously recorded within 5 km of the survey area however: • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area. • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area. OR Those species that have a known distribution overlapping with the survey area however: • There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.
Highly unlikely	Species that are considered **highly unlikely** to occur in the survey area include: • Those species that have no suitable habitat within the survey area. • Those species that have become locally extinct, or are not known to have ever been present in the region of the survey area.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Birds							
Actitis hypoleucos (Common Sandpiper)	MI	MI	X	X	X	Habitat for the Common Sandpiper is varied: coastal and interior wetlands – narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches. Avoids wide open mudflats. This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	**Unlikely**, the species has not been recorded in the survey area, with scattered but clumped areas utilised in the region. The closest records are from Bibra and North Lakes, north along the Swan and Canning Rivers (but within the lower reaches).

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Apus pacificus (Fork-tailed Swift)	Mi	MI		X		The fork-tailed Swift is a migratory species that follows large storm fronts and are almost exclusively areal species. In Western Australia, there are sparsely scattered records of the Fork-tailed Swift along the south coast, ranging from near the Eyre Bird Observatory and west to Denmark. They are widespread in coastal and subcoastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. Scattered records are present in the Perth region (Higgins 1999).	**Unlikely**, although this species may periodically occur in the region the species is exclusively areal in nature and not utilise terrestrial habitats.
Botaurus poiciloptilus (Australasian Bittern)	En	En		X	X	The Australasian Bittern prefers densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. In the southwest of WA, the Bittern is found in beds of tall rush mixed with or near short fine sedge or open pools. It also occurs around swamps, lakes, pools, rivers and channels fringed with *Lignum, Muehlenbeckia*, *Eragrostis* spp. or other dense vegetation. It occasionally ventures into areas of open water or onto banks (DEE 2019).	**Highly unlikely**, there is no suitable habitat within the survey area for this species. Most observations occur within lakes and wetland where dense vegetation is present.
Calidris acuminata (Sharp-tailed Sandpiper)	Mi	MI	X	X	X	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry (DEE 2019). They are found throughout many wetlands on the Swan Coastal Plain, in Perth lakes with wet grassed margins and receding waters, Vasse and Harvey Estuaries, and the Busselton wetlands, but are less common on the south coast until the Esperance region (Nevill 2013).	**Unlikely**, the species has not been recorded in the survey area, with scattered records in the region. The closest records is at Bibra, North and Forrestdale Lakes, north long the Swan and Canning Rivers (lower reaches).

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Calidris canutus (Red Knot)	En, Mi	EN		X	X	In Australasia the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (DEE 2019). They are found near mudflats and estuaries from Murchison to Bunbury. In Perth region they are mainly seen in Alfred Cove and Peel Inlet (Nevill 2013).	**Highly unlikely**, there is no suitable habitat within the survey area for this species. Most observations occur along the coast line and lower reaches of Swan River areas.
Calidris ferruginea (Curlew Sandpiper)	Mi, Cr	CR	X	X	X	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (DEE 2019).	**Unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with scattered but clumped areas utilised in the region. The closest records is at Bibra, North and Forrestdale Lakes, north along the Swan River.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Calidris melanotos (Pectoral Sandpiper)	Mi	Mi	X	X	X	In Australia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum (DEE 2019). The bird can be seen on the Swan Coastal Plain but is rare to scarce on Lake Thompson, and as well on any freshwater wetland in the southwest with shallow, well-grassed margins.	**Unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with scattered but clumped areas utilised in the region. The closest records is at Bibra and Forrestdale Lakes, north along the Swan River.
Calidris ruficollis (Red-Necked Stint)	Mi	Mi	X	X	X	The Red-necked Stint can be found in fresh and saline water, but primarily in coastal regions (Nevill 2013). It is mostly found in areas including sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They are common in many parts of the south west, and can be found in the Murchison down to Busselton and Augusta to Cape Arid, and on islands, particularly Rottnest (Nevill 2013).	**Unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with scattered but clumped areas utilised in the region. The closest records are at Bibra, North and Forrestdale Lakes, north along the Swan and lower reaches of the Canning River.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Calidris subminuta (Long-toed Stint)	Mi	Mi	X	X	X	In Australia, the Long-toed Stint occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. The species is also fond of areas of muddy shoreline, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire. In WA the species is found mainly along the coast, with a few scattered inland records (DEE 2019; Nevill 2013).	**Unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with scattered records in the region. The closest records are at Bibra and Forrestdale Lakes, north along the lower reaches of the Canning River.
Calidris tenuirostris (Great Knot)	Cr, Mi	Cr			X	The Great Knot typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps (DEE 2019). In the south west they can be found in the Murchison region and then further down the coast to Bunbury, in the Perth region, Alfred Cove, Woodman Point, and Peel Inlet.	**Highly unlikely**, there is no suitable habitat within the survey area for this species. Most observations occur along the coast line and lower reaches of Swan River area.
Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)	Vu	Vu	X	X	X	Forest Red-tailed Black Cockatoo typically occurs in dense Jarrah, Karri and Marri forests, however the species also occurs in a range of other forest and woodland types, including Blackbutt, Wandoo, Tuart, Albany Blackbutt, Yate and Flooded Gum. Habitats also tend to have an understorey of *Banksia, Persoonia* and *Allocasuarina* In recent years the species has been recorded utilising areas of the SCP for resources (Johnstone et al 2017). The Forest Red-tailed Black Cockatoo generally nests in hollows in live or dead trees of Marri, Karri, Wandoo, Bullich, Blackbutt, Tuart and Jarrah (DSEWPaC 2012) in the Darling Range and recently on the Swan Coastal Plain.	**Present**, species was recorded within survey area via feeding evidence. This species feeds extensively and frequently on remnant Marri, Jarrah, and Sheoak within the survey area.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Calyptorhynchus baudinii (Baudin's Black Cockatoo)	En	En	X	X	X	Baudin's Black Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri and Eucalyptus species, especially Karri and Jarrah. The species also occurs in woodlands of Blackbutt, Flooded Gum, and Yate. Baudin's Black Cockatoo breeds in the Jarrah, Marri and Karri forests of the deep south-west in areas averaging more than 750 mm of rainfall annually. The range of the species extends from Albany to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Boyup Brook. Preferred roosts are in areas with a dense canopy close to permanent water sources that provide the birds with protection from weather conditions (DSEWPaC 2012).	**Unlikely**, the location of the survey area is lies beyond the north-western limit of Baudin's Cockatoo modelled distribution. The species' occurrence be may as a vagrant or highly infrequent visitor. It occurs more frequently further east and south of the survey area.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	En	En	X	X	X	This species mainly occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by *Hakea*, *Banksia* and *Grevillea* species. The species also occurs in forests containing Marri, Jarrah or Karri. Breeding usually occurs in the western Wheatbelt region of WA, with flocks moving to the higher rainfall coastal area to forage after the breeding season. Feeds on the seeds of a variety of native plants, including *Allocasuarina*, *Banksia*, *Eucalyptus*, *Grevillea* and *Hakea*, and some introduced plants (DSEWPaC 2012).	**Present**, species was recorded within survey area via feeding evidence: chewed pods of Banksia attenuata and B.menziesii. Carnaby's Cockatoo feeds extensively and frequently on remnant Banksia woodland within the survey area.
Charadrius dubius (Little Ringed Plover)	Mi	Mi	X	X	X	The Little Ringed Plover winters in Asia but several will overshoot and land in Australia. They have a preference for stony shorelines around freshwater as well as brackish and coastal beaches. It is possible to find this species not only on beaches but also on freshwater lakes, marshes or perimeters of sewerage ponds (Nevill 2013; Simpson and Day 1996).	**Highly unlikely**, this species appears to have a coastal preference with the only inland records at Bibra and associated lakes.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Chlidonias leucopterus (White-winged Black Tern)	Mi	Mi	X		X	The White-winged Black Tern is a non-breeding migrant to Australia, where it is widespread and common along south-western, northern and central-eastern coasts, with only scattered records of small numbers along the coasts elsewhere in southern Australia. In Western Australia, the species is widespread on the southern west coast, mainly from Ballingup and the estuary of Vasse River north to Mongers Lake, and also on coasts of the Pilbara region and Kimberley Division, with occasional records farther inland, along major rivers, such as the Ord (DEE 2019).	**Highly unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with two locations (coastal lakes) utilised in the region.
Falco peregrinus (Peregrine Falcon)		OS	X		X	The Peregrine Falcon is seen occasionally anywhere in the south-west of WA. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe 2004).	**Likely**, the species is known from the area with records from Jandakot and Gosnells. Known records in the area are generally confined to the lake systems west of Kwinana Freeway, Forestdale Lake and Canning River. The Peregrine Falcon is likely to use suitable habitat within the survey area for foraging only. No breeding habitat is present therefore any use of habitat would be opportunistic.
Gallinago hardwickii (Latham's Snipe)	Mi	Mi	X			In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). The species is occasionally recorded at sites in WA, despite being located to the west of its core range (DEE 2019).	**Highly unlikely**, no habitat present for this species. Few records available in the Perth region however the closest record is from North Lake.
Gelochelidon nilotica (Gull-billed Tern)	Mi	Mi	X			The Gull-billed Tern can be found on beaches and mudflats in the southwest but has a preference for ephemeral freshwater or brackish lakes. It is highly nomadic and will also disperse to inland lakes. It is uncommon on the Swan	**Highly unlikely**, there is no suitable coastal or extensive wetland habitat within the survey area, the species has not been recorded in the survey area, with scattered but clumped

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
						Coastal Plain and scare in the southern region (Nevill 2013).	areas utilised in the region. The closest records are at Bibra and Forrestdale Lakes.
Ixobrychus dubius (Australian Little Bittern)		P4	X		X	The Australian Little Bittern is uncommon in WA but can be found in lakes around Perth as it requires less extensive reed beds as the Australasian Bittern (*Botaurus poiciloptilus*). There have been sightings in Jandabup, Joondalup, Herdsman Lake, smaller lakes in the southwest (Nevill 2013).	**Highly unlikely**, there is no suitable habitat within the survey area, the species has not been recorded in the survey area, with records from Bibra (area) and Forrestdale Lakes.
Leipoa ocellata (Malleefowl)	Vu	Vu		X	X	The Malleefowl generally occurs in semi-arid areas of WA, from Carnarvon to south east of the Eyre Bird Observatory (south-east WA). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine (*Callitris spp.*) woodlands, Acacia shrublands, *Melaleuca uncinata* vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones & Goth 2008; Morcombe, 2004). Few records are present on the SCP and are historical observations.	**Highly unlikely**, the nearest record is located over 40 km away and was recorded in 1972. This species is considered locally extinct.
Limosa limosa (Black-tailed Godwit)	Mi	Mi	X	X	X	In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains (DEE 2019).	**Highly unlikely**, no habitat present. This species appears to have a coastal and coastal lakes preference with North and Forrestdale Lakes and lower reaches of the Swan River the closest recorded.
Numenius madagascariensis (Eastern Curlew)	Mi, Cr	CR		X	X	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Marchant and Higgins 1993).	**Highly unlikely**, no habitat present. This species appears to have a coastal and coastal lakes preference. The lower reaches of the Swan River is the closest recorded.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Oxyura australis (Blue-billed Duck)		P4	X		X	The blue-billed Duck is a small Australian almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright-blue during the breeding season. The Blue-billed Duck is endemic to Australia's temperate regions, ranging from the south west of WA, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).	**Unlikely**, there is no suitable habitat within the survey area however it has been recorded in nearby lakes and wetlands.
Pandion cristatus (Osprey)	Mi	Mi	X	X	X	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range but may also occur on low sandy, muddy or rocky shores and over coral cays. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging (DEE 2019).	**Highly unlikely**, the species has not been recorded in the survey area, with few recorded in the region. The closest records are along the coast or associated to the Swan River and lower reaches of the Canning River.
Philomachus pugnax (Ruff)	Mi	Mi		X	X	In Australia the Ruff is found on generally fresh or saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds. In WA the species has been recorded at the lower King River and it is mostly found in the south-west region of the state. It has been sighted at the Vasse	**Highly unlikely**, the species has not been recorded in the survey area, with few recorded in the region. The closest record is along the coast.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
						River estuary, north to Namming Lake and Lake McLarty (DEE 2019).	
Plegadis falcinellus (Glossy Ibis)	Mi	Mi	X		X	The Glossy Ibis' preferred habitat for foraging and breeding are shallow, grassy, fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons, and in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves. It may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (DEE 2019). It can be seen at Herdsman Lake regularly, and at Joondalup, McClarty, Thompson and Forrestdale Lakes when winter wet (Nevill 2013).	**Unlikely**, the species has not been recorded in the survey area, with scattered but clumped areas utilised in the region. The closest records is at Bibra, North and Forrestdale Lakes, north long the Swan and Canning Rivers (lower reaches).
Pluvialis fulva (Pacific Golden Plover)	Mi	Mi	X		X	In Australia this species usually inhabits coastal habitats, on beaches, mudflats and sandflats in sheltered areas including harbours, estuaries and lagoons, and also in saltworks. It is sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, but can be seen in habitats with short grass in paddocks, crops or airstrips, or ploughed or recently burnt areas. In WA, the species is seldom recorded along the southern or south-western coasts (DEE 2018). They can be seen to the Vasse Inlet, on the south coast to Oyster Harbour, the Kalgan River, and occasionally in inland lakes close to the coast (Nevill 2013).	**Unlikely**, the species has not been recorded in the survey area, with few recorded in the region. The closest record is at Bibra Lake, long the coast, Forrestdale Lake and the Swan River.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Pluvialis squatarola (Grey Plover)	Mi	Mi	X		X	Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes (DEE 2019).	**Unlikely**, the species has not been recorded in the survey area, with few recorded in the region. The closest record is at Bibra Lake, long the coast, Forrestdale Lake and the Swan River.
Rostratula australis (Australian Painted Snipe)	En	En		X	X	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The species rarely occurs in the south-western of Western Australia (Marchant and Higgins 1993; Garnett and Crowley 2000).	**Unlikely**, the species has not been recorded in the survey area, with few recorded in the region. The closest record is at Lake Kogolup.
Sterna nereis nereis (Fairy Tern)	Vu, Mi	Vu			X	The Fairy Tern occurs along the coast of WA as far north as the Dampier Archipelago near Karratha, but mostly in the southern part of Australia including most of the coastline in the south west. It nests on sheltered sandy beaches, coastal inlets, spits and banks above the high tide line and below vegetation. It has been found in embayments of habitats including offshore, estuarine or lake islands, wetlands, and mainland coastline (DEE 2019).	**Unlikely**, there is no suitable habitat within the survey area. There are no records of the species within the survey area, all are on the coast line.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Tringa glareola (Wood Sandpiper)	Mi	Mi	X	X	X	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums *E. camaldulensis*. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding. In WA, they can be found in many of Perth's wetlands including drainage channels, in Wheatbelt inland ephemeral lakes if they are not too saline, but are uncommon on the south coast (Nevill 2013).	**Unlikely**, there is no suitable habitat within the survey area. There are no records of the species within the survey area nearest records are from Bibra and North Lake in the west and lower reaches of Canning River to the north.
Tringa nebularia (Common Greenshank)	Mi	IA	X	X	X	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetland and has the widest distribution of any shorebird in Australia. The Common Greenshank is generally absent from the Western Deserts although there are a few records from the Great Sandy Desert and the Nullarbor Plain. It occurs around the coast from Cape Arid in the south to Carnarvon in the north-west. (DEE 2019).	**Unlikely**, there is no suitable habitat within the survey area. There are no records and the nearest records are from Bibra and North Lake in the west and lower reaches of Canning River to the north.
Tringa stagnatilis (Marsh Sandpiper)	Mi	Mi	X	X	X	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. In WA they prefer freshwater to marine environments (DEE 2019), but are uncommon throughout most of the south west, with the exception of a few freshwater lakes, including Bibra, Kogolup, North, Thompson, Herdsman, and McLarty Lakes (Nevill 2013).	**Unlikely**, there is no suitable habitat within the survey area. There are no records of the species within the survey area nearest records are from Bibra and North Lake in the west.
Mammals							

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Dasyurus geoffroii (Western Quoll, Chuditch)	Vu	Vu	X	X	X	The Chuditch inhabits eucalypt forest (especially Jarrah, *Eucalyptus marginata*), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyck and Strahan 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.	**Unlikely**, this species requires large areas of connected habitat to persist, the habitat is the survey area would not be suitable for this species.
Hydromys chrysogaster (Water Rat)		P4	X		X	Water-rats live primarily in a wide variety of freshwater habitats, from sub-alpine streams and other inland waterways to lakes, swamps, farm dams and irrigation channels and are thought to be one of the few native species to have at least partially benefited from human encroachment (Gardner and Serena 1995).	**Unlikely**, there is no suitable habitat within the survey area.
Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)		P4	X		X	The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland close to dense cover (Van Dyck and Strahan 2008).	**Present**, there is suitable habitat within the survey area. The species was recorded within survey area via observation, digs and scats. There are records present within the survey area.
Notamacropus irma (Western Brush Wallaby)		P4			X	The Western Brush Wallaby is a grazer found primarily in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest. This species was once very common in the south-west of WA but has undergone a reduction in range and a significant decline in abundance in its current habitat. (Van Dyck and Strahan 2008).	**Unlikely**, the habitat within the survey area is suitable for this species however they are heavily impacted by predation from foxes and therefore unlikely to be present in the survey area.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Myrmecobius fasciatus (Numbat)	En	En	X		X	The numbat's distribution once encompassed a number of habitat types, including eucalypt forest, eucalypt woodland, Acacia woodland and Triodia grasslands. Current populations occupy several different habitat types: upland Jarrah forest, open eucalypt woodland, banksia woodland and tall closed shrubland. There are currently two remnant native populations at Dryandra and Perup, WA and several reintroduced populations including Boyagin, Tutanning, Batalling and Karroun Hill Nature Reserves. Habitats usually have an abundance of termites in the soil, hollow logs and branches for shelter (Friend 2008).	**Highly unlikely**, the species is locally extinct.
Pseudocheirus occidentalis (Western Ringtail Possum)	Vu	Cr	X		X	The Western Ringtail Possum occurs in and near coastal Peppermint Tree forest and Tuart dominated forest with a Peppermint Tree understorey from Bunbury to Albany. Also occurs in Jarrah forest and Jarrah-Marri forest associated with Peppermint Tree (Van Dyck and Strahan 2008).	**Highly unlikely**, there is no suitable habitat within the survey area and the species is not known from the Swan Coastal Plain north of Mandurah.
Setonix brachyurus (Quokka)	Vu	Vu		X	X	The Quokka prefer dense forests and thickets, streamside vegetation, heaths and shrublands of *Agonis linearifolia*-dominated swamps in the Jarrah forest. The northern extent of the current distribution on the mainland is in the Jarrah forest in the Perth hills, to southward through the southern Jarrah, Marri and Karri forests to the south coast, but largely confined to areas receiving an annual rainfall of 1,000 mm or more (Van Dyck and Strahan 2008).	**Highly unlikely**, the species is locally extinct.
Reptiles							
Ctenotus delli (Dell's Skink)		P4			X	Dell's Skink is associated with Jarrah-Marri woodland that has a shrub-dominated understorey, on laterite, sandy or clay soils. It is found in the north Darling Range and inhabits dry sclerophyll forest on granite outcrops, stony hills and ranges. It is absent from the Swan Coastal Plain (Cogger 2014; Wilson and Swan 2013).	**Highly unlikely**, the species is not known from the survey area and is restricted to the Darling Range.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Lerista lineata (Perth Slider, Lined Skink)		P3			X	The Perth Slider is locally restricted to the Swan Coastal Plain south of the Swan River, including Rottnest and Garden Islands, where it inhabits coastal dunes, Banksia/eucalypt woodlands and disturbed areas including suburban gardens. There are also isolated populations on the mid-west coast at Woodleigh Station and in Busselton (Wilson and Swan 2013).	**Likely**, habitat is present within the survey area, and the species is known to occur locally. There a number of recent records (between 2009 to 2016) of this species within 5 km of the study area, including Ken Hurst Park, around Jandakot airport and near Aubin Park. Although this species seems to survive well in small patches of remnant vegetation ongoing development is further reducing remaining suitable habitat.
Neelaps calonotos (Black-striped Snake)		P3			X	This Black-striped Snake is restricted to the sandy coastal strip near Perth, between Mandurah and Lancelin. It occurs on dunes and sand-plains vegetated with heaths and eucalypt/banksia woodlands. This species is seriously threatened by increasing development within its restricted distribution (Wilson and Swan 2013). This species is thought to prefer mature *Banksia* woodlands and hence frequent fires may become a threat (Valentine *et al*. 2012); this is supported by the observation that, in nine reserves on the Swan Coastal Plain where it was historically recorded, it appears to persist only in the larger ones (and so those most resistant to fire) based on the results of repeated surveys (How and Dell 2000). This suggests it may be at significant risk from fire only as a secondary pressure in areas already under pressure from habitat fragmentation (M. Craig pers. comm. 2017 in IUCN 2018).	**Likely**, the habitat within the survey area is suitable for this species. There are a number of historical records within 5 km of the survey area (multiple records at Thomsons Lake). There is one record from 2011 which appears to occur within or immediately adjacent to the study area in bushland at the corner of Ranford Rd and Livingston Drive (near Ken Hurst Park). The larger patches of remnant vegetation comprising of *Banksia* woodlands provide the most suitable habitat for this species, in particular the area adjacent Ken Hurst Park
Invertebrates							

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Leioproctus contrarius (a bee)		P3	X		X	Very little information is available on this species. This species (like the above) is only known from few locations near Murdoch, Forrestdale Lake on the Swan Coastal Plain and just north of Wanneroo. These localities consist of clay plans dominated by shrubs and herbs that may seasonally inundate. There are few remaining communities remaining of this habitat type are now listed as threatened Ecological communities.	**Unlikely**, there is no habitat present in the survey area and no records are present in the survey area. Records are present in the Forrestdale Lake associated wetlands approximately 10 km south of the survey area.
Synemon gratiosa (Graceful Sunmoth)		P4	X		X	The Graceful Sunmoth occurs within the Swan, South West and Midwest WA DBCA regions. The range of the Graceful Sunmoth is from Namburg National Park (near Dandaragan) in the north to Mandurah in the south. The Graceful Sun Moth is associated with two habitat types: (1) Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant *Lomandra maritima*. (2) *Banksia* woodland on Spearwood and Bassendean dunes, where the second known host plant *L. hermaphrodita* is widespread (DEE 2019).	**Likely**, Banksia woodland patches within the survey area represent habitat for the species, and there are three recent local records. The larger intact areas of *Banksia* woodland in good or better condition provide the most suitable habitat for the Graceful sunmoth. However it is considered likely to persist in remnant Bushland areas that support the host plant species.
Throscodectes xiphos (a cricket)		P1	X		X	No data can be found on this species including habitat preference. The collection records for the museum specimens are from heathland (*Banksia* woodlands) in the Jandakot area.	**Unknown**, there are only four known records of this species, all of which are in the Jandakot area, less than 1 km from the study area (recorded 1975, 1981, 1983 and 1999). Given the lack of information available on this species it is difficult to identify significant habitat within the project as well as potential impacts to the species.

Species Name	Status		Desktop Search			Description and habitat requirements	Likelihood
	EPBC Act	WA	NM	PMST	DBCA		
Westralunio carteri (Carter's Freshwater Mussel)	VU	VU	X			The Carter's Freshwater Mussel is restricted to south-western Western Australia, and occurs in 13 of 18 river basins in the South West Coast Drainage Division. It was formerly found from Moore River in the north to King George Sound in the south and inland to the Avon River (McMichael and Hiscock 1958; WA Museum Records; Kendrick 1976). Currently distributed in freshwater streams, rivers, reservoirs and lakes within 50-100 km of the coast, from Gingin Brook southward to the Kent River, Doodga River and Waychinicup River (Klunzinger et al. 2012c, 2014). It patchily distributes itself in sandy/muddy sediments of freshwater lakes, rivers and streams with greatest densities associated with exposed submerged tree roots (*Eucalyptus rudis, Melaleuca* spp. and others), woody debris and overhanging riparian vegetation near stream banks and edges of lakes/dams (DEE 2019).	**Unlikely**, there no suitable habitat for this species.

Conservation significant fauna signs recorded during the field survey

Carnaby's Cockatoo foraging sign – chewed Banksia ilicifolia pods

Carnaby's Cockatoo foraging sign – chewed Banksia attenuata pods

Forest Red-tailed Black Cockatoo foraging sign – chewed Marri pods

Forest Red-tailed Black Cockatoo foraging sign – chewed Jarrah pods

Quenda diggings

Quenda scats

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