Tonkin Highway / Hale Road, Tonkin Highway / Welshpool Road and Tonkin Highway / Kelvin Road

Biological Assessment

Tonkin Highway / Hale Road, Tonkin Highway / Welshpool Road and Tonkin Highway / Kelvin Road

Biological Assessment

Client: Main Roads Western Australia

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Executive Summary

Main Roads Western Australia (MRWA) proposes to construct grade-separated interchanges at the intersections of Tonkin Highway and Hale Road in Forrestfield, Tonkin Highway and Welshpool Road in Wattle Grove and Tonkin Highway and Kelvin Road in Orange Grove (the Project Areas). AECOM Australia (AECOM) was commissioned to conduct biological assessments within defined Project Areas along Tonkin Highway. The biological assessments included a Level 1 Flora and Vegetation Assessment, a Level 1 Fauna Assessment and a Wetland Assessment.

The results of the biological assessment were used to inform the assessment against the ten clearing principles under Part V Division 2 of the *Environmental Protection Act 1986*. Furthermore, results of the assessments will determine the requirement for additional environmental approvals for the project and inform management plans.

The significant ecological findings from the assessment are:

- One Threatened Flora and two Priority Flora species occur within the Project Area. *Conospermum undulatum* (T), *Isopogon drummondii* (P3) and *Verticordia lindleyi* subsp*. lindleyi* (P4) occur at Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange. *Conospermum undulatum* and *Isopogon drummondii* occur within the Tonkin Highway/Kelvin Road interchange.
- A State listed TEC (SCP 20a – *Banksia attenuata* woodland over species rich dense scrublands) was identified as occurring within the Project Area. This was further verified by Department of Parks and Wildlife. This TEC is represented by EBWES, AHES and BAAS.
- Vegetation communities EBWES, AHES, AEBS, VHS and CEW are considered to be of national significance as they support populations of EPBC Act listed species *Conospermum undulatum*.
- Vegetation community EBWES is considered to be locally significant as it supports populations of Priority Flora.
- Both of the interchanges within the Project Area contain potential breeding habitat and foraging habitat for EPBC Act listed Black Cockatoo species.
- Twelve Geomorphic Wetlands traverse the Project Area, comprising of six Conservation Category Wetlands (CCW), five Multiple Use Wetlands and one Resource Enhancement Wetland.
- The Wetland Assessment identified one wetland currently mapped as Multiple Use displayed seven of the triggers for automatic classifications as a Conservation Category Wetland, further supported by a Secondary Evaluation.

Clearing for the proposed Tonkin Highway/Hale Road interchange and the proposed Tonkin Highway/Welshpool Road interchange upgrade is considered to be **at variance** with three of the ten clearing principles, **likely to be at variance** with two principles, **may be at variance** with one principle and **not likely to be at variance** with four principles.

The clearing within the proposed Tonkin Highway/Kelvin Road interchange is considered to be **at variance** with four of the ten clearing principles, **likely to be at variance** with two principles, **may be at variance** with one principle and **not likely to be at variance** with three principles.

It is recommended that infrastructure design take into account locations of conservation significant environmental factors including flora, fauna and wetlands. Appropriate management plans should be developed including a Wetland Management Plan, a Site Hygiene Management Plan, and a Fauna Management Plan.

Referral pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is likely to be required for both of the proposed interchange upgrades. Referral under Part IV of the *Environmental Protection Act 1986 (*EP Act) may also be required for both proposed interchange upgrades to assess impacts on Threatened Ecological Communities, Bush Forever and Threatened flora species. Once detailed design has been finalised, it is recommended that the potential impacts of each of the proposed intersection upgrades be considered with reference to relevant government guidance to confirm whether referral under the EPBC Act or EP Act is required.

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1.0 Introduction

1.1 Background

Tonkin Highway is a major arterial highway in the Perth Metropolitan Area. It links the south-east corridor of Perth with the north-east and north-west corridors of the metropolitan area. It services the Kewdale industrial area as well as the Perth Airport. It is a strategic freight, tourist and inter town route. Welshpool Road East is a major arterial road intersecting Tonkin Highway in Wattle Grove. Hale Road and Kelvin Road are minor arterial roads.

Main Roads Western Australia (MRWA) proposes to construct grade-separated interchanges at the intersections of Tonkin Highway and Hale Road in Forrestfield, Tonkin Highway and Welshpool Road in Wattle Grove and Tonkin Highway and Kelvin Road in Orange Grove. Grade separation is necessary at each of these locations to reduce potential vehicular conflict, improve travel times, congestion and safety for both vehicles and pedestrians.

AECOM Australia (AECOM) was commissioned to conduct a biological assessment for the Project Area. The results of this assessment will inform the environmental assessment and approvals process for the project. Survey findings will also identify the need for any requirements for further field investigations. Additionally, results of the assessment will assist preparation of the Clearing Impact Assessment and Vegetation Management Plan for the project.

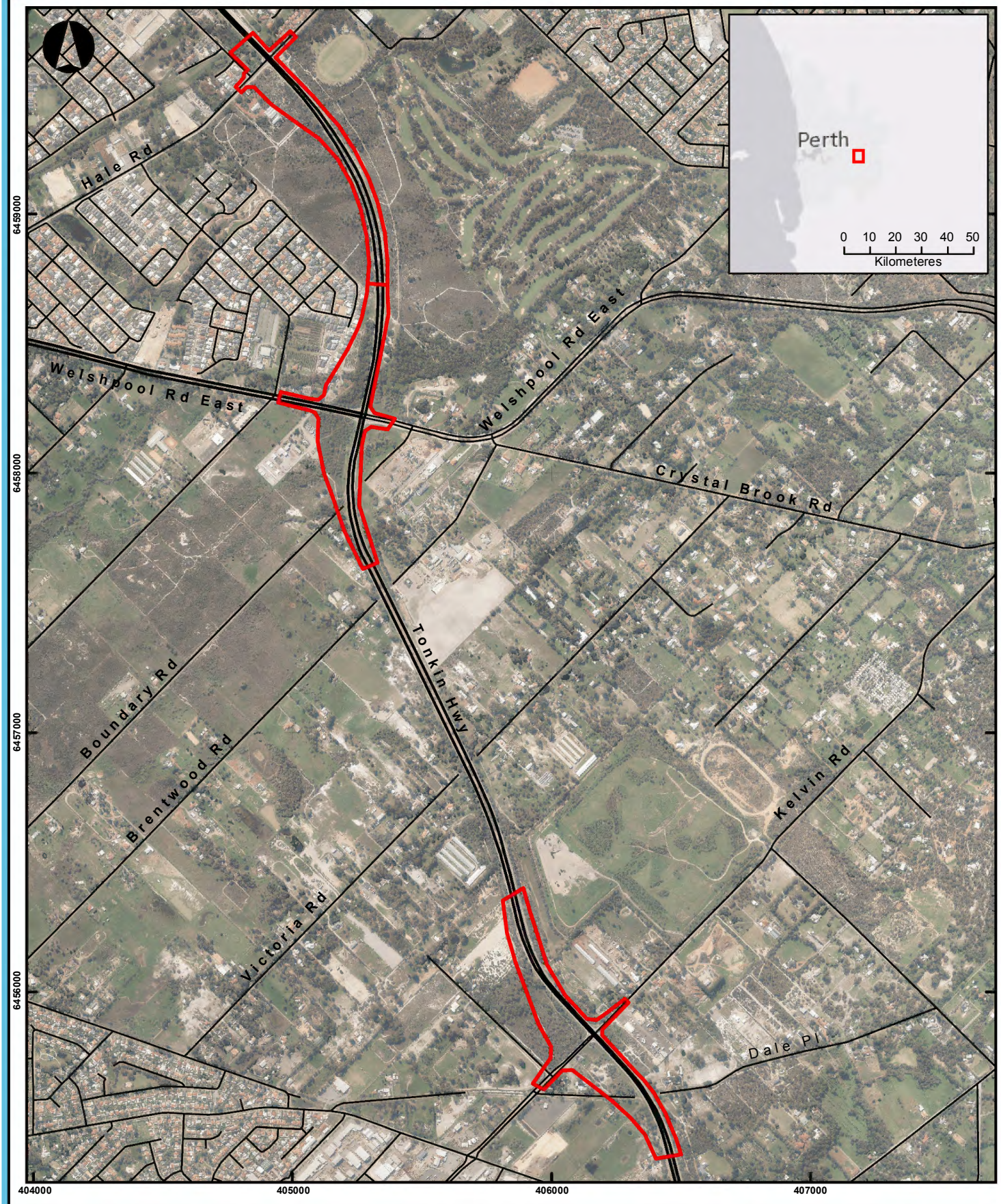
1.2 Location

The three intersections with Tonkin Highway are located within the Shire of Kalamunda and City of Gosnells local government authorities, situated approximately 12 km south east of the Perth Central Business District. The Project Area is illustrated in Figure 1.

1.3 Objectives

The primary purpose of this biological assessment was to identify the key flora, fauna, soil, groundwater and surface water values of the Project Area and their potential sensitivity to impact, primarily to inform the environmental assessment and approvals process for the project. The biological assessment consisted of a desktop review, field survey and discussion of results in this technical report. Specific objectives of the assessment were to:

- Conduct a ‘Level 1’ Flora and Vegetation assessment in accordance with methodologies stated in Environmental Protection Authority (EPA) Guidance Statement 51
    - Map vegetation communities and condition
    - Undertake targeted searches for Threatened and Priority 1 and 2 flora species
- Conduct a ‘Level 1’ Fauna assessment in accordance with methodologies stated in EPA Guidance Statement 56
    - Define and map fauna habitat within the project area
    - Undertake a targeted Black Cockatoo survey
- Undertake a wetland field assessment using Department of Parks and Wildlife (2013) draft Guidelines
- Undertake an assessment against the 10 Clearing Principles in accordance with the requirements of Main Roads Statewide Purpose Clearing Permit, CPS818/12.



Project Area

Tonkin Grade Separation Biological Survey

Figure 1

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500

Metres

1:20,000 (A4)

LEGEND

Tonkin Hwy Grade Separation Project Area

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2.0 Existing Environment

2.1 Climate

The Swan Coastal Plain has a warm Mediterranean climate (Mitchell *et al.,* 2002), characterised by hot dry summers and cool to mild wet winters. The closest meteorological recording station to the Project Area with comprehensive data is the Perth Airport station (station 009021), located less than 6 km to the north of the Project Area at its closest point. Perth Airport meteorological station is maintained by the Bureau of Meteorology (BoM) and commenced recording in 1944.

Perth Airport has experienced an average annual rainfall of 770.8 mm since 1944, with the majority of rainfall occurring between May and September (BoM, 2015) (**Error! Reference source not found.** 2).

Rainfall leading up to the 2014 survey was close to the average rainfall for the months of July to September leading up to the survey in October. Rainfall was unlikely to be a limiting factor for capturing detection periods of flora species in 2014.

Rainfall in 2015 was below average for consecutive months leading up to the surveys. This was not considered a limitation for undertaking the wetlands assessment.

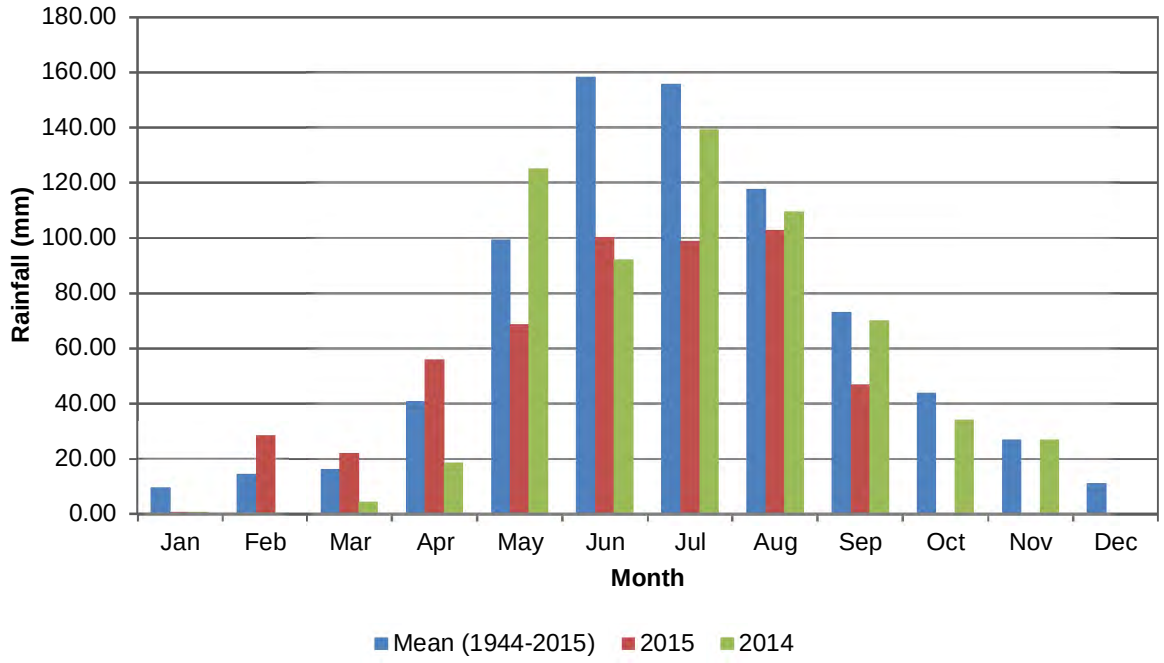


Figure 2 Rainfall and Temperature Statistics for Perth Airport (Source: BoM 2015)

2.2 Geology and Soils

The surface geology of the Project Area comprises the following three geological types:

- Bassendean Sand, which is derived from aeolian sand and coastal sediment and is described as basal conglomerate overlain by dune quartz sand with heavy mineral concentrations
- Guildford Formation, derived from alluvial and estuarine sediment and consisting of alluvial sand and clay with shallow marine and estuarine lenses and local basal conglomerates
- Yoganup Formation, which is derived from aeolian, coastal sediment and conglomerate sands. This formation consists of basal conglomerate overlain by dune quartz sand with heavy mineral concentrations (Geological Survey of Western Australia and Geoscience Australia, 2008).

The portion of the Project Area incorporating the Hale and Welshpool Road East interchanges is composed of Bassendean Sand and Guildford Formation. The Kelvin Road interchange is underlain by Bassendean Sand and the Yoganup Formation.

The underlying geology has given rise to the soils of the area. The Hale and Welshpool Road East interchanges occur entirely within the Cb38 soil type. These soils are described as sandy dunes with intervening sandy and clayey swamp flats (Bureau of Rural Science, 1991). The chief soils are leached sands, sometimes with a clay horizon on the dunes and sandy swamps. The Kelvin Road interchange lies on the Wd6 soil type, which is described as sandy acidic yellow mottled soils, some of which contain ironstone gravel. This soil type is associated with acid yellow earths, low dunes and some swamps with variable soils (Bureau of Rural Science, 1991).

2.3 IBRA Regions

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Commonwealth of Australia, 2013a). The Project Area lies within the Swan Coastal Plain IBRA region and, at a finer scale, within the Perth subregion (Mitchell *et al*., 2002).

The Perth subregion consists of alluvial river flats, colluvial and aeolian sands, and coastal limestone (Mitchell *et al*., 2002). Vegetation of the subregion comprises heath and/or Tuart (*Eucalyptus gomphocephala*) woodlands on limestone, Jarrah (*Eucalyptus marginata*) and *Banksia* woodlands on Quaternary marine dunes and Marri (*Corymbia calophylla*) on colluvial and alluvial sands. The subregion includes Rottnest, Carnac and Garden Islands as well as a complex chain of seasonal wetlands.

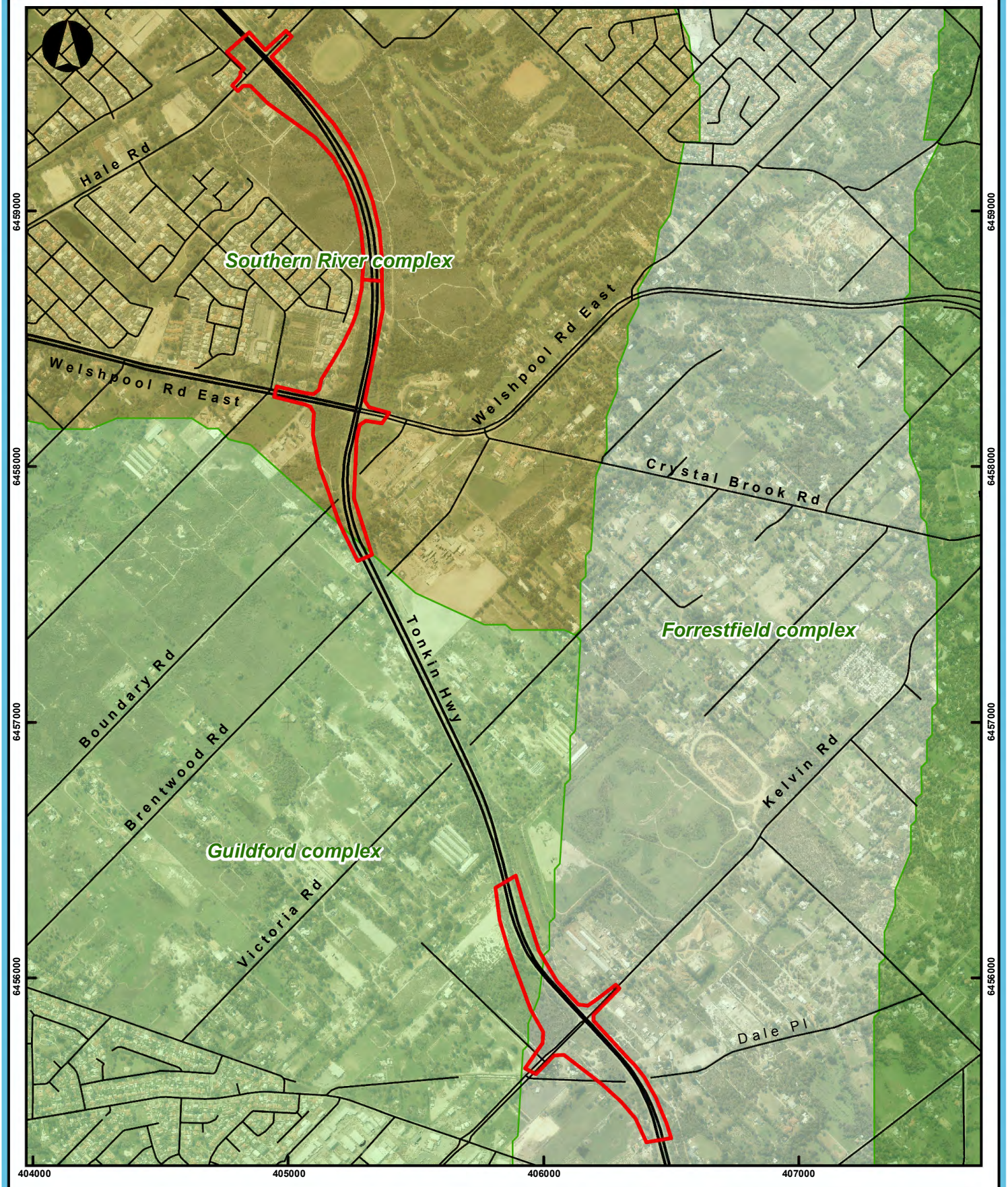
2.4 Flora and Vegetation

The Project Area is located on the Swan Coastal Plain and has been broadly characterised by Beard (1990) as medium woodland of Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Wandoo (*Eucalyptus wandoo*). Vegetation complexes within the Project Area have been defined by Heddle *et al.* (1980) and are based on vegetation in association with landforms and underlying geology.

The following vegetation complexes, the Guildford Complex, Forrestfield Complex and Southern River Complex (Heddle *et al.,* 1980), occur within the Project Area, and are described as:

- Guildford Complex – A mixture of open forest and tall open forest of *Corymbia calophylla, Eucalyptus wandoo, Eucalyptus marginata* as well as *Eucalyptus wandoo* woodland. Fringing woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* occur along streams.
- Forrestfield Complex – Open Forest of *Corymbia calophylla, Eucalyptus wandoo, Eucalyptus marginata* to Open forest of *Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana* and *Banksia* species, with fringing Woodlands of *Eucalyptus rudis* in gullies.
- Southern River Complex – Open Woodland of *Corymbia calophylla*, *Eucalyptus marginata*, *Banksia* species with fringing woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* along creek beds.

The majority of the native vegetation occurring within the Project Area is Southern River complex, with smaller areas of the Forrestfield and Guildford complexes occurring within the southern extent of the Project Area. Vegetation complexes within the Project Area are spatially presented in Figure 3.



Vegetation Complexes

Tonkin Grade Separation Biological Survey

Figure 3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500

Metres

1:20,000 (A4)

LEGEND

- Tonkin Hwy Grade Separation Project Area
- Darling Scarp complex
- Forrestfield complex
- Guildford complex
- Southern River complex

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2.5 Vegetation Factors of Environmental Significance

2.5.1 Threatened and Priority Species

The DPaW assigns conservation codes to endemic plant species that are geographically restricted to few known populations or threatened by local processes. Allocating conservation codes to plant species assists in protecting populations and conserving species from potential threats (DPaW, 2013).

Under the *Wildlife Conservation Act 1950* (WC Act) the State Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 include species that are threatened and those that are presumed extinct, respectively (DPaW, 2013).

It is an offence to "take" or damage Rare Flora without Ministerial approval. Section 23F of the WC Act defines "to take" as "to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Species designated as Priority Flora are species that have not yet been adequately surveyed and are in urgent need of further survey (Priority 1 to 3), are rare but not threatened (Priority 4) or conservation dependent species (Priority 5) (DPaW, 2013). Appendix A presents the updated definitions of Conservation Codes for Western Australian Flora.

Species at risk of extinction are recognised at a Commonwealth level and are categorised according to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as summarised in Appendix A.

2.5.2 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat, and that are subject to processes that threaten to destroy or significantly modify the assemblage across its range (Department of Environment and Conservation (DEC), 2001).

Vegetation communities in Western Australia are described as TECs if they have been defined by DPaW's Species and Community Branch and found to be Presumed Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU).

The categories and the criteria for defining TECs have been described by English and Blyth (1997). A publicly available database, listing TECs within Western Australia, is maintained by DPaW (2014a) and available via their website (www.dpaw.wa.gov.au).

There is currently no legislation covering the conservation of TECs in Western Australia, however some are protected under the Commonwealth EPBC Act. For those State TECs not listed on the Commonwealth register, land clearing legislation under the *Environmental Protection Act 1986* (EP Act) provides protection from clearing. The Western Australian EPA position on TECs is that proposals resulting in their direct loss are likely to be formally assessed.

Potential TECs that do not currently meet criteria or that are not adequately defined, are rare but not threatened, have been recently removed from the TEC list or require regular monitoring are classified as Priority Ecological Communities (PECs) (DPaW, 2014a) and DPaW requires them to be taken into consideration during environmental impact assessments.

2.5.3 Locally, Regionally and Nationally Significant Communities

Vegetation communities are referred to as locally significant where they:

- support populations of Priority Flora
- extend the geographic range of particular taxa from previously recorded locations
- are restricted to only one or a few locations
- occur as small isolated communities
- exhibit unusually high structural and species diversity.

Vegetation communities are referred to as regionally significant where they:

- are limited to specific landform types
- are uncommon or restricted plant community types within the regional context
- support populations of Threatened Flora (T or X).

Vegetation communities are referred to as nationally significant where they:

- support populations of Threatened (EPBC Act listed) species
- support populations of TECs listed with national (EPBC Act listed) significance.

Guidance Statement 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a) also states that "vegetation may be significant for a range of reasons, other than a statutory listing as a TEC or because the extent is below threshold level". According to Guidance Statement 51, other significant vegetation may include communities that:

- exhibit scarcity
- support unusual species
- support a novel combination of species
- provide a role as a refuge
- provide a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- are representative of the range of a unit (particularly, a good local and/or regional example of a unit in "prime" habitat, at the extremes of a range, recently discovered range extensions, or isolated outliers of the main range)
- have a restricted distribution.

2.5.4 Significant Species

Guidance Statement 51 (EPA, 2004a) states that "species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than as Threatened Flora (T or X) or Priority Flora". According to Guidance Statement 51 (EPA, 2004a), other significant flora may include taxa that:

- have a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species
- have a relic status
- have anomalous features that indicate a potential new discovery
- are representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- show the presence of restricted subspecies, varieties or naturally occurring hybrids
- have local endemism/a restricted distribution
- are poorly reserved.

2.5.5 Vegetation Representation and Significance

The current extent of vegetation types that remain is important in considering the significance of proposed clearing. That is, vegetation that is poorly represented is of greater significance and proposed impacts on such vegetation types are also considered to be of greater significance in terms of impact assessment.

Where clearing of native vegetation is proposed to occur, from a biodiversity perspective and not taking into account any other land degradation issues present, there are now several key criteria being applied to clearing permits. The criteria are outlined in the EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation, with particular reference to the agricultural area* (EPA, 2000). This position statement is used to help reverse the long-term decline in the quality and extent of

Australia's native vegetation cover and applies to all areas of native remnant vegetation in the state, with particular reference to the agricultural area. The criteria are as follows:

- the "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type
- a level of 10% of the original extent is regarded as being a level representing "endangered"
- clearing which would put the threat level into the class below should be avoided
- from a biodiversity perspective, stream reserves should generally be in the order of at least 200m wide.

The status of remaining vegetation can be delineated into five different classes:

- Presumed extinct: Probably no longer present in the bioregion
- Endangered: <10% of pre-European extent remains
- Vulnerable: 10-30% of pre-European extent exists
- Depleted: >30% and up to 50% of pre-European extent exists
- Least concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

2.6 Threatened, Priority and Migratory Fauna Species

Species of fauna are defined as Threatened where their populations are under threat, require protection or are protected under an international agreement between federal governments. DPaW recognises these threats of extinction and consequently applies regulations towards population and species protection.

Threatened fauna species are protected under Section 16 of the WC Act. Under the WC Act, it is an offence to "take, destroy or possess" threatened fauna without Ministerial approval. Threatened fauna (Schedule 1) are further ranked by DPaW according to their threat using International Union for Conservation of Nature (IUCN) Red List criteria that are described as follows:

- CR Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN Endangered – considered to be facing a very high risk of extinction in the wild
- VU Vulnerable – considered to be facing a high risk of extinction in the wild.

Priority fauna not listed as Threatened (Scheduled) under the WC Act, but that are poorly known or poorly represented in the conservation estate are regarded as priority and attention is given to their conservation by DPaW.

Threats of extinction of fauna species are also recognised at a Commonwealth level and are categorised according to the EPBC Act, administered by Department of the Environment (DotE). Conservation categories of fauna listed under Schedule 1 to 4 of the WC Act, listed as Priorities, or under the EPBC Act are summarised in Appendix A.

Migratory species are Matters of National Environmental Significance (MNES) under the EPBC Act. Migratory species are defined as animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations (DotE, 2013). Recognised migratory species include any native species identified in an international agreement approved by the Minister and those listed under:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA).

3.0 Methodology

3.1 Level 1 Flora and Vegetation Assessment

3.1.1 Desktop Assessment

The desktop assessment incorporated a literature review and database searches from relevant databases. These searches included:

- DPaW database searches for conservation significant vegetation communities, flora and fauna species
- Western Australian Herbarium database search
- EPBC Act Protected Matters Search Tool
- Department of Agriculture and Food, Western Australia (DAFWA) Western Australian Organism List pursuant to the *Biosecurity and Agriculture Management Act 2007.*

The searches were conducted based on the Project Area and included a buffer area of 1km surrounding the Project Area.

3.1.2 Field Assessment

The flora, vegetation and fauna surveys were conducted simultaneously by Lisa Chappell (Senior Environmental Scientist) and Andrew Batty (Principal Ecologist) on the 10, 12-13 and 21 October 2014. The Project Area was traversed on foot and observations made relevant to the biological survey as detailed below.

The flora and vegetation assessment of the Project Area was conducted in accordance with EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a) and EPA Position Statement No.3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002). EPA (2002) states that flora and vegetation surveys in the South-West Province should generally be conducted following winter (the season which normally contributes the most rainfall in the bioregion) so that the majority of plant species in the area are displaying characteristics (e.g. flowers) that allow identification. Given that the majority of rainfall in the Project Area occurs between May and September (BoM, 2014), October was considered to be an optimal time to conduct a survey on the Swan Coastal Plain. The likelihood of recording a high proportion of the species diversity supported by the Project Area at the time of the field survey is high.

Prior to the field assessment, results of the desktop assessment were analysed to determine the potential presence of conservation significant species occurring within the Project Area.

The assessment was carried out by recording floristic data at various locations throughout the Project Area, wherever changes in floristic composition and structure were observed. Detailed information was recorded to enable characterisation of each vegetation community and all flora species encountered were recorded. The survey was conducted using point sample locations within the Project Area. Areas of 10x10 m were sampled and all vascular flora species within this area were recorded. In addition, the following parameters were recorded:

- location (UTM GDA), date, site number
- site characteristics including soil and outcrops, vegetation community description, condition and evidence of disturbance and fire
- vascular plant species including their height and foliage cover.

Characterisation of the vegetation communities involved identification, description and spatial mapping of the floristic communities based on changes in dominant species composition and landform. Where marked changes in species composition and floristic structure were observed, species within the vegetation community were recorded in order to characterise vegetation units.

3.1.3 Vegetation Condition

Vegetation condition was determined at a range of detailed recording sites and in between as necessary, where condition was observed to change. Vegetation condition was determined in relation to the (perceived) ability of the bushland to maintain itself (Keighery, 1994). This is commonly interpreted primarily by the ratio of visible introduced species to native species; however, disturbance (e.g. grazing, erosion), degree of alteration of community and habitat structure, site ecology and other factors are also considered (Table 1).

Table 1 Bushland Condition Ratings (adapted from Keighery, 1994)

Descriptor	Explanation
Pristine	Pristine or nearly so, no obvious signs of disturbance. *0% weed cover*
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are nonaggressive species. *1 – 5% weed cover*
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing. *5 – 25% weed cover*
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing. *25 – 50% weed cover*
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance of vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing. *50 – 75% weed cover*
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs. *75 – 100% weed cover*

3.1.4 Determining Threatened Ecological Communities from Vegetation Data

The primary tool for classification of Threatened Ecological Communities (TECs) on the Swan Coastal Plain is by assigning a Floristic Community Type (FCT), as classified by Gibson *et al.*, (1994). The Floristic Survey of the Swan Coastal Plain (Gibson *et al.*, 1994) identifies suites of dominant and indicator flora species, in combination with the landform complex of the location, as characteristic of a specific FCT. Therefore, results from the field survey were used to compare common species and confirm suitable distributions with regard to landform complexes in respect to Gibson *et al.* (1994) to categorically determine FCTs.

Gibson *et al.* (1994) and outcomes of this are widely recognised in Western Australia as the benchmark study that has defined broad vegetation types (FCTs) across the Swan Coastal Plain. The data and information in the Gibson *et al.* (1994) publication forms the basis of all vegetation assessments in the region. Although the publication is now 17 years old, no other, more recent comprehensive study exists and this publication therefore remains the primary reference.

The Gibson *et al.* (1994) methodology is considered to be rigorous and therefore has been accepted as a methodology in defining communities for the purpose of identifying threatened ecological communities by DPaW. DPaW continues to utilise the Gibson *et al.,* (1994) methodology for determining floristic communities on the Swan Coastal Plain, and consequently is adding to the dataset originally developed for Gibson *et al.* (1994).

Collected data was compared to the most recent dataset available on Naturemap which includes the Gibson *et al* (1994) data and Bush Forever (2000) data. This dataset is referred to as Keighery (2005) combined dataset. Statistical analysis was conducted using PCOrd (MJM Software), to determine the common species in recorded communities with the Keighery (2005) dataset. FCTs that have the highest percentage of common species are then examined further with regards to suitability of location, soil (complex) type and typical dominant and indicator species to determine the FCT of described vegetation communities.

3.1.5 Targeted Threatened Flora Assessment

Flora searches were conducted simultaneously with the Level 1 Flora and Vegetation Assessment. They were conducted systematically at defined locations and involved traversing the area on foot and walking meandering transects or a grid pattern. The search methods employed were based on species habit and size, and whether the location of the search was at a known location (i.e. existing DPaW record), or in suitable habitat. Meandering transects were used in areas that provided suitable habitat for targeted flora species. A grid pattern was used when searching for a targeted species at a historic record/known location using a GPS for navigation. The grid pattern provides a more intense coverage for a smaller area where by systematic sweeps were traversed approximately 10m apart.

3.1.6 *Drakaea elastica*

Drakaea elastica is documented as 'being found in deep sandy soil in Banksia woodland, usually under *Kunzea glabrescens*, in low-lying situations adjoining winter-wet swamps' (Hoffman & Brown, 2011). Database searches identified *Drakaea elastica* as potentially occurring in the Project Area and discussions with Andrew Brown (DPaW) further confirmed this. Andrew identified those parts of the Project Area which were remnant Banksia woodlands, including Banksia- *Eucalyptus marginata* (Jarrah) woodlands and Banksia-*Eucalyptus gomphocephala* (Tuart) woodlands, as potential *Drakaea elastica* habitat.

Drakaea elastica has a glossy, light-green heart shaped leaf and flowers in October to early November. The basal leaf has normally withered by flowering time. Andrew Brown (DPaW) recommended that a *Drakaea elastica* search on the Swan Coastal Plain was best undertaken by the end of August, when the orchid leaf is still green and more easily sighted, given that the plant can be difficult to see during its flowering period.

Targeted surveys for the Threatened *Drakaea elastica* were conducted in the proposed Tonkin Highway-Hale Road interchange. Surveys were undertaken by Brian Morgan (Senior Botanist) and Matthew Cann (Field Assistant) on 18th August, 2015. Areas of plantings adjacent to Tonkin Hwy, were not suitable habitat and were not searched. Similarly, areas of past soil removal (old excavated sand pit) and areas of closed weed grasslands/herblands (only small areas) were not searched.

Where orchids of potential interest were observed, the location was flagged and the coordinate was recorded, and numbers of plants estimated and photographs taken. The orchid photographs were subsequently shown to Andrew Brown (DPaW) who was able to identify the orchid taxon from the leaves. The search was conducted using a 5 metre to 7.5 metre gridline spacing.

3.1.7 Taxonomy and Nomenclature

Species that were unable to be identified in the field were collected and pressed for identification using the AECOM in-house Herbarium or the Western Australian (WA) State Herbarium. Plant specimens were identified by Lisa Chappell (Senior Environmental Scientist), Catherine Krens (Senior Botanist), Floora de Wit (Senior Botanist) and Lyn Van Gorp (Environmental Scientist) of AECOM using a combination of taxonomic keys and comparison with pressed specimens housed at the AECOM or WA Herbariums. Nomenclature of the species recorded follows the protocol of the WA Herbarium.

3.2 Wetland Assessment

3.2.1 Initial Assessment - 2014

The assessment used the EPA Bulletin 686 (EPA, 1993) methods to identify the natural and human attributes of the wetland and determine the suitable management category. The following information was recorded for each of the wetlands where a site visit was conducted:

- location details including GPS, Unique Identification Code (UFI) and corridor intersection
- Geomorphic Wetland Management Category
- Bulletin 686 evaluation
- conservation significance comments
- whether the wetland can be avoided
- extent (if any) of vegetation buffer around wetland
- other aspects of interest.

3.2.2 Confirmation Assessment - 2015

Following advice received from the DPaW Wetlands Branch in January 2015, the wetland assessment was revised in accordance with methodology described in *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DPaW, 2013b).

The wetland evaluation methodology for the Swan Coastal Plain is a two tiered approach. This approach has been adopted to avoid detailed evaluations being undertaken where it may not be necessary. The two tiers of evaluation are as follows:

1) Preliminary Evaluation – if any one of the preliminary evaluation criteria is met the wetland is automatically to be assigned a Conservation management category and no further evaluation is required.

2) Secondary Evaluation – if the wetland does not meet the preliminary evaluation criteria the secondary evaluation should be conducted to determine the wetland's management category.

Prior to undertaking the wetland evaluation, a preliminary desktop and site assessment must be undertaken and a *Wetland evaluation and desktop and site assessment form* filled out (DPaW 2013b). The information gathered by this form then informs the Preliminary evaluation.

Online government desktop information sources (such as SLIP database) in addition to data collected as part of the flora, vegetation and fauna assessments as well as the initial wetland assessment undertaken in 2014 were used to populate the *Wetland evaluation and desktop and site assessment form.*

The Preliminary evaluation was undertaken using the information contained in the *Wetland evaluation and desktop and site assessment form*. In accordance with DPaW (2013b) methodology, if a wetland met any one of the Preliminary evaluation criteria then it was assigned a Conservation management category. Wetland UFI 8025, 8028, 14,962, 15,021, 15,116 and 15,257 were visited on 30th September, at which time the Secondary Evaluation was completed.

3.2.3 Geomorphic Wetlands Dataset of the Swan Coastal Plain

The Geomorphic Wetlands Dataset (GWD) provides aspirational guidance on management objectives for three wetland management categories. The dataset has been recognised and endorsed by the Wetlands Coordinating Committee as the most comprehensive wetland mapping, classification and evaluation work on the Swan Coastal Plain (DPaW, 2014b). The dataset provides a systematic method of classifying wetlands by assessing the level of significance. The management categories applied to wetlands of the Swan Coastal Plain are provided in Table 2.

Table 2 Management Categories and Objectives for the Geomorphic Wetlands of the Swan Coastal Plain

Management Category	General Description	Management Objectives
Conservation (CC or CCW)	Wetlands which support a high level of attributes and functions.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: i) reservation in national parks, crown reserves and State owned land ii) protection under Environmental Protection Policies iii) wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement (RE)	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their Conservation value. These wetlands have the potential to be restored to Conservation Category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use (MU)	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

3.3 Level 1 Fauna Assessment

3.3.1 Desktop Assessment

A Level 1 Fauna Survey was conducted according to EPA Guidance Statement 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004b).

Prior to the commencement of the field assessment, database searches were conducted using the EPBC Act Protected Matters Search Tool and DPaW Threatened and Priority Fauna databases to determine the presence or potential presence of fauna species within the Project Area.

3.3.2 Field Assessment

The fauna field assessment was conducted in conjunction with the flora and vegetation field assessment. In addition to recording all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings was documented. In particular, attention was given to conservation significant species identified in the desktop assessment as having the potential to occur in the area. Conservation significant fauna targeted during the field survey included three species of Threatened Black Cockatoo, Quenda (Priority 5) and the Eastern Great Egret, Cattle Egret and Rainbow Bee-eater which are all Migratory species and protected under international agreements.

Conducting the two assessments concurrently enabled interpretation of the habitat value of each of the vegetation units described and mapped, and determination of each of these as suitable for significant fauna. Where habitat for conservation significant species was located, site details were recorded using iPad units including GPS (GDA 94, MGA Zone 50).

At each habitat visited, micro habitat searches were conducted. This included raking soil and leaf litter, inspecting dead logs and timber, inspecting burrows, lifting rocks and inspecting loose bark where found. Bird counts were conducted at each site. Incidental observations of fauna were recorded during travel between sites.

Potential Black Cockatoo breeding habitat trees were visually examined to determine the presence of hollows and locations were recorded using GPS (MGA Zone 50, GDA 1994) as were details including tree height, DBH and presence of any hollows. Where potential breeding habitat trees were observed, location was recorded using a GPS (MGA Zone 50, GDA 1994). These units typically have an accuracy of between 3 and 4 metres. All effort was taken to ensure the maximum accuracy was available when recording tree location.

Potential Black Cockatoo foraging habitat was defined by the presence of one or more known foraging species within any particular vegetation community and was based on the flora and vegetation results. This allows for accurate descriptions of vegetation communities and ensures correct identification of foraging species present within that community. Fauna habitats were mapped using ArcGIS software.

3.3.3 Taxonomy and Nomenclature

The taxonomy and nomenclature of vertebrate species for mammals, reptiles and amphibians was in accordance with the Western Australian Museum's Checklist of Vertebrates of Western Australia (WA Museum, 2014) and for bird species the Bird's Australia Checklist of Australian Birds based on Christidis and Boles (2008).

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4.0 Survey Limitations

A number of limitations relating to the Biological Survey have been considered and these are described below:

- Specimens that could not be identified to a high degree of certainty are denoted by a question mark in front of the name. This can be the case, for example, when a collection of a flora species is made but no flowering parts are available. In this instance it may not be possible to confidently attribute a particular species to the specimen.
- Statistical analysis of floristic data in comparison to the Gibson *et al*. (1994) dataset is limited. The vegetation assessment conducted by Gibson *et. al.* (1994) was conducted over multiple seasons using multiple quadrats and as a result a larger number of species were recorded to occur. Due to the limited number of recorded species within vegetation communities of the Project Area in comparison to Gibson *et al.* (1994) it may be difficult to definitively determine the Floristic Community Type (FCT).
- Species presence absence data inherently suffers from a number of limitations. This is particularly relevant for targeted Threatened and Priority flora species. In the past decade the use of presence/absence data to make management decisions has come into question. A species that is observed as absent (non-detection of species) does not necessarily imply that the species is genuinely absent as often they can be present in an area but go undetected due to random chance (MacKenzie, 2005a). Several studies have investigated detection probabilities of flora for both Threatened species and common easily-detectable species (Chen et al., 2009; Clarke et al., 2012; MacKenzie 2005a). The studies showed a large discrepancy between the detection of species after one sampling effort compared to multiple sampling efforts. Recently it has been suggested that a statistical detectability calculation should be used to determine the probability of species presence (or absence) (MacKenzie 2005a; MacKenzie 2005b; MacKenzie & Royle, 2005).
- Rainfall in 2015 was significantly lower than average since May. Multiple consecutive months of low rainfall may have caused a decline in floristic diversity, and prevented the germination of species including Orchids. Orchids are very sensitive to climate receptors and will only emerge from their tuber in ideal conditions. These may not have been prevalent in 2015.

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5.0 Results

5.1 Flora

5.1.1 Desktop Assessment

The database searches identified that 60 Threatened or Priority Flora species are known or have the potential to occur within the Project Area. This comprises 21 EPBC Act listed species (ranked as either Critically Endangered, Endangered or Vulnerable under the WC Act), one species that is classified as Critically Endangered under the WC Act but not listed under the EPBC Act, five Priority 1, six Priority 2, 19 Priority 3 and eight Priority 4 species (Table 3).

Three of these species have previously been recorded within the Project Area, including:

- *Conospermum undulatum*, listed as Vulnerable under both the EPBC Act and WC Act and known from four location(s)
- *Isopogon drummondii* (Priority 3), known from one location
- *Verticordia lindleyi* subsp. *lindleyi* (Priority 4), known from two locations.

The likelihood of occurrence of each of the conservation significant species identified through the desktop assessment has been determined based on a number of factors. These include locations of known records in the vicinity of the Project Area, interpretation of the preferred habitat and soil types in comparison with that supported by the Project Area.

Table 3 Priority Flora Identified as Potentially Occurring within the Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Acacia horridula		Priority 3	May to August	Gravelly soils over granite, sand. Rocky hillsides.	*Unlikely to occur* – No suitable habitat present within Project Area
Andersonia gracilis	Endangered	Threatened – Vulnerable	September to November	White/grey sand, sandy clay, gravelly loam. Winter-wet areas near swamps	*Unlikely to occur* – all known records from Cataby area
Andersonia sp. Blepharifolia (F. & J. Hort 1919) PN		Priority 2	September to November	Jarrah forest.	*May occur* – suitable habitat present within Project Area
Asteridea gracilis		Priority 3	September to December	Sand, clay, gravelly soils.	*Unlikely to occur* – No suitable habitat present within Project Area
Austrostipa bronwenae		Priority 1	September	Wetland. Seasonally waterlogged muddy sand.	*Likely to occur* – recorded from Kenwick area
Baeckea sp. Perth Region (R.J. Cranfield 444)		Priority 3	January to March	Orange sand, brown loam, white sandy clay. Low flats, winter-wet swamps, railway reserves.	*May occur* – suitable habitat present within Project Area
Banksia mimica	Endangered	Threatened - Vulnerable	December or January to February	White or grey sand over laterite, sandy loam Woodland heath with *Banksia*, *Melaleuca* and *Dasypogon*.	*Likely to occur* – known to occur within Bush Forever Site 320; recorded within 300 m of Project Area
Banksia pteridifolia subsp. *vernalis*		Priority 3	September to October	White/grey sand over laterite.	*May occur* – suitable habitat present within Project Area
Boronia tenuis		Priority 4	August to November	Laterite, stony soils, granite.	*Unlikely to occur* – No suitable habitat present within Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Byblis gigantea		Priority 3	September to December or January	Sandy soil often swampy. Sandy-peat swamps. Seasonally wet areas.	*Likely to occur* – recorded in Bush Forever Sites 320 and 387
Caladenia huegelii	Endangered	Threatened – Critically Endangered	September to October	Grey or brown sand, clay loam	*May occur* – suitable habitat present within Project Area
Calytrix breviseta subsp *breviseta*	Endangered	Threatened - Critically Endangered	October to November	Sandy clay, Swampy flats	*May occur* – species recorded from Kenwick area and Bush Forever Site 387; suitable habitat present within Project Area
Centrolepis caespitosa	Endangered	Priority 4	October to December	White sand, clay, salt flats and wet areas.	*Unlikely to occur* – No suitable habitat present within Project Area
Chamelaucium sp. Gingin (NG Marchant 6)	Endangered	Threatened - Vulnerable	October to December	White/grey sand	*Unlikely to occur* – known records from Muchea area
Comesperma rhadinocarpum		Priority 2	October to November	Sandy soils.	*May occur* – suitable habitat present within Project Area
Conospermum undulatum	Vulnerable	Threatened - Vulnerable	May to October	Grey or yellow - orange clayey sand	*Known to occur* within the Project Area
Darwinia foetida	Critically Endangered	Threatened – Endangered	October to November	Low plain with dry grey sand	*Unlikely to occur* – all known records from Muchea area
Diuris micrantha	Vulnerable	Threatened - Vulnerable	September to October	Brown loamy clay. Winter wet swamps in shallow water	*Unlikely to occur* – No suitable habitat present within Project Area
Diuris purdiei	Endangered	Threatened – Endangered	September to October	Grey-black sand. Winter wet swamps	*May occur* – suitable habitat present within Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Drakaea elastica	Endangered	Threatened – Critically Endangered	October to November	White or grey sand. Low lying situations adjoining winter wet swamps	*Likely to occur* – suitable habitat present within Project Area
Drakaea micrantha	Vulnerable	Threatened - Endangered	September to October	White grey sand	*May occur* – suitable habitat present within Project Area
Drosera occidentalis subsp. *occidentalis*		Priority 4	November to December	Sandy and clayey soils. Swamps and wet depressions.	*May occur* – suitable habitat present within Project Area
Eleocharis keigheryi	Vulnerable	Threatened - Vulnerable	August to November	Clay sandy loam. Emergent in freshwater creeks and clayplans	*May occur* – suitable habitat present within Project Area
Eremophila glabra subsp. *chlorella*		Threatened - Critically Endangered	July to November	Sandy clay. Winter-wet depressions.	*May occur* – suitable habitat present within Project Area
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) PN		Priority 3	September to November	Alluvial flat, under water. Grey sand over clay.	*May occur* – suitable habitat present within Project Area
Eryngium sp. Subdecumbens (G.J. Keighery 5390) PN		Priority 3	September	Open claypan, winter wet, claypan. Grey-white clay over clay.	*May occur* – suitable habitat present within Project Area
Eucalyptus x balanites	Endangered	Threatened - Critically Endangered	October to December or January to February	Sandy soils with lateritic gravel	*Unlikely to occur* – No suitable habitat present within Project Area
Grevillea curviloba subsp. *incurva*	Endangered	Threatened - Endangered	August to September	Sand, sandy loam, Winter wet heath	*May occur* – suitable habitat present within Project Area
Grevillea manglesii subsp. *dissectifolia*		Priority 3	January or March to April or June to November	Gravelly loam, sandy loam on granite, clay. Roadsides, granite outcrops.	*May occur* – suitable habitat present within Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Grevillea pimeleoides		Priority 4	July to November	Jarrah Forest.	*May occur* – suitable habitat present within Project Area
Grevillea thelemanniana subsp. *thelemanniana*		Priority 2	June to September	Edge of seasonal clay based open depression. Moist grey brown sandy loam over clay.	*May occur* – suitable habitat present within Project Area; recorded 100 m west of Project Area
Haemodorum loratum		Priority 3	November	Grey or yellow sand, gravel.	*May occur* – suitable habitat present within Project Area
Hydrocotyle striata		Priority 1	October	Herb. Clay. Springs.	*May occur* – suitable habitat present within Project Area
Isopogon drummondii		Priority 3	February to June	White, grey or yellow sand, often over laterite.	*Previously recorded* within the Project Area
Jacksonia gracillima		Priority 3	October to November	*Banksia* woodland. winter-wet swamp; pale grey sand.	*Likely to occur* – suitable habitat present within Project Area
Lasiopetalum bracteatum		Priority 4	August to November	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	*May occur* – suitable habitat present within Project Area
Lepidosperma rostratum	Endangered	Threatened - Endangered	May to June	Peaty sand, clay	*May occur* – suitable habitat present within Project Area
Lepyrodia curvescens		Priority 2	September to November	Sand, laterite. Seasonally inundated swampland.	*May occur* – suitable habitat present within Project Area
Macarthuria keigheryi	Endangered	Threatened - Endangered	September to December or February to March	White or grey sand	*May occur* – suitable habitat present within Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Meionectes tenuifolia		Priority 3	October to December	Granite flats, shallow soil at margins, inundated among moss beds.	*May occur* – suitable habitat present within Project Area
Melaleuca viminalis		Priority 2	November to December	Drain. Brown sandy clay over clay.	*May occur* – suitable habitat present within Project Area
Ornduffia submersa		Priority 4	September to October	Wet black sand.	*May occur* – suitable habitat present within Project Area
Pithocarpa corymbulosa		Priority 3	January to April	Gravelly or sandy loam. Amongst granite outcrops	*Unlikely to occur* – No suitable habitat present within Project Area
Ptilotus pyramidatus	Critically Endangered	Threatened - Critically Endangered	October	Scrub. Growing under *Melaleuca lateriflora* subsp. *acutifolia*. Grey-white sandy clay	*May occur* – suitable habitat present within Project Area
Schoenus benthamii		Priority 3	October to November	White, grey sand, sandy clay. Winter-wet flats, swamps.	*May occur* – suitable habitat present within Project Area
Schoenus capillifolius		Priority 3	October to November	Brown mud. Claypans.	*May occur* – suitable habitat present within Project Area
Schoenus griffinianus		Priority 3	September to October	White sand.	*May occur* – suitable habitat present within Project Area
Schoenus loliaceus		Priority 2	August to November	Sandy soils. Winter-wet depressions	*Unlikely to occur* – No suitable habitat present within Project Area
Schoenus pennisetis		Priority 1	August to September	Grey or peaty sand, sandy clay.	*May occur* – suitable habitat present within Project Area
Schoenus sp. Waroona (G.J. Keigheryi 12235)		Priority 3	October to November	Clay or sandy clay. Winter-wet flats.	*May occur* – suitable habitat present within Project Area

Species	Conservation Code		Flowering Period	Preferred Habitat	Likelihood of Occurrence
	Commonwealth	State			
Senecio gilbertii		Priority 1	September to November	Peaty sand. Swamps, slopes	*May occur* – suitable habitat present within Project Area
Stylidium striatum		Priority 4	October to November	Brown clay loam over laterite. Hill slopes. Jarrah/Marri forest. Wandoo woodland.	*May occur* – suitable habitat present within Project Area
Synaphea sp. Fairbridge Farm (D Papenfus 696)	Critically Endangered	Threatened - Critically Endangered	October	Sandy with lateritic pebbles, near winter wet flats in low woodland with weedy grasses	*Unlikely to occur* – no known records occurring near Project Area
Tetratheca sp. Granite (S. Patrick SP1224)		Priority 3	May to November	Clay, moist, clayey sand. Granite boulders.	*Unlikely to occur* – No suitable habitat present within Project Area
Thelymitra dedmaniarum	Endangered	Threatened - Critically Endangered	November January	Granite	*Unlikely to occur* – No suitable habitat present within Project Area
Thelymitra magnifica		Priority 1	September to October	Stony ridges	*Unlikely to occur* – No suitable habitat present within Project Area
Thelymitra stellata	Endangered	Threatened – Endangered	October to November	Sand, gravel, lateritic loam	*May occur* – suitable habitat present within Project Area
Thysanotus anceps		Priority 3	October to December	Lateritic gravel. Open Jarrah and Marri woodland.	*May occur* – suitable habitat present within Project Area
Tripterococcus paniculatus		Priority 4	October to November	Grey, black or peaty sand. Winter wet flats.	*May occur* – suitable habitat present within Project Area
Verticordia lindleyi subsp. *lindleyi*		Priority 4	May or November to December or January	Sand, Sandy Clay. Winter wet depressions.	*Likely to occur* – known to occur within Bush Forever Site 320

5.1.2 Field Assessment

During the October 2014 field assessment, a total of 151 vascular flora species from 38 families and 102 genera were recorded within the Project Area. This total includes 110 (73.3%) native species, 33 (22.0%) introduced (weed) species and seven (4.7%) species that have been planted outside of their usual range.

The most highly represented families were Fabaceae (21 taxa; 17 native and four introduced), Myrtaceae (32 taxa; 24 native, one introduced and seven planted) and Proteaceae (16 native taxa). The full list of vascular species recorded and representative communities in which they occur are presented in Appendix B.

5.1.2.1 Threatened and Priority Flora

Two Priority flora species, *Conospermum undulatum* (Threatened – Vulnerable) and *Isopogon drummondii* (Priority 3) were recorded within the Project Area during the October 2014 survey. A total of 249 individual *Conospermum undulatum* and three *Isopogon drummondii* were recorded. These records are summarised by location in Table 4 and are spatially presented in Figure 6. A full list of records is provided in Appendix C.

One additional species, *Verticordia lindleyi* subsp. *lindleyi* (P4) was identified to occur within the Project Area through database searches, however was not recorded by AECOM during the field assessment. An additional 45 individual *Conospermum undulatum* were recorded outside of the Project Area within Bush Forever Site 53.

No *Drakaea elastica* plants were recorded during the 2015 targeted searches. A species of interest that was recorded included *Drosera zonaria*. This species was interesting due to its later flowering period in 2015 (usually April to June).

Table 4 Threatened and Priority Flora Recorded within Tonkin Highway Project Area

Species	Conservation status	No. recorded by AECOM within Project Area		DPaW Records within Project Area	
		Tonkin / Hale to Tonkin / Welshpool Rd East Interchange	Tonkin / Kelvin Road Interchange	Tonkin / Hale to Tonkin / Welshpool Rd East Interchange	Tonkin / Kelvin Road Interchange
Conospermum undulatum	Threatened – Vulnerable	5	244	2	2
Isopogon drummondii	P3	0	3	1	0
Verticordia lindleyi subsp. *lindleyi*	P4	0	0	2	0

5.1.2.2 Introduced Species

A total of 33 weed species were recorded within the Project Area (Table 5). Three of the recorded introduced species are categorised as Declared Pests in accordance with Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act):

- **Asparagus asparagoides*
- **Echium plantagineum*
- **Opuntia stricta*.

Under the BAM Act, all declared pests are placed in one of three management categories: C1 (Exclusion), C2 (Eradication) or C3 (Management). **Asparagus asparagoides* requires C3 management for the whole of the State. **Echium plantagineum* requires C3 management in a variety of areas around the State but not within the Project Area. **Opuntia stricta* requires C3 management for '*that portion of the State North of the 26th parallel of latitude*' (Department of Agriculture and Food (DAF), 2014).

Of the recorded weeds, **Asparagus asparagoides* and **Opuntia stricta* are also listed as Weeds of National Significance (WoNS). Management of WoNS requires coordination among all levels of government, organisations and individual landowners. Individual landowners and managers are responsible for managing WoNS occurring on their properties.

The environmental weed rating for each species as defined by the former Conservation and Land Management authority (CALM; now DPaW) is presented in Table 5. Nine of the introduced species recorded within the Project Area are considered to have a High impact.

Table 5 Summary of Environmental Weed Ratings (DEC, 1999)

Species	Common Name	Environmental Weed Rating (CALM, 1999)
Asparagus asparagoides	Bridal Creeper	High
Bromus diandrus	Great Brome	High
Ehrharta calycina	Veld Grass	High
Eragrostis curvula	Weeping Love Grass	High
Euphorbia terracina	Geraldton Carnation Weed	High
Lagurus ovatus	Hares Tail Grass	High
Leptospermum laevigatum	Victorian Tea Tree	High
Lupinus cosentinii	Sandplain Lupin	High
Pelargonium capitatum	Rose Pelargonium	High
Avena barbata	Bearded Oat	Moderate
Briza maxima	Blowfly Grass	Moderate
Cynodon dactylon	Couch	Moderate
Ehrharta longiflora	Annual Veldgrass	Moderate
Gladiolus caryophyllaceus	Wild Gladiolus	Moderate
Hypochaeris glabra	Flat Weed	Moderate
Pinus pinaster	Pinaster Pine	Moderate
Trifolium dubium		Moderate
Ursinia anthemoides	Ursinia	Moderate
Watsonia meriana var. *meriana*		Moderate
Chamaecytisus palmensis		Mild
Fumaria capreolata		Mild
Oxalis pes-caprae		Mild
Arundo donax		Low
Daucus carota		Low
Ricinus communis	Castor Oil Plant	Low
Salix babylonica		Low

Species	Common Name	Environmental Weed Rating (CALM, 1999)
Arctotheca calendula	Cape Weed	No rating
Echium plantagineum	Paterson's Curse	No rating
Erythrina variegata		No rating
Jacaranda mimosifolia	Jacaranda	No rating
Morus nigra	Mulberry Tree	No rating
Opuntia stricta		No rating
Schinus terebinthifolius		No rating

5.2 Vegetation

5.2.1 Desktop Assessment

Three vegetation complexes described by Heddle *et al.* (1980) occur within the Project Area. These complexes are based on vegetation in association with landforms and underlying geology. The remaining extents of the Southern River and Forrestfield complexes exceeds the minimum 10% target for the retention of vegetation complexes in constrained areas on the Swan Coastal Plain (EPA, 2000); however the Guildford Complex only has 5.9% of its original extent remaining on the Swan Coastal Plain (Table 6). Data was obtained from the Local Biodiversity Program (2013) dataset.

Table 6 Vegetation Complexes on the Swan Coastal Plain (Source: Local Biodiversity Program, 2013)

Vegetation Complex	Original Area in Swan Coastal Plain (ha)	Remaining Area (ha)	Percentage Remaining (%)
Guildford Complex	92,281.4	5,412.8	5.9
Forrestfield Complex	21,210.5	2,523.8	11.9
Southern River Complex	57,171.5	11,255.0	19.7

5.2.1.1 Threatened and Priority Ecological Communities

Review of the EPBC Act Protected Matters Search Tool and the DPaW Threatened and Priority Ecological Communities database search identified that four Threatened Ecological Communities (TECs) and/or their buffer have the potential to occur within the Project Area (Table 7; Figure 4). No Priority Ecological Communities are known to occur within close proximity to the Project Area.

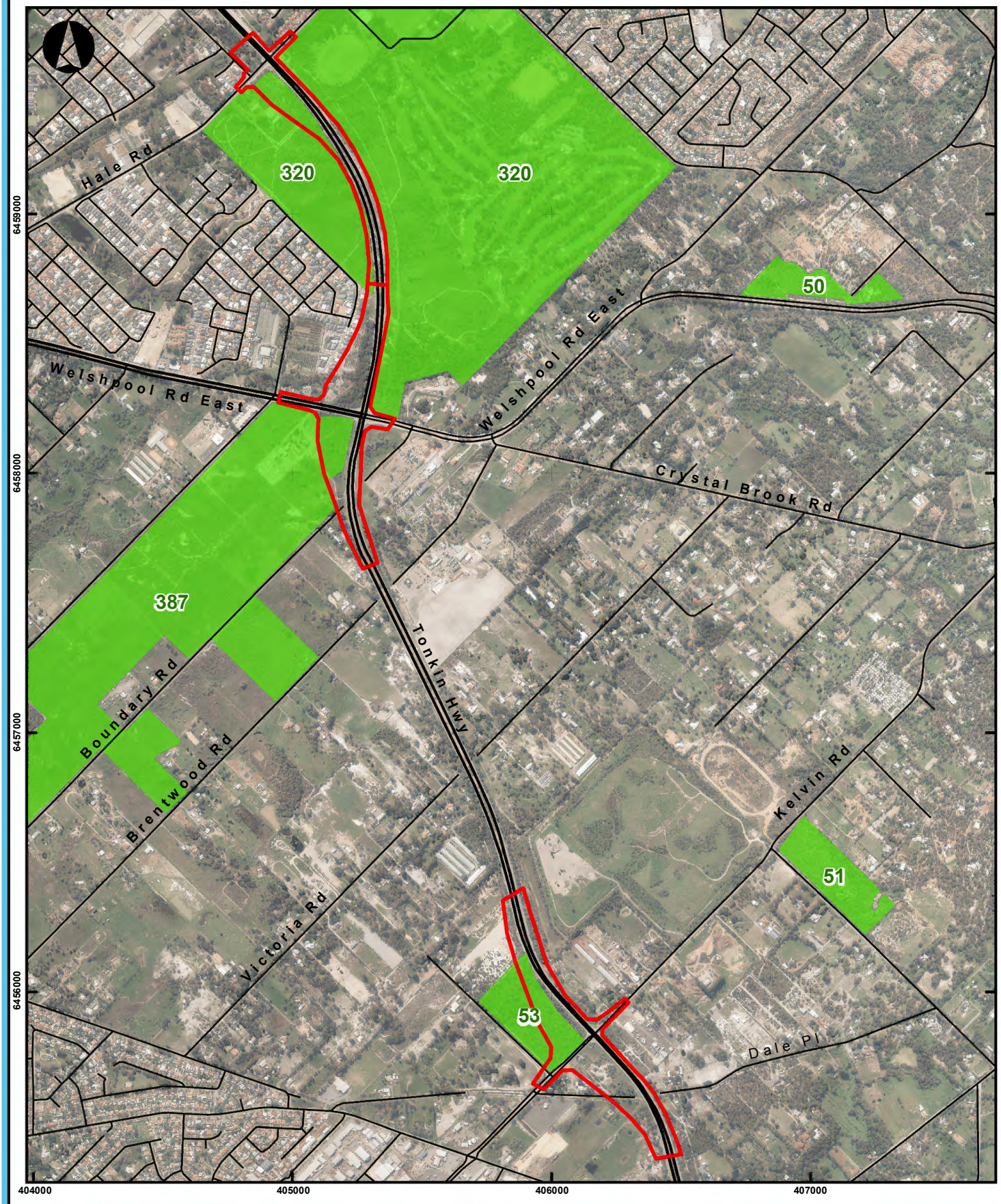
Table 7 Threatened Ecological Communities within close proximity to the Project Area

Description	Conservation Status		Distance from Project Area	
	Commonwealth	State	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
SCP3b - *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain		Vulnerable	1.2 km	TEC or TEC buffer occurs within Project Area
SCP10a - Shrublands on dry clay flats	Critically Endangered	Endangered	TEC or TEC buffer occurs within Project Area	2.5 km
SCP20a - *Banksia attenuata* woodland over species rich dense scrublands		Endangered	1.1 km	TEC or TEC buffer occurs within Project Area
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Endangered	Critically Endangered	1.2 km	TEC or TEC buffer occurs within Project Area

5.2.1.2 Bush Forever

Three Bush Forever sites (53, 320 and 387) are located within or adjacent to the Project Area (Figure 4). Clifford Street Bushland (Bush Forever Site 53) occurs partially within the Project Area. It is 7.74 ha in size and is known to contain TECs and Threatened and Priority flora, such as *Conospermum undulatum* (Figure 4). Part of the Project Area intersects Hartfield Park Bushland (Bush Forever Site 320). Hartfield Park Bushland consists of 73.6 ha of remnant bushland and has been reported to contain Endangered TEC *Banksia attenuata woodlands over species rich dense shrublands* (SCP20a) (Figure 4).

A small section of the Greater Brixton Street Wetland (Bush Forever Site 387) is intersected by the Project Area (Figure 4). This Bush Forever Site is 126.7 ha in size and has been reported to contain numerous Threatened flora. It is also known to contain four TECs (Figure 4).



Bush Forever

Tonkin Grade Separation Biological Survey

Figure 4

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500

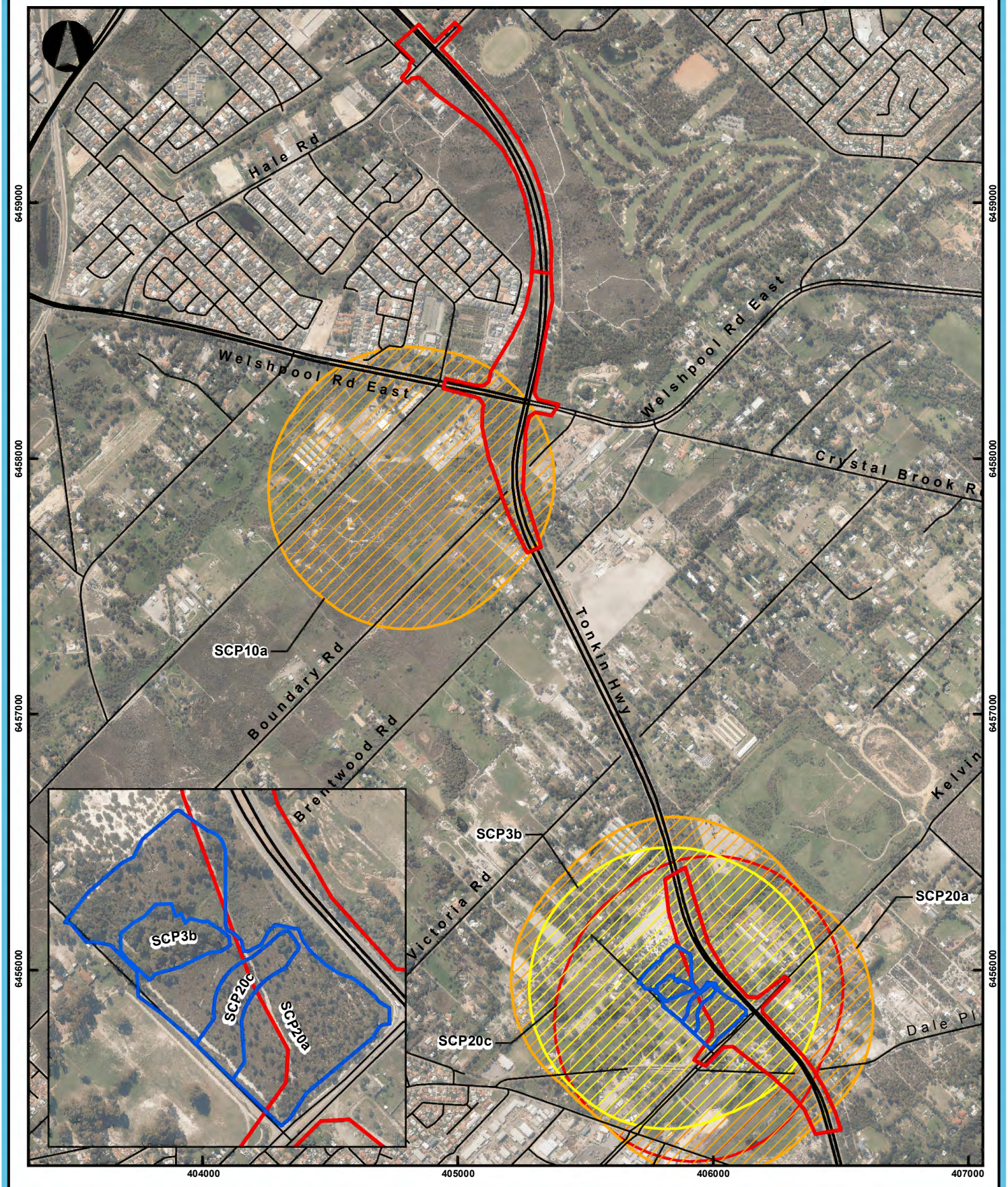
Metres

1:20,000 (A4)

Tonkin Hwy Grade Separation Project Area

Bush Forever Sites

AECOM



Threatened Ecological Communities

Tonkin Grade Separation Biological Survey

Figure 5

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500

Metres

1:20,000 (A4)

DPaW TEC Boundary

Tonkin Hwy Grade Separation Project Area

TEC / PEC

Critically Endangered

Endangered

Vulnerable

AECOM

5.2.2 Field Assessment

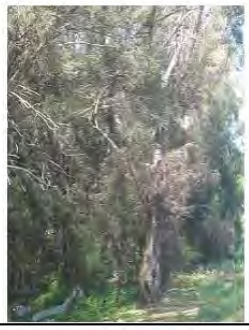
5.2.2.1 Vegetation Communities

A total of 21 vegetation communities were described and mapped within the Project Area during the field assessment. These comprised 10 woodlands, 9 shrublands and two rehabilitation communities. These communities are described in Table 8 and illustrated in Figure 6.

Table 8 Vegetation Communities described within the Project Area

Community Type	Vegetation Code	Vegetation Description	Representative Photo
Woodland Communities			
Banksia Woodland over *Allocasuarina* and *Adenanthos* Shrubland	BAAS	*Banksia attenuata* and *Banksia menziesii* Woodland over *Allocasuarina fraseriana, Adenanthos cygnorum* and *Xanthorrhoea preissii* Shrubland over *Anigozanthos manglesii* and *Dasypogon bromeliifolius* Open Low Heath	
Callitris Low Open Woodland over *Melaleuca* and *Hypocalymma* Low Shrubland	CWMHS	*Callitris pyramidalis* Low Open Woodland over *Melaleuca viminea* and *Hypocalymma angustifolium* Low Shrubland	
Eucalyptus and *Banksia* Woodland over *Allocasuarina, Hibbertia* and *Eremaea* Shrubland	EBWES	*Eucalyptus* sp., *Banksia menziesii*, *Banksia attenuata* Woodland over *Allocasuarina humilis*, *Hibbertia hypericoides* and *Eremaea pauciflora* subsp. *pauciflora* Low Heath	
Eucalyptus rudis Woodland over *Melaleuca* Shrubland	ErWMS	*Eucalyptus rudis* Woodland over *Melaleuca rhaphiophylla* and *Adenanthos cygnorum* Shrubland over introduced weed and grass species	No representative photo
Corymbia and *Eucalyptus* Woodland	CEPW	*Corymbia calophylla, Eucalyptus marginata* and planted *Eucalyptus* species over introduced weed and grass species	

Community Type	Vegetation Code	Vegetation Description	Representative Photo
Eucalyptus Woodland	EW	*Eucalyptus* sp. Woodland over **Leptospermum laevigatum* Shrubland over introduced weed and grass species	
Eucalyptus Woodland over *Melaleuca* and *Trymalium* Open Shrubland	EWMS	*Corymbia calophylla, Eucalyptus rudis* and *Eucalyptus marginata* Woodland over *Melaleuca rhaphiophylla, Viminaria juncea* and *Trymalium odoratissimum* subsp. *odoratissimum* Open Shrubland in wetland depression	
Corymbia and *Eucalyptus* Woodland	CEW	*Corymbia calophylla* and *Eucalyptus marginata* Woodland with occasional understorey species over introduced weed and grass species	
Corymbia Woodland over *Adenanthos* and *Allocasuarina* Shrubland	CWAAS	*Corymbia calophylla* Woodland over *Adenanthos cygnorum*, *Allocasuarina humilis*, *Acacia pulchella* and *Xanthorrhoea preissii* Shrubland over introduced weed and grass species	
Corymbia Woodland over *Adenanthos* and *Calothamnus* Shrubland	CWCS	*Corymbia calophylla* Woodland over *Adenanthos cygnorum* subsp. *cygnorum*, *Xanthorrhoea preissii* and *Calothamnus sanguineus* open shrubland over **Ehrharta calycina, *Avena barbata* and **Oxalis pes-caprae*	

Community Type	Vegetation Code	Vegetation Description	Representative Photo
Shrubland Communities			
Adenanthos Tall Shrubland	ATS	*Adenanthos cygnorum* Tall Shrubland over *Eremaea pauciflora* subsp. *pauciflora* Low Shrubland over introduced weeds	
Adenanthos, *Beaufortia* and *Hypocalymma* Low Shrubland	ABHS	*Adenanthos cygnorum, Beaufortia elegans* and *Hypocalymma angustifolium* Low Shrubland	
Adenanthos, *Eremaea* and *Beaufortia* Shrubland	AEBS	*Adenanthos cygnorum*, *Eremaea pauciflora* subsp. *pauciflora* and *Beaufortia elegans* Shrubland over *Dasypogon bromeliifolius* and *Lepidosperma* sp. over sedgeland	
Allocasuarina and *Melaleuca* Shrubland	AMS	*Allocasuarina fraseriana* Tall Shrubland over *Melaleuca preissiana* Shrubland over introduced weeds	
Allocasuarina, Hibbertia and *Eremaea* Shrubland	AHES	*Allocasuarina humilis*, *Hibbertia hypericoides* and *Eremaea pauciflora* subsp. *pauciflora* Low Heath	
Leptospermum Shrubland	LS	**Leptospermum laevigatum* Tall Shrubland over introduced weed and grass species	No representative photo

Community Type	Vegetation Code	Vegetation Description	Representative Photo
Melaleuca Tall Shrubland	MTS	*Melaleuca rhaphiophylla, Melaleuca preissiana* and *Melaleuca lanceolata* Tall Shrubland in wetland depression	
Pericalymma and *Verticordia* Closed Shrubland	PVS	*Pericalymma ellipticum* and *Verticordia* sp. Closed Shrubland over Low Sedgeland	
Viminaria and *Hakea* Shrubland	VHS	*Viminaria juncea*, *Hakea lissocarpha* and *Acacia pulchella* Tall Open Scrub over *Mesomelaena pseudostygia* Open Sedgeland	No representative photo
Rehabilitation Communities			
Mixed Shrubland (rehabilitation)	MS1	*Chamelaucium uncinatum*, *Adenanthos cygnorum* and **Leptospermum laevigatum* shrubland	No representative photo
Mixed Shrubland (rehabilitation)	MS2	Degraded Road reserve consisting of isolated species of *Acacia pulchella*, *Calothamnus quadrifidus*, *Adenanthos cygnorum* and *Callistemon phoeniceus* over introduced grasses	No representative photo

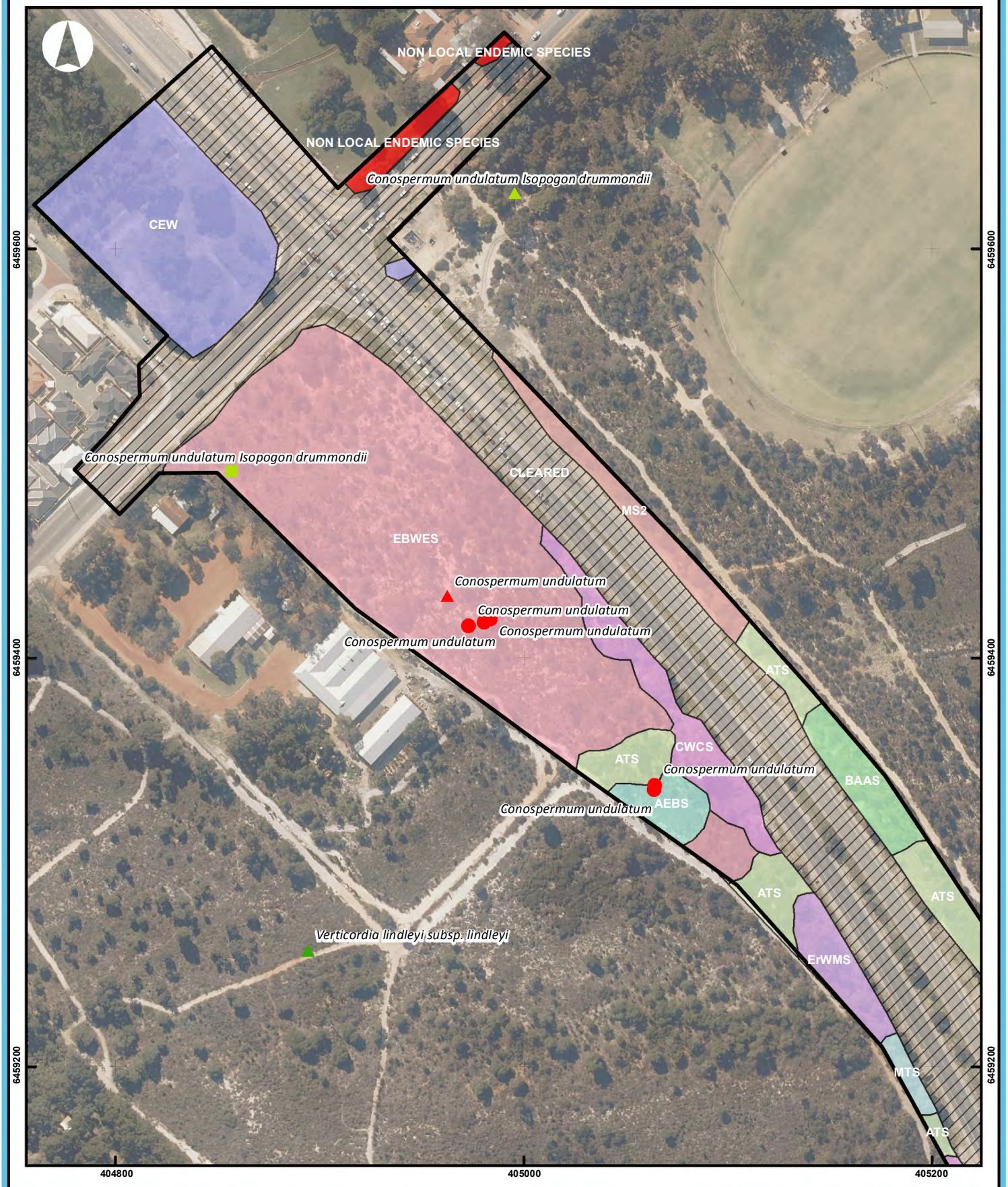
The Project Area encompasses a total area of 43.78 ha. Of this, 21.46 ha (49.01%) has been previously cleared for existing roads, tracks or other infrastructure. A total area of 21.91 ha of remnant vegetation occurs within the Project Area. The area of each vegetation community which makes up this total is summarised in Table 9.

Table 9 Proportion of Vegetation Communities occurring within the Project Area

Veg. Code	Description	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
		Area within proposed Interchange (ha)	% of proposed interchange area (%)	Area within proposed Interchange (ha)	% of proposed interchange area (%)
BAAS	*Banksia attenuata* and *Banksia menziesii* Woodland over *Allocasuarina fraseriana, Adenanthos cygnorum* and *Xanthorrhoea preissii* Shrubland over *Anigozanthos manglesii* and *Dasypogon bromeliifolius* Open Low Heath	0.15	0.59	0	0
CWMHS	*Callitris pyramidalis* Low Open Woodland over *Melaleuca viminea* and *Hypocalymma angustifolium* Low Shrubland	0.09	0.34	0	0
EBWES	*Eucalyptus* sp., *Banksia menziesii*, *Banksia attenuata* Woodland over *Allocasuarina humilis*, *Hibbertia hypericoides* and *Eremaea pauciflora* subsp. *pauciflora* Low Heath	2.38	9.02	2.39	13.77
ErWMS	*Eucalyptus rudis* Woodland over *Melaleuca rhaphiophylla* and *Adenanthos cygnorum* Shrubland over introduced weed and grass species	0.14	0.54	0	0
CEPW	*Corymbia calophylla, Eucalyptus marginata* and planted *Eucalyptus* species over introduced weed and grass species	0.31	1.17	0	0
EW	*Eucalyptus* sp. Woodland over **Leptospermum laevigatum* Shrubland over introduced weed and grass species	0	0	2.19	12.59
EWMS	*Corymbia calophylla, Eucalyptus rudis* and *Eucalyptus marginata* Woodland over *Melaleuca rhaphiophylla, Viminaria juncea* and *Trymalium odoratissimum* subsp. *odoratissimum* Open Shrubland in wetland depression	2.49	9.44	0	0
CEW	*Corymbia calophylla* and *Eucalyptus marginata* Woodland with occasional understorey species over introduced weed and grass species	1.25	4.73	0.63	3.65

Veg. Code	Description	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
		Area within proposed Interchange (ha)	% of proposed interchange area (%)	Area within proposed Interchange (ha)	% of proposed interchange area (%)
CWAAS	*Corymbia calophylla* Woodland over *Adenanthos cygnorum*, *Allocasuarina humilis*, *Acacia pulchella* and *Xanthorrhoea preissii* Shrubland over introduced weed and grass species	0.11	0.42	0	0
CWCS	*Corymbia calophylla* Woodland over *Adenanthos cygnorum* subsp. *cygnorum*, *Xanthorrhoea preissii* and *Calothamnus sanguineus* open shrubland over **Ehrharta calycina, *Avena barbata* and **Oxalis pes-caprae*	0.31	1.16	2.35	13.53
ATS	*Adenanthos cygnorum* Tall Shrubland over *Eremaea pauciflora* subsp. *pauciflora* Low Shrubland over introduced weeds	0.40	1.51	0	0
ABHS	*Adenanthos cygnorum, Beaufortia elegans* and *Hypocalymma angustifolium* Low Shrubland	0.30	1.14	0	0
AEBS	*Adenanthos cygnorum*, *Eremaea pauciflora* subsp. *pauciflora* and *Beaufortia elegans* Shrubland over *Dasypogon bromeliifolius* and *Lepidosperma* sp. sedgeland	0.10	0.38	0	0
AMS	*Allocasuarina fraseriana* Tall Shrubland over *Melaleuca preissiana* Shrubland over introduced weeds	0.35	1.34	0	0
AHES	*Allocasuarina humilis*, *Hibbertia hypericoides* and *Eremaea pauciflora* subsp. *pauciflora* Low Heath	0	0	0.57	3.31
LS	**Leptospermum laevigatum* Tall Shrubland over introduced weed and grass species	0	0	0.22	1.25
MTS	*Melaleuca rhaphiophylla, Melaleuca preissiana* and *Melaleuca lanceolata* Tall Shrubland in wetland depression	3.05	11.54	0.37	2.14
PVS	*Pericalymma ellipticum* and *Verticordia* sp. Closed Shrubland over Low Sedgeland	0.20	0.76	0	0

Veg. Code	Description	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
		Area within proposed Interchange (ha)	% of proposed interchange area (%)	Area within proposed Interchange (ha)	% of proposed interchange area (%)
VHS	*Viminaria juncea*, *Hakea lissocarpha* and *Acacia pulchella* Tall Open Scrub over *Mesomelaena pseudostygia* Open Sedgeland	0	0	0.58	3.33
MS1	*Chamelaucium uncinatum*, *Adenanthos cygnorum* and **Leptospermum laevigatum* shrubland	0.25	0.95	0.49	2.81
MS2	Degraded Road reserve consisting of isolated species of *Acacia pulchella*, *Calothamnus quadrifidus*, *Adenanthos cygnorum* and *Callistemon phoeniceus* over introduced grasses	0.24	0.90	0	0
	CLEARED	14.19	53.73	7.26	41.83
	NON LOCAL ENDEMIC SPECIES	0.09	0.35	0.31	1.81
	TOTAL	**26.42**		**17.36**	



Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6a

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

a b c d e f g

AECOM

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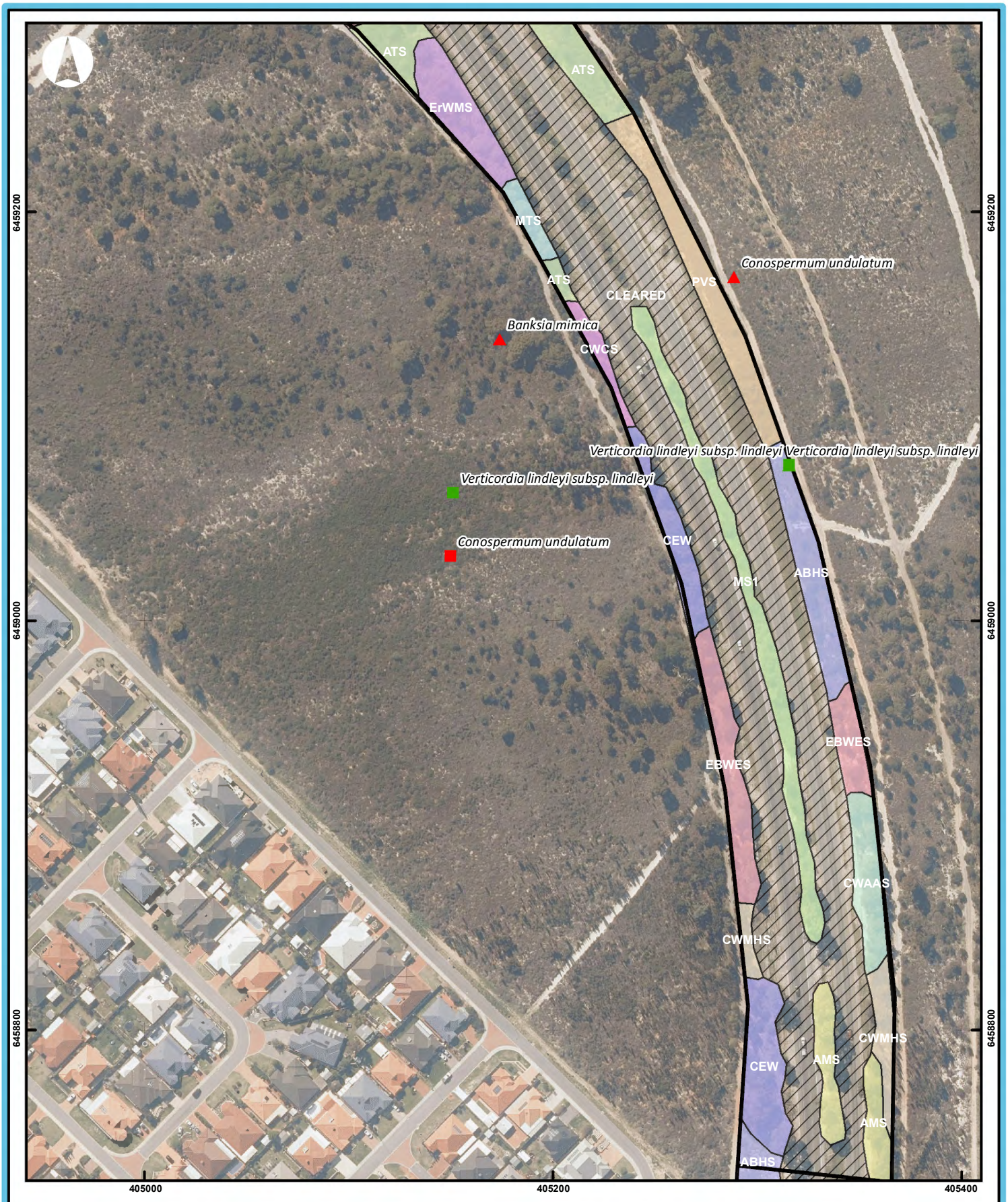

Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6b

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

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Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6c

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

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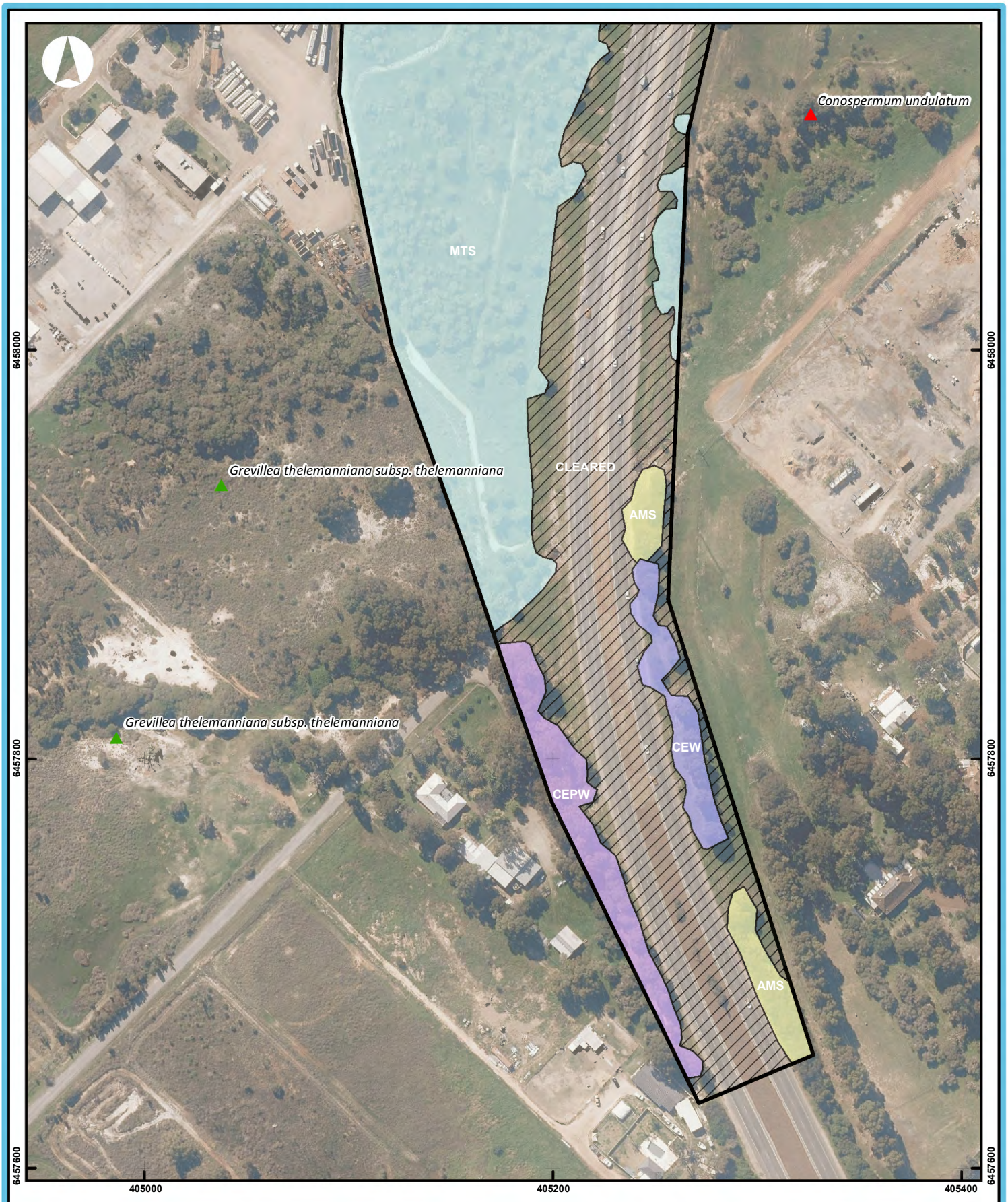


Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6d

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

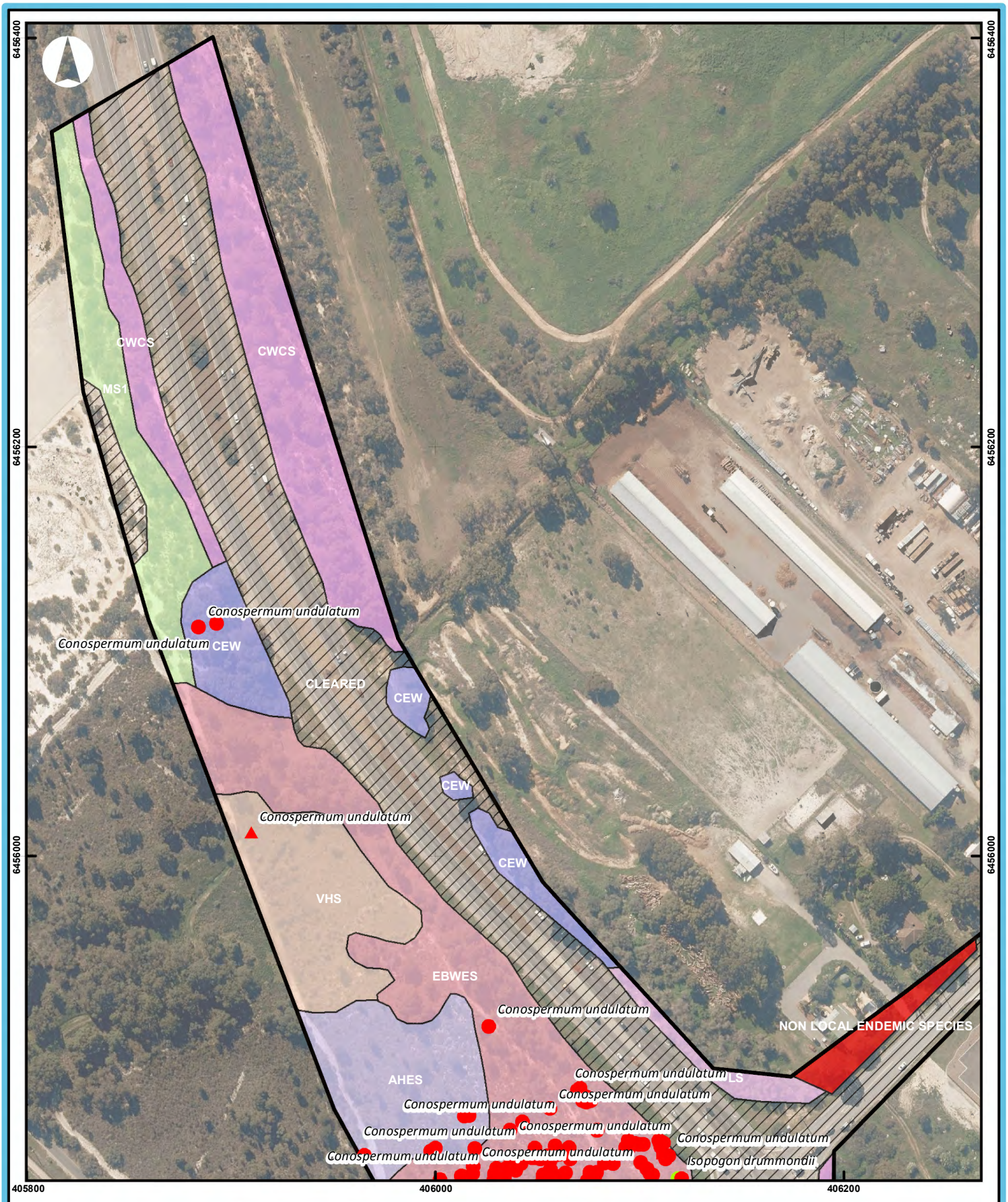
Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

a b c d e f g

AECOM



Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6e

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

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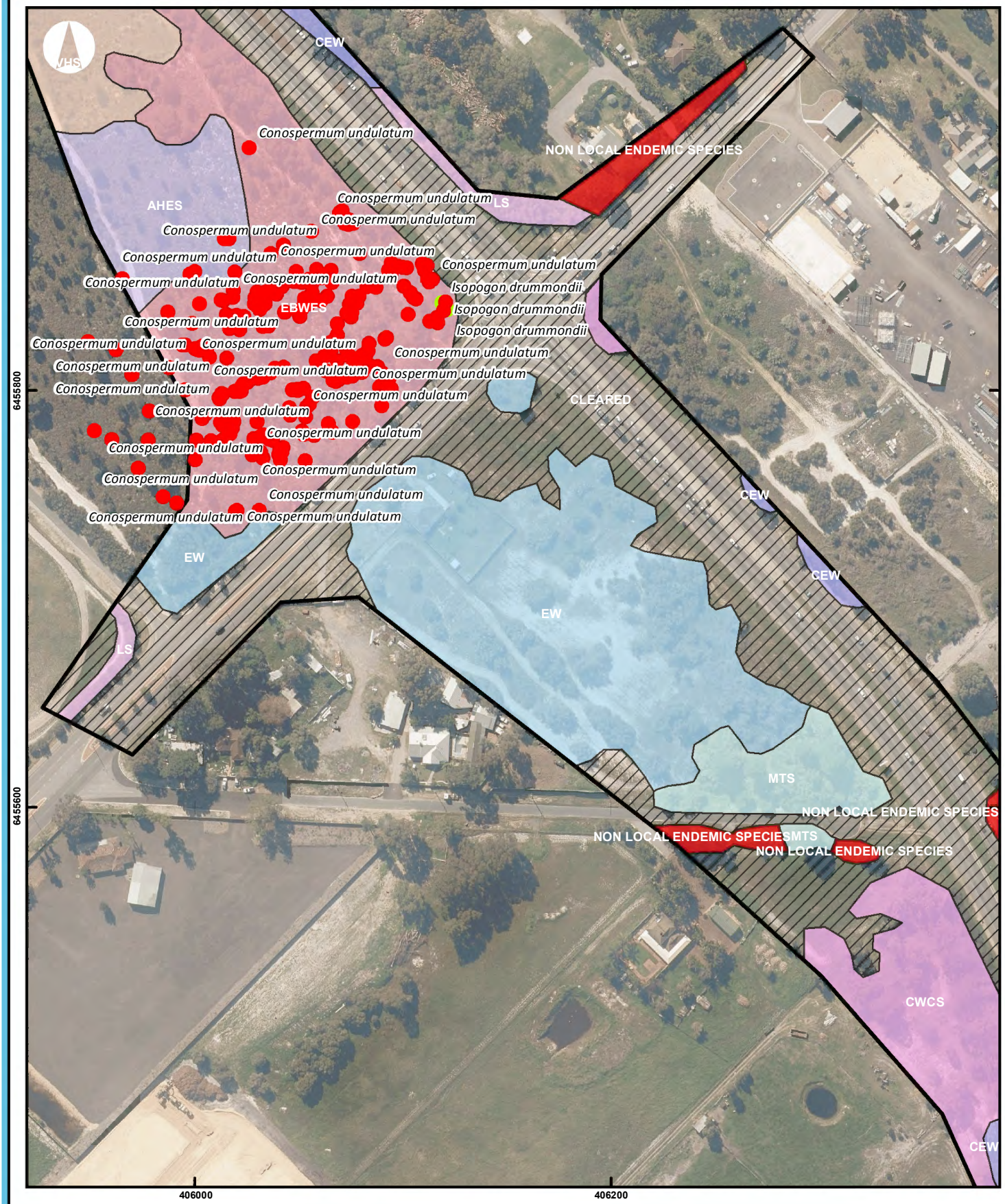


Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6f

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

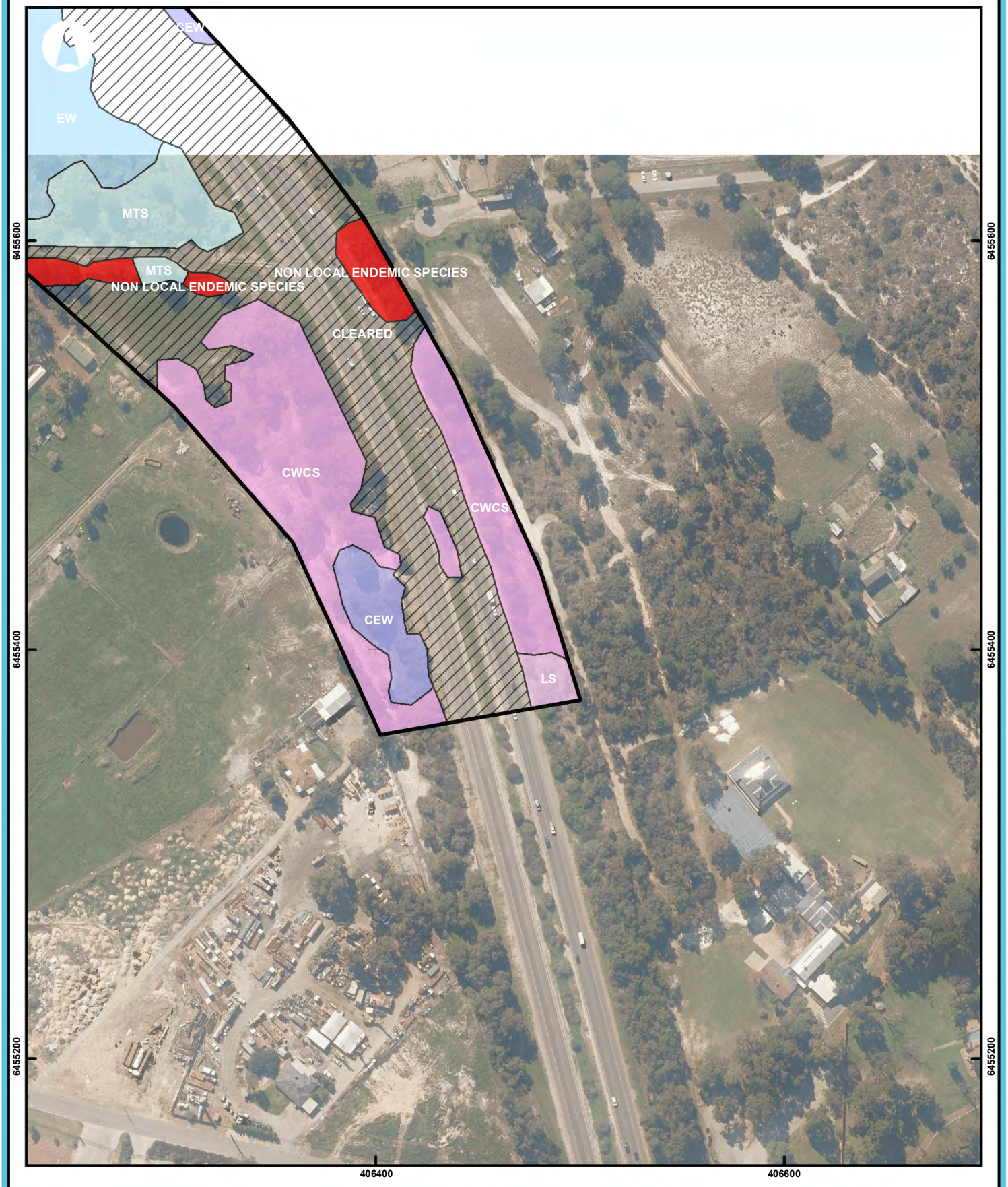
Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

a b c d e f g

AECOM



Vegetation Community

Tonkin Grade Separation Biological Survey

Figure 6g

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

DPaW TPFL	WA Herb	AECOM TPFL
Threatened	Threatened	Priority 3
Priority 1	Priority 1	Threatened
Priority 3	Priority 2	
Priority 4	Priority 3	
	Priority 4	

a b c d e f g

AECOM

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The species compositions for each of the intact vegetation communities recorded within the Project Area were analysed and compared to the Gibson *et al.* (1994) dataset and equivalent FCTs have been determined. Inferred FCTs for vegetation communities described during the October assessment are presented in Table 10. Five communities are considered to be equivalent to a Gibson *et al.* (1994) FCT.

Table 10 Comparison of Recorded Vegetation Communities with Gibson *et al*. (1994) Floristic Community Types

Vegetation Code	Floristic Community Type (FCT)	Reservation Status	Conservation Status	TEC Status
Tonkin Highway / Hale Road Interchange to Tonkin Highway / Welshpool Road East Interchange				
BAAS	20a	Unreserved	Endangered	State TEC
CWMHS	indeterminate	-	-	-
EBWES	20a	Unreserved	Endangered	State TEC
ErWMS	indeterminate	-	-	-
CEPW	indeterminate	-	-	-
EWMS	indeterminate	-	-	-
CEW	indeterminate	-	-	-
CWAAS	Indeterminate	-	-	-
CWCS	indeterminate	-	-	-
ATS	indeterminate	-	-	-
ABHS	indeterminate	-	-	-
AEBS	23b	Unreserved	Susceptible	-
AMS	indeterminate	-	-	-
MTS	indeterminate	-	-	-
PVS	6	Well reserved	Low risk	-
MS1	indeterminate	-	-	-
MS2	indeterminate	-	-	-
Tonkin Highway/Kelvin Road Interchange				
EBWES	20a	Unreserved	Endangered	State TEC
EW	indeterminate	-	-	-
CEW	indeterminate	-	-	-
CWCS	indeterminate	-	-	-
AHES	20a	Unreserved	Endangered	State TEC
LS	indeterminate	-	-	-
MTS	indeterminate	-	-	-
VHS	indeterminate	-	-	-
MS1	indeterminate	-	-	-

5.2.2.2 Local, Regional and National Significance

Six vegetation communities within the Project Area are considered to be either Locally, Regionally or Nationally significant, or a combination of these. These communities are summarised in Table 11. Two of these vegetation communities (AEBS and BAAS) occur only within the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. Two of the vegetation communities (AHES and VHS) occur only in the Tonkin Highway/Kelvin Road interchange area. Another two of the vegetation communities (EBWES and CEW) occur in both of the interchange areas

Although *Conospermum undulatum* was recorded to occur within community CEW, due to the degraded nature of this vegetation community it is not considered to be representative of Pre European vegetation and is considered unlikely to be considered of National significance.

Table 11 Locally, Regionally and Nationally Significant Communities

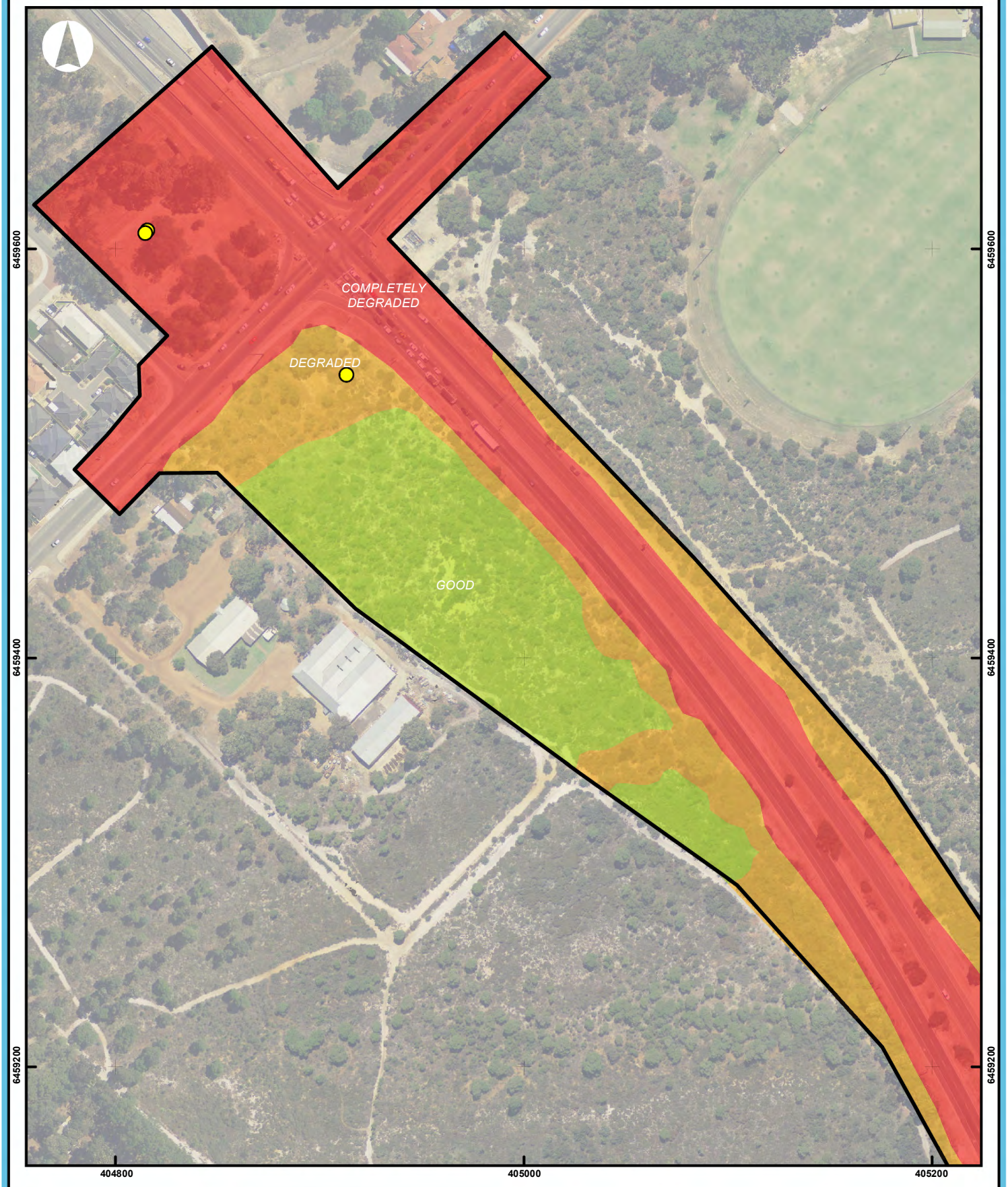
Vegetation Code	Locally Significant	Regionally Significant	Nationally Significant
EBWES	Supports *Isopogon drummondii* (P3)	Supports State listed Endangered TEC SCP 20a	Supports *Conospermum undulatum* listed as Vulnerable under the EPBC Act and the WC Act
AHES	NA	Supports State listed Endangered TEC SCP 20a	Supports *Conospermum undulatum* listed as Vulnerable under the EPBC Act and the WC Act
AEBS	NA	NA	Supports *Conospermum undulatum* listed as Vulnerable under the EPBC Act and the WC Act
VHS	NA	NA	Supports *Conospermum undulatum* listed as Vulnerable under the EPBC Act and the WC Act
CEW	NA	NA	Supports *Conospermum undulatum* listed as Vulnerable under the EPBC Act and the WC Act
BAAS	NA	Supports State listed Endangered TEC SCP 20a	NA

5.2.2.3 Vegetation Condition

The condition of vegetation within the Project Area ranges between ‘Completely Degraded’ and ‘Very Good’. The majority of the Project Area is Degraded (36.60%) or Completely Degraded (52.29%). The area and proportion of each vegetation condition contained within the Project Area are summarised in Table 12 and shown in Figure 7.

Table 12 Vegetation Condition within the Project Area

Condition Rating	Tonkin Highway / Hale Road Interchange to Tonkin Highway / Welshpool Road East Interchange		Tonkin Highway / Kelvin Road Interchange	
	Area within proposed Interchange (ha)	% of proposed interchange area (%)	Area within proposed Interchange (ha)	% of proposed interchange area (%)
Very Good	0	0	2.68	15.42
Good	1.87	7.06	0.32	1.85
Degraded	9.45	35.78	6.57	37.84
Completely Degraded	15.10	57.16	7.79	44.89



Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7a

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

AECOM

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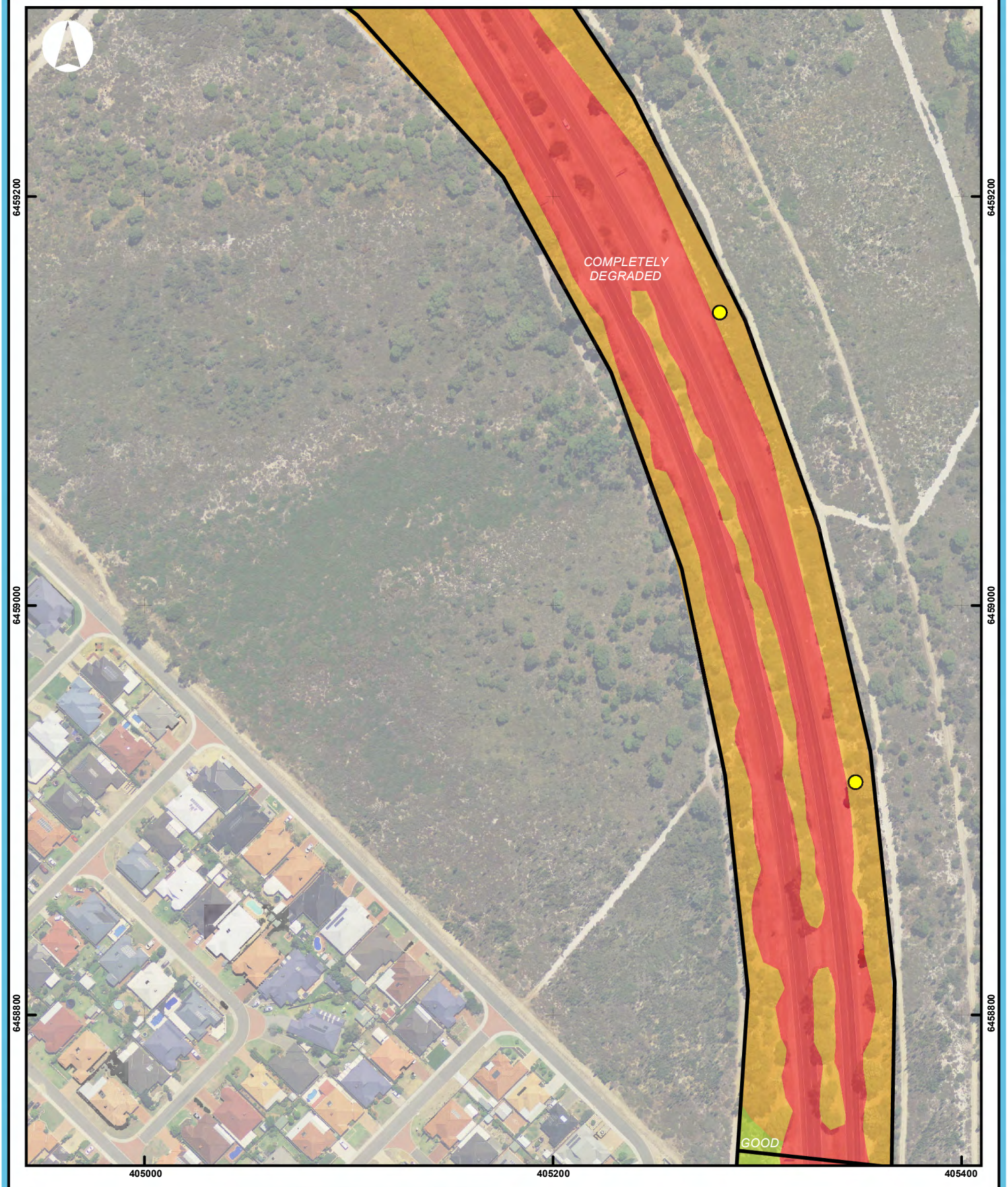

Vegetation Condition

Tonkin Grade Separation
Biological Survey

Figure 7b

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

AECOM

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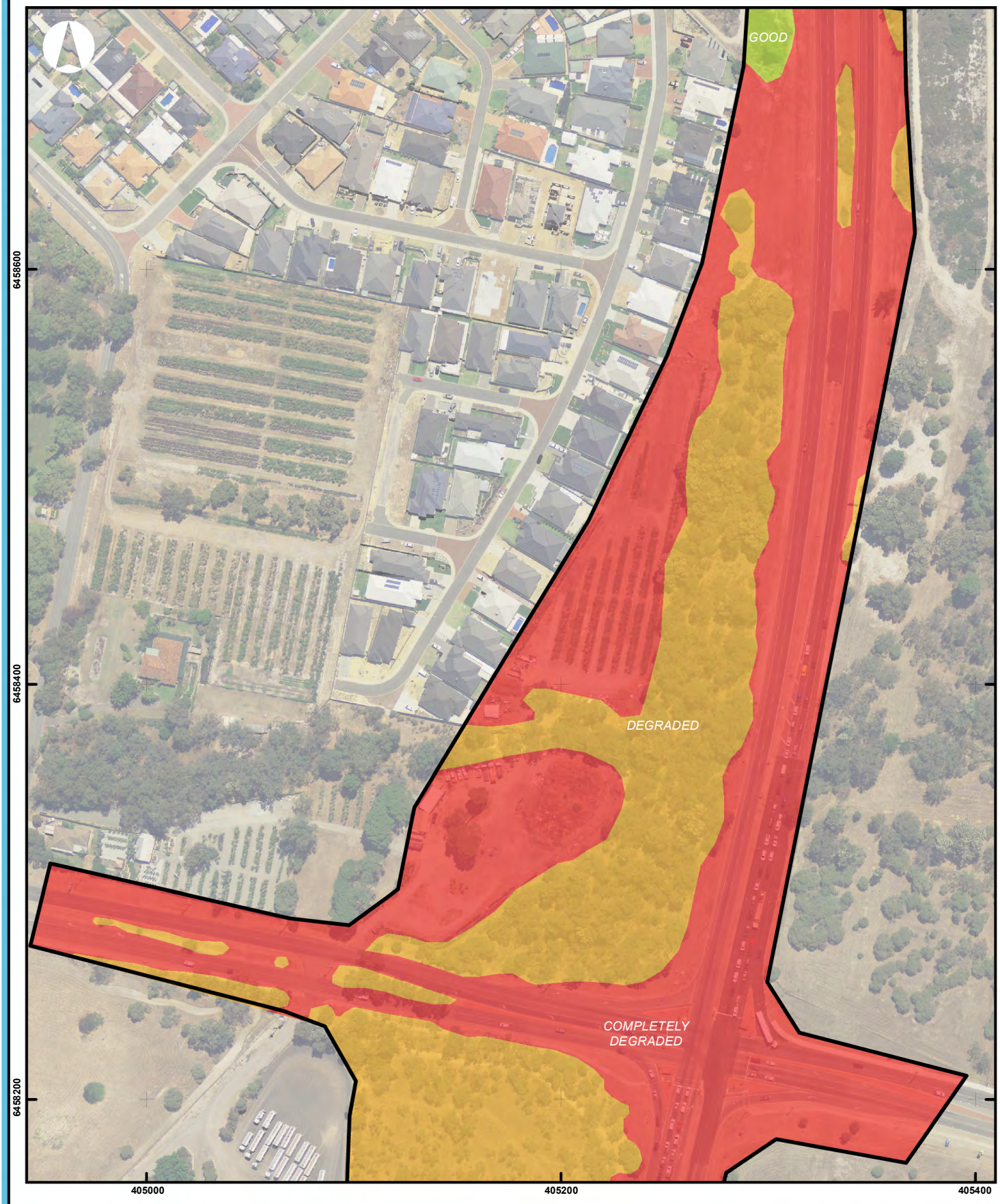

Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7c

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

AECOM

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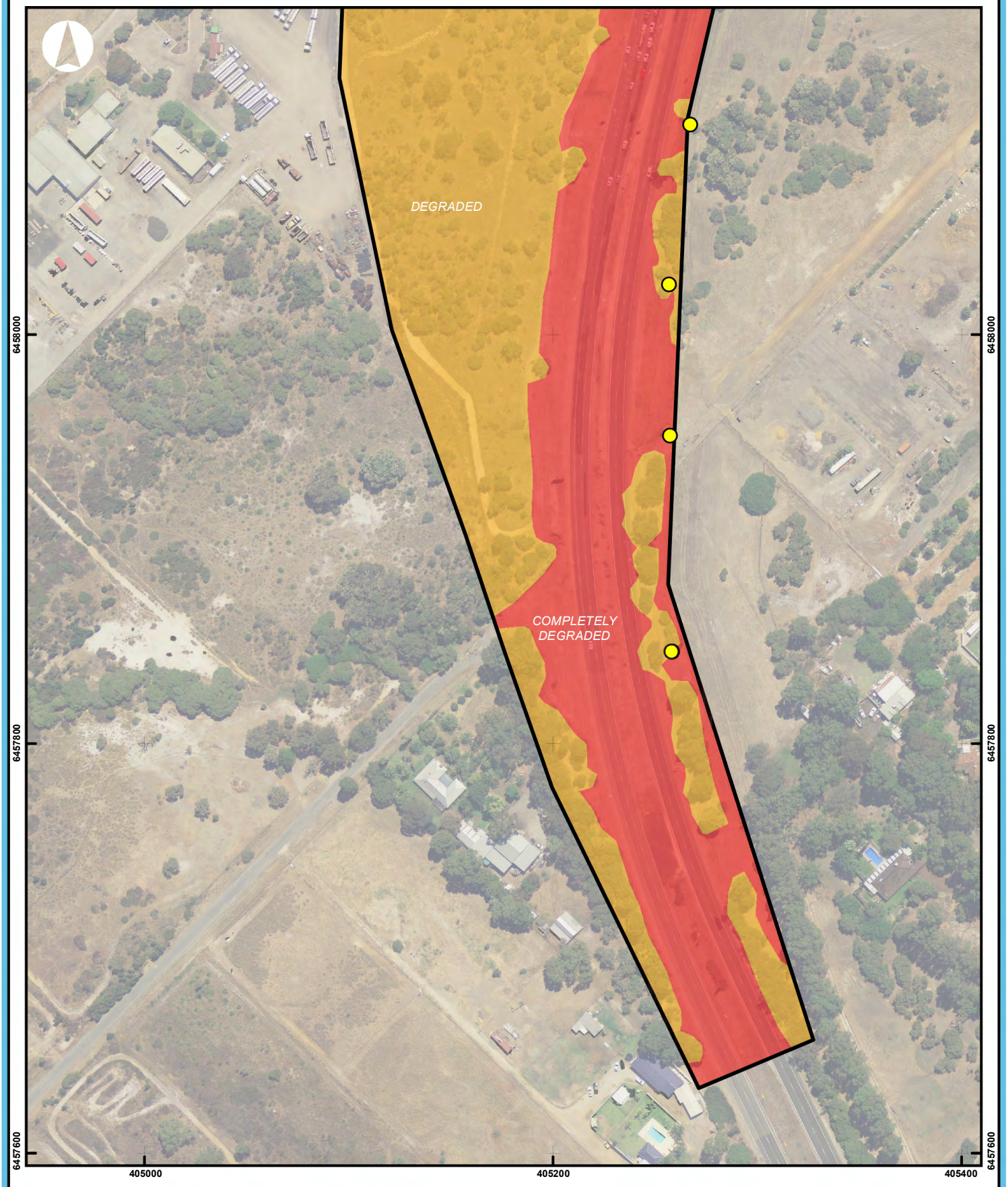

Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7d

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

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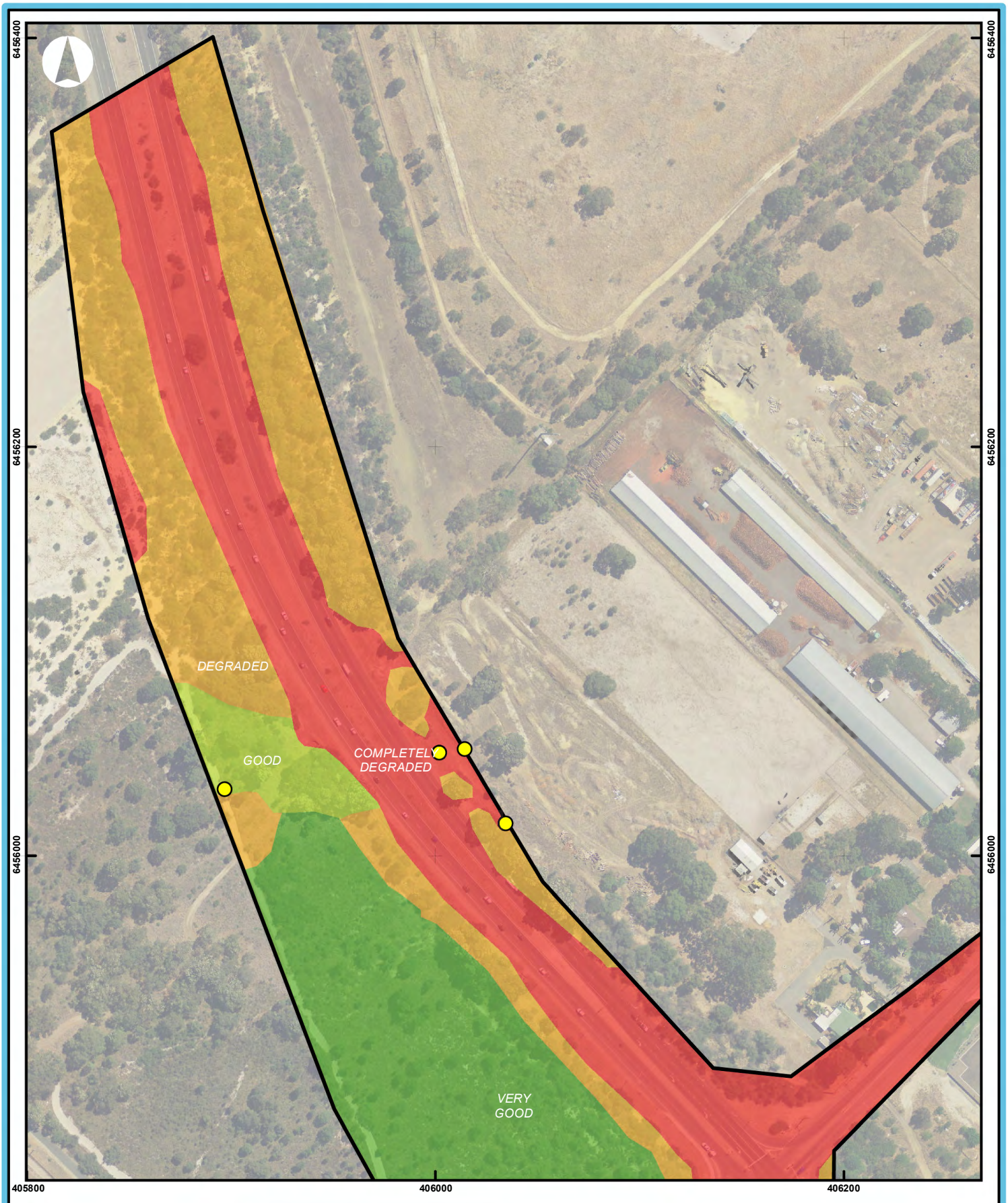

Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7e

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

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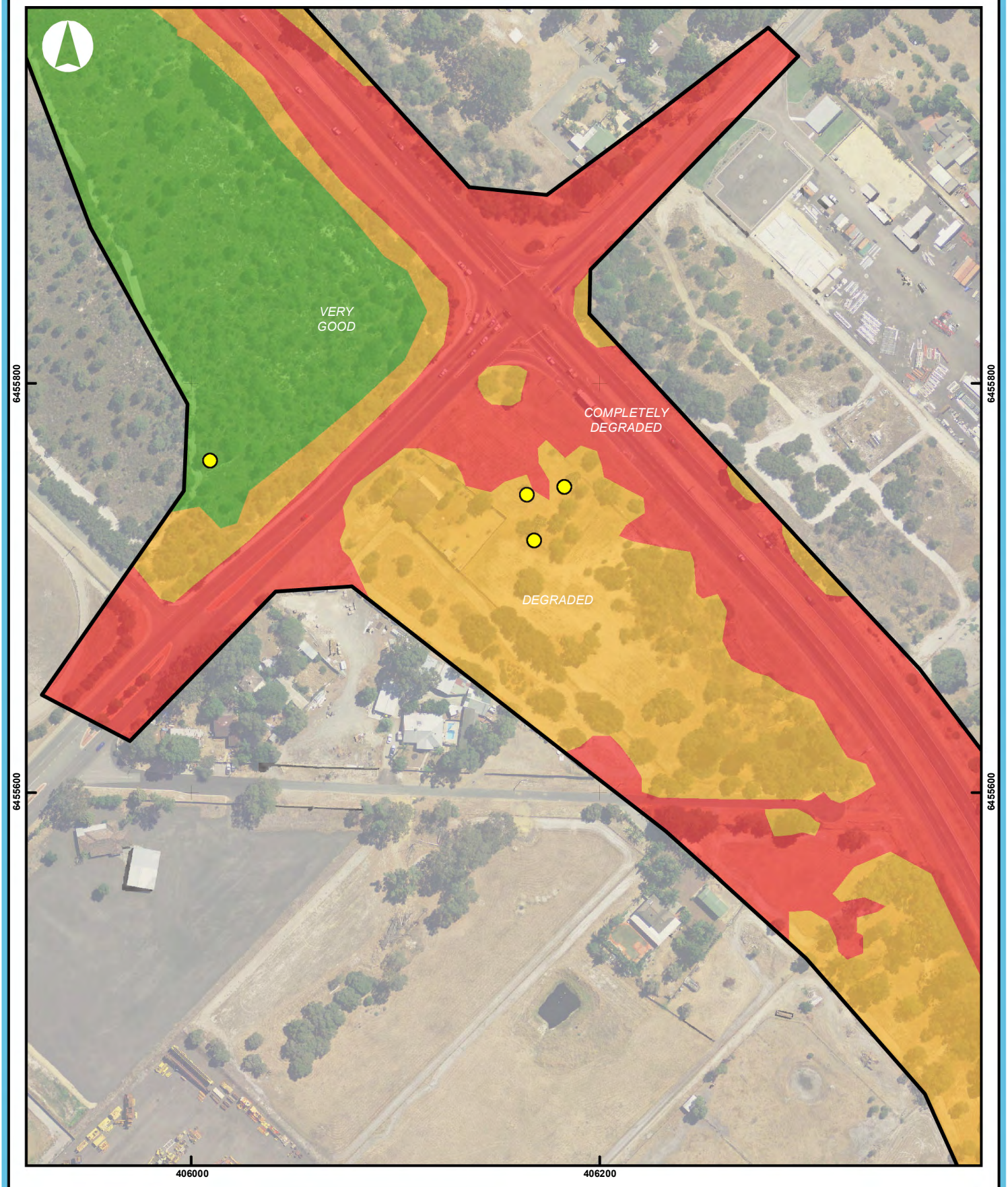

Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7f

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

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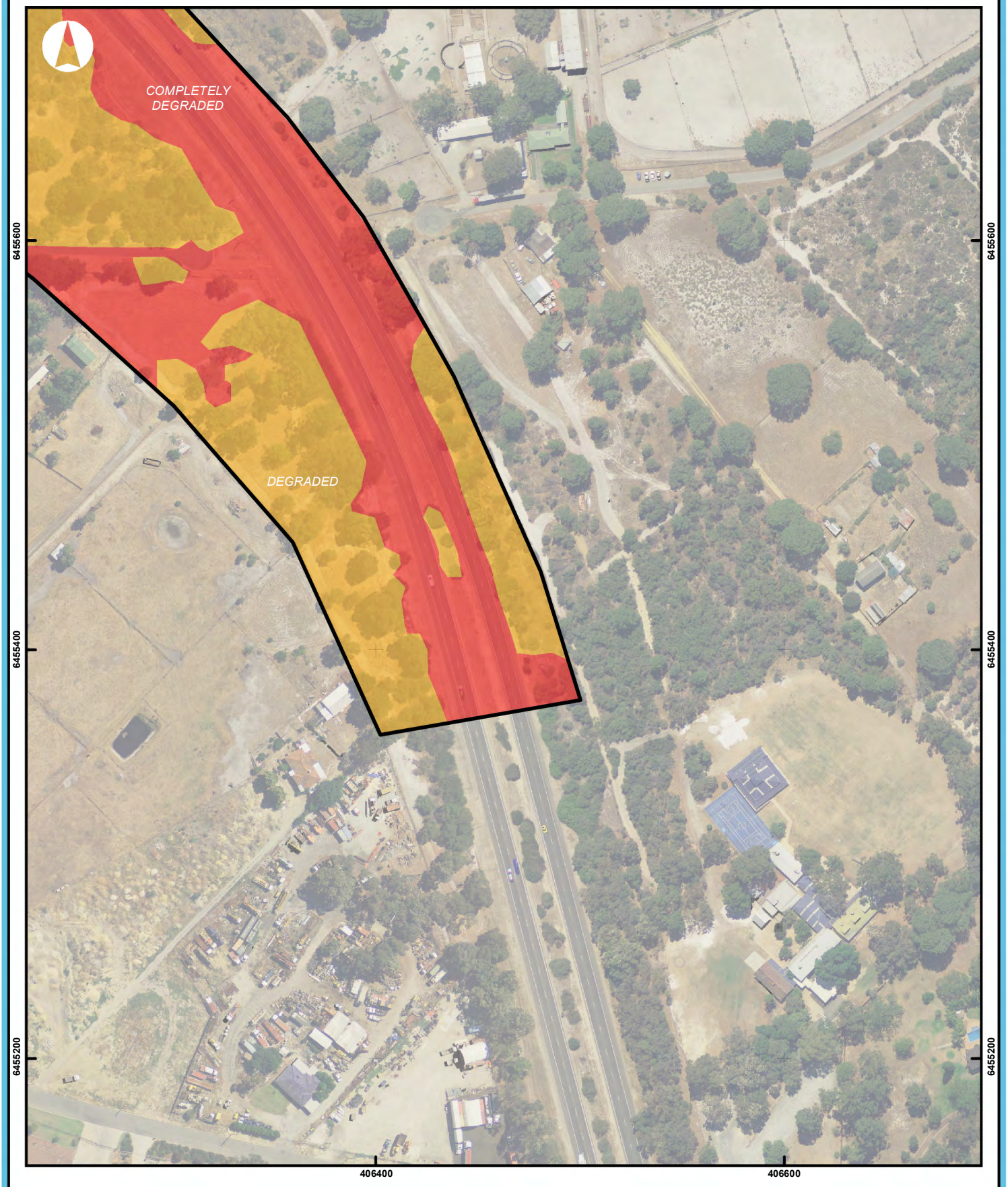

Vegetation Condition

Tonkin Grade Separation Biological Survey

Figure 7g

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

Weed Locations

Condition

- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED

a b c d e f g

AECOM

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5.3 Fauna

A total of 26 fauna species were recorded during the field survey including:

- 20 birds including two introduced species
- Four mammals including three introduced and one Priority 5, the Quenda.
- two reptile species.

A list of species recorded during the survey is provided in Appendix D.

5.3.1 Conservation Significant Fauna

Three conservation significant fauna species were recorded during the field survey, the Forest Red-tailed Black Cockatoo (Vulnerable EPBC Act and Schedule 1 WC Act), Rainbow Bee-eater (Migratory EPBC Act and Schedule 1 WC Act) and the Quenda (Priority 5 DPaW) (Table 13;Figure 8).

Forest Red-tailed Black Cockatoos were recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. The Quenda was recorded through the identification of diggings and tracks at the Tonkin Highway/Kelvin Road interchange and the Tonkin Highway/Hale Road interchange. Calls belonging to the Rainbow Bee-eater were recorded at the Tonkin Highway/Kelvin Road interchange.

Table 13 Conservation significant fauna recorded during the survey

Species	Evidence	Location		
		Interchange	Latitude	Longitude
Forest Red-tailed Black Cockatoo	Direct sighting	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	-32.010833	115.996234
Rainbow Bee-eater	Calls	Tonkin Highway / Kelvin Road interchange	-32.028283	116.003604
Quenda	Tracks	Tonkin Highway / Kelvin Road interchange	-32.030490	116.004498
	Diggings	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	-31.998220	115.995226

5.3.2 Black Cockatoos

5.3.2.1 Breeding Habitat

A total of 65 trees considered to be potential breeding habitat according to the Commonwealth guidelines (Australian Government, 2012) were recorded within the Project Area. Forty-two of these potential breeding habitat trees are located within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange. The remaining 23 potential breeding habitat trees occur within the proposed Tonkin Highway/Kelvin Road Interchange. A complete list of these trees including species, location, height, Diameter at Breast Height (DBH) and details of any hollows is provided in Appendix E. Tree species recorded were Jarrah, Marri and Flooded Gum. One Flooded Gum tree (tree 66) had one hollow present, however, due to the restricted opening diameter was not considered suitable for use by Black Cockatoos. No other trees were observed to have hollows (Appendix E).

5.3.2.2 Roosting Habitat

Potential roosting habitat comprises large eucalypts near fresh water, which are an important foraging resource and are typically the tallest trees in a landscape (Australian Government, 2012). Approximately nine introduced eucalypt trees were recorded at the proposed Tonkin Highway/Welshpool Road East interchange and one large potential roosting tree was recorded at the proposed Tonkin Highway/Hale Road interchange.

5.3.2.3 Foraging Habitat

In total, 14.7 ha of the overall Project Area is considered to be suitable potential foraging habitat for Black Cockatoos. The fauna habitats which contained suitable Black Cockatoo foraging habitat and associated areas are listed in Table 14 and mapped in Figure 8.

Table 14 Carnaby's Cockatoo Foraging Habitat Areas

Fauna Habitat	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
	Area (ha)	% of proposed interchange area	Area (ha)	% of proposed interchange area
Banksia Woodland	0.15	0.59	0	0
Eucalyptus and *Banksia* Woodland	2.38	9.02	4.74	27.29
Eucalyptus Woodland	2.01	7.60	2.82	16.24
Eucalyptus Woodland over sedges	2.49	9.44	0	0
Jarrah/Marri Woodland	0.11	0.42	0	0
Total	**7.15**	**27.06**	**7.56**	**43.53**

5.3.3 Additional Species

The desktop assessment identified 27 conservation significant (listed Threatened, Migratory or Priority) fauna species that relate to the Tonkin Highway project, including:

- seven species that are likely to occur (described in Table 15. Forest Red-tailed Black Cockatoo, Quenda and the Rainbow Bee-eater were omitted as these were confirmed to occur and discussed previously in Section 5.3.1
- three bird species which may overfly the area
- 17 species which were considered unlikely to occur.

Descriptions and an assessment of likelihood for all species identified in the desktop assessment are provided in Appendix F. The remaining species considered likely to occur within the Project Area but not recorded are detailed in Table 15.

Table 15 Conservation Significant Fauna Species Considered Likely to Occur in the Project Area

Species	Cons. Status	Details
Eastern Great Egret *Ardea modesta*	Marine, Migratory (CAMBA, JAMBA)	The Eastern Great Egret is a large bird (~100 cm, 1 kg) with white plumage and black or yellow bill. The species occurs individually or in small groups when foraging, but roosts in large flocks. Non-breeding individuals have been recorded throughout Australia. Almost all breeding colonies are located in the Top End of the Northern Territory (DotE, 2014). Non breeding individuals have been recorded across much of the Australian continent (DotE, 2014).
Baudin's Black Cockatoo *Calyptorhynchus baudinii*	Endangered WC Act Vulnerable EPBC Act	Habitat critical to the survival of this species includes forests of Karri *(E. diversicolor),* Jarrah (*E. marginata*) and Marri (*C. calophylla*), in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and continues south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al.,* 2010).

Species	Cons. Status	Details
Carnaby's Black Cockatoo *Calyptorhynchus latirostris*	Endangered WC Act & EPBC Act	Carnaby's Cockatoo is a postnuptial nomad and typically moves west soon after breeding. The species nests in hollows of smooth-barked eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*E. Wandoo*) but is not limited to these eucalypts. Diet consists of an array of Proteaceous and Eucalypt species prevalent on the Swan Coastal Plain. Foraging habitat, including Banksia woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al.,* 2010).
Cattle Egret *Ardea ibis*	Marine, Migratory (CAMBA, JAMBA)	The Cattle Egret is a small egret weighing only 390g and standing 70 cm tall. The heaviest distribution of this species in WA is in the north east, and into the Northern Territory. In the non-breeding season, it can be found throughout most of Australia (DotE, 2014).

5.3.4 Introduced Fauna

Five introduced fauna species were recorded in the Project Area, three of which are listed as Declared Pests under the BAM Act and management actions to prevent further spread beyond the current distribution may be required (DAF, 2014). Species included:

- Cat (*Felis catus*) (Declared Pest S.22 unless domestic pet)
- Dog (*Canis lupus* subsp. *familiaris*) (Declared Pest S.22 unless domestic pet)
- Domestic Pigeon (*Columba livia*)
- Rabbit (*Oryctolagus cuniculus*) (Declared Pest S.22)
- Laughing Turtle-Dove (*Streptopelia senegalensis*).

Cats, Dogs and Rabbits were recorded intermittently in the Project Area. Dogs were identified through tracks and scats which were typically common around drainage lines and access tracks. It is unlikely that Dog and Cat records were from wild individuals as dog and cat ownership is common in the Perth Metropolitan Area. Rabbits were recorded at both exchanges with seemingly high activity in the area.

5.3.5 Fauna Habitats

Ten fauna habitats were delineated and described at both interchanges (Table 16; Figure 8). The fauna habitats were defined using vegetation mapping and site observations by a qualified zoologist. Some habitats have been split to help delineate between preferred habitat for Black Cockatoos (Table 16). The Project Area is comprised of 50% cleared ground, including highway and adjacent road reserve. The most common habitat was *Eucalyptus* woodland (16%), containing foraging species and potential breeding habitat for the Threatened Black Cockatoos discussed in this report.

Condition of fauna habitat was generally poor throughout the Project Area with only 5 ha classified as Very Good. 0.9 ha was classified as Good, 9.9 ha was classified as Degraded, 5.5 ha was Degraded – Completely Degraded and 5.1 ha was classified as Completely Degraded. Fauna habitat condition mapping is presented in Figure 9.

Table 16 Fauna Habitats of the Project Area

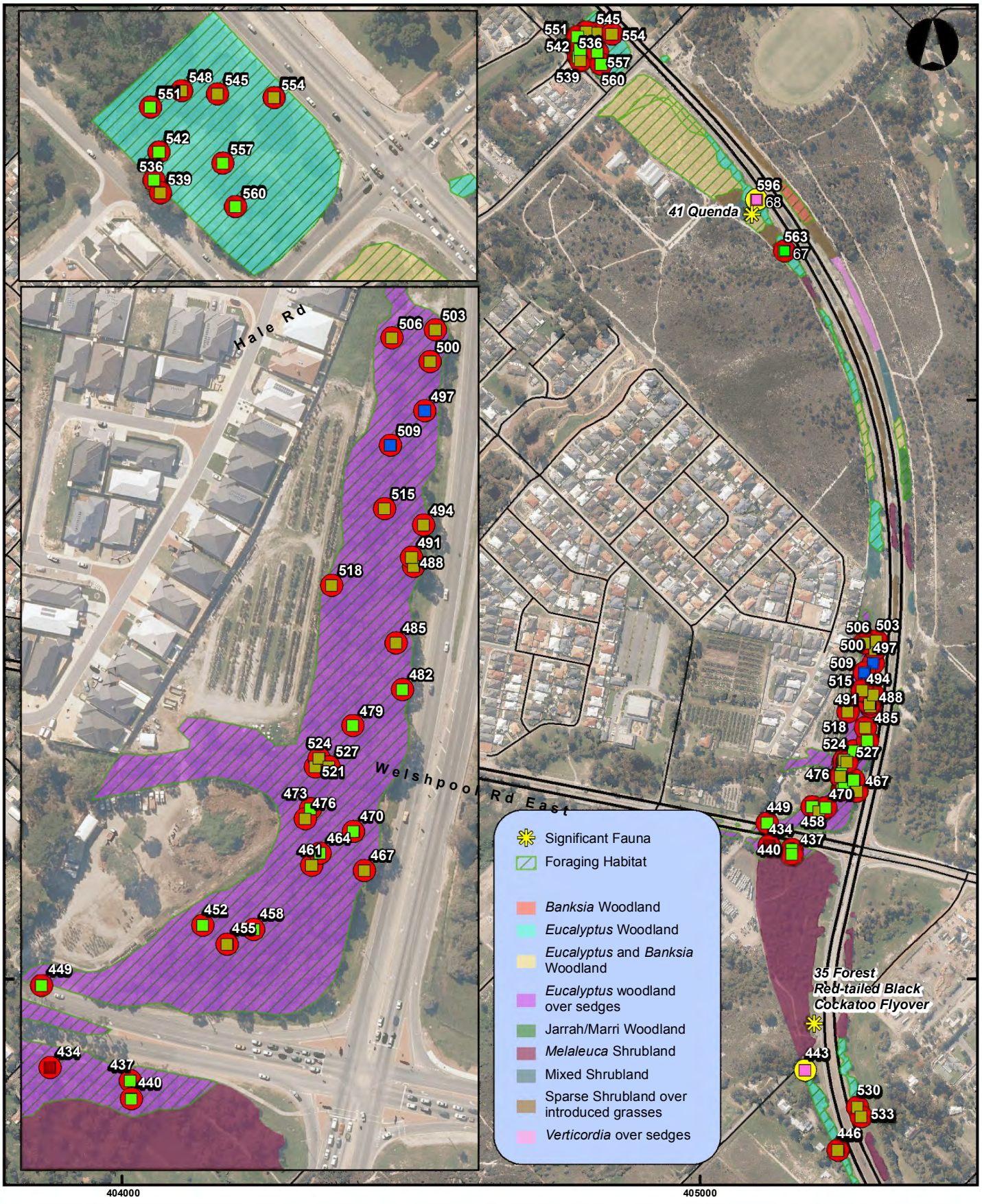
Fauna Habitat	Description	Habitat for Conservation Significant Fauna	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
			Area (ha)	Area (%)	Area (ha)	Area (%)
Banksia Woodland	*Banksia attenuata* and *Banksia menziesii* Woodland over *Allocasuarina fraseriana*, *Adenanthos cygnorum* and *Xanthorrhoea preissii* shrubland over mixed native low heath on sandy soils.	Black Cockatoos	0.15	0.59	0	0
Cleared	Areas devoid of native vegetation and includes infrastructure corridors such as roads and paths.	-	14.35	54.32	7.58	43.64
Eucalyptus and *Banksia* Woodland	*Eucalyptus rudis* and *Eucalyptus todtiana* over *Banksia menziesii* and *Banksia attenuata* woodland over low heath and introduced grasses.	Black Cockatoos	2.38	9.02	4.74	27.29
Eucalyptus Woodland	Mixed *Eucalyptus* species over introduced grassland.	Black Cockatoos	2.01	7.60	2.82	16.24
Eucalyptus woodland over sedges	*Corymbia calophylla, Eucalyptus rudis* and *Eucalyptus marginata* woodland over *Melaleuca rhaphiophylla*, *Viminaria juncea* and *Trymalium odoratissimum* ssp. *odoratissimum* shrubland in wetland depression	Black Cockatoos, Quenda	2.49	9.44	0	0
Jarrah/Marri Woodland	*Corymbia calophylla*, *Eucalyptus marginata* and *Banksia attenuata* Woodland over mixed shrubland over introduced weed species.	Black Cockatoos	0.11	0.42	0	0
Melaleuca shrubland	*Melaleuca rhaphiophylla* and *Melaleuca preissiana* Shrubland over *Adenanthos cygnorum* with occasional *Xanthorrhoea preissii* Shrubland over introduced grass species.	Quenda	3.40	12.88	0.37	2.14
Mixed shrubland	Mixed native shrubland over introduced grasses or low heath on sandy soils.	-	0.43	1.62	1.15	6.64

Fauna Habitat	Description	Habitat for Conservation Significant Fauna	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange		Tonkin Highway / Kelvin Road interchange	
			Area (ha)	Area (%)	Area (ha)	Area (%)
Sparse shrubland over introduced grasses	Degraded areas of mixed native shrubs over introduced grasses.	Quenda	0.89	3.36	0.70	4.06
Verticordia over sedges	*Pericalymma ellipticum* and *Verticordia* sp. Closed Shrubland over low sedgeland.	Quenda	0.20	0.76	0	0
Total			**26.42**	**100**	**17.36**	**100**

5.3.6 Habitat Linkages

Habitat linkages are typically corridors of vegetation that link larger areas of potential fauna habitat. Linkages are important as they enable organisms to move freely between remnant bushland patches, therefore increasing gene-flow between populations. A study conducted by Gilbert *et al.* (1998) found that corridors and/or linkages do maintain species richness in fragmented landscapes.

The Project Area lies within the Swan Coastal Plain IBRA region and, on a finer scale, within the Perth subregion (Mitchell *et al.,* 2002). As such, much of the existing habitat has been cleared and developed and so linkage corridors remain a valuable asset to local fauna. Roadside vegetation can function as habitat corridors (Bennett, 1998) and as such, the vegetation present in the Project Area provides a link for faunal movement in a highly modified landscape.



Fauna Habitats

Roe Grade Separation Biological Survey

Figure 8a

Coordinate System: GDA 1994 MGA Zone 50

0 50 100 150 200

Metres

1:9,000 (A4)

Tree_Type

- Flooded gum
- Introduced Eucalypt
- Jarrah
- Marri
- Stag

Breeding & Roosting

- Potential Breeding
- Roosting

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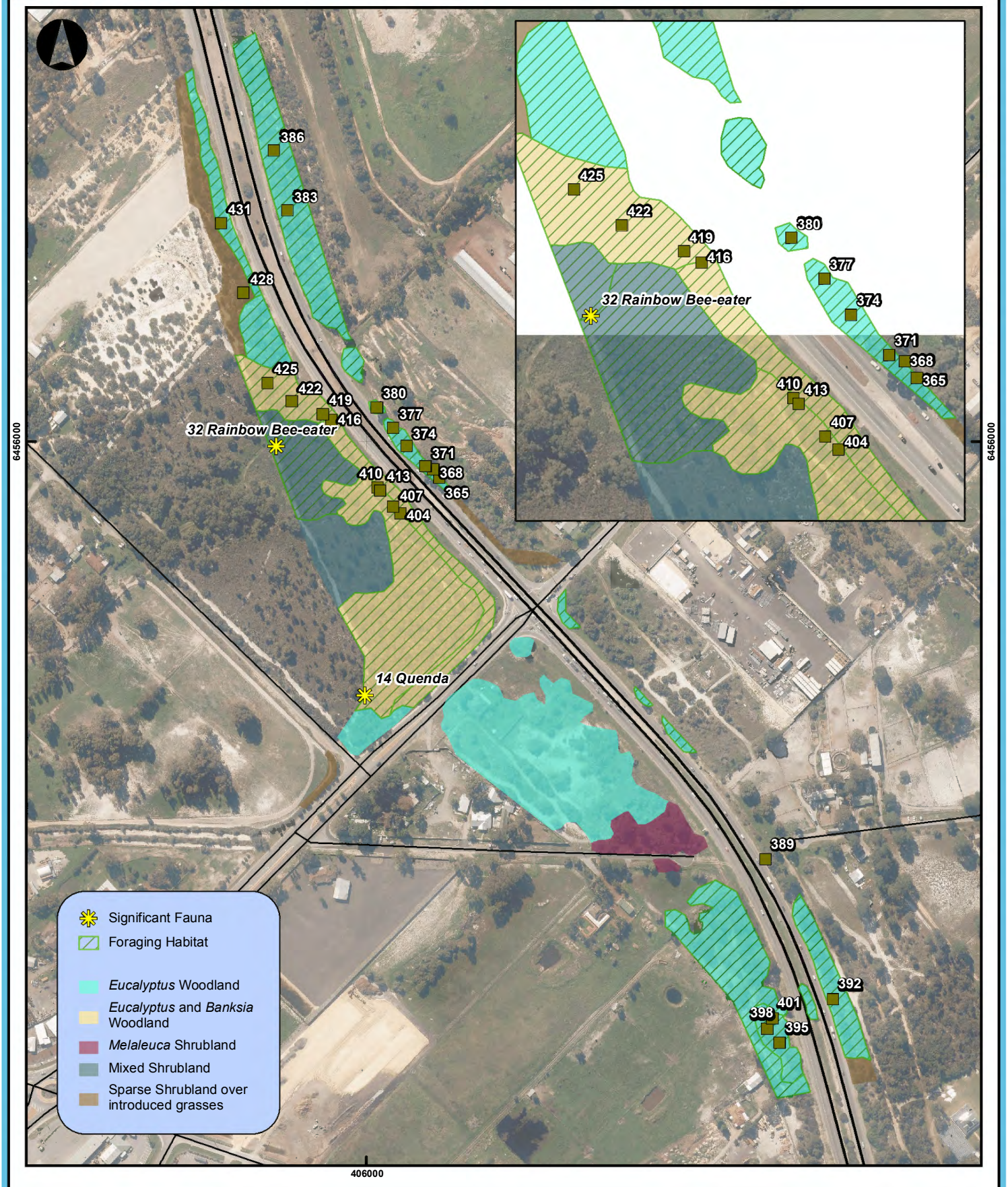

Fauna Habitats

Roe Grade Separation Biological Survey

Figure 8b

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80 100 120 140 160

Metres

1:5,000 (A4)

Tree Type

- Flooded Gum
- Introduced Eucalypt
- Jarrah
- Marri
- Stag
- Tuart

Potential Breeding & Roosting

- Flooded Gum
- Introduced Eucalypt

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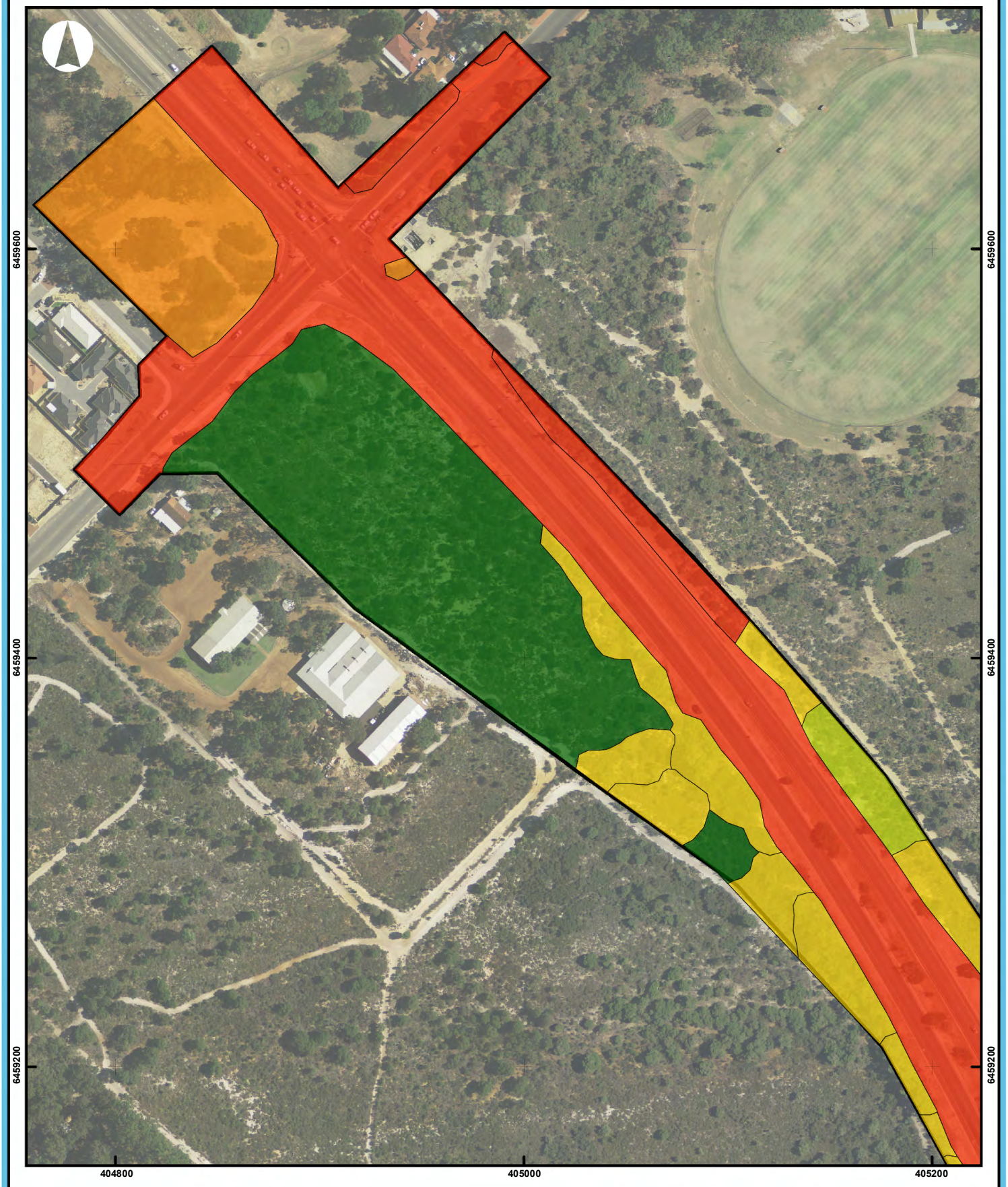

Fauna Habitat Condition

Tonkin Grade Separation Biological Survey

Figure 9a

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80

Metres

1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded

a b c d e f g

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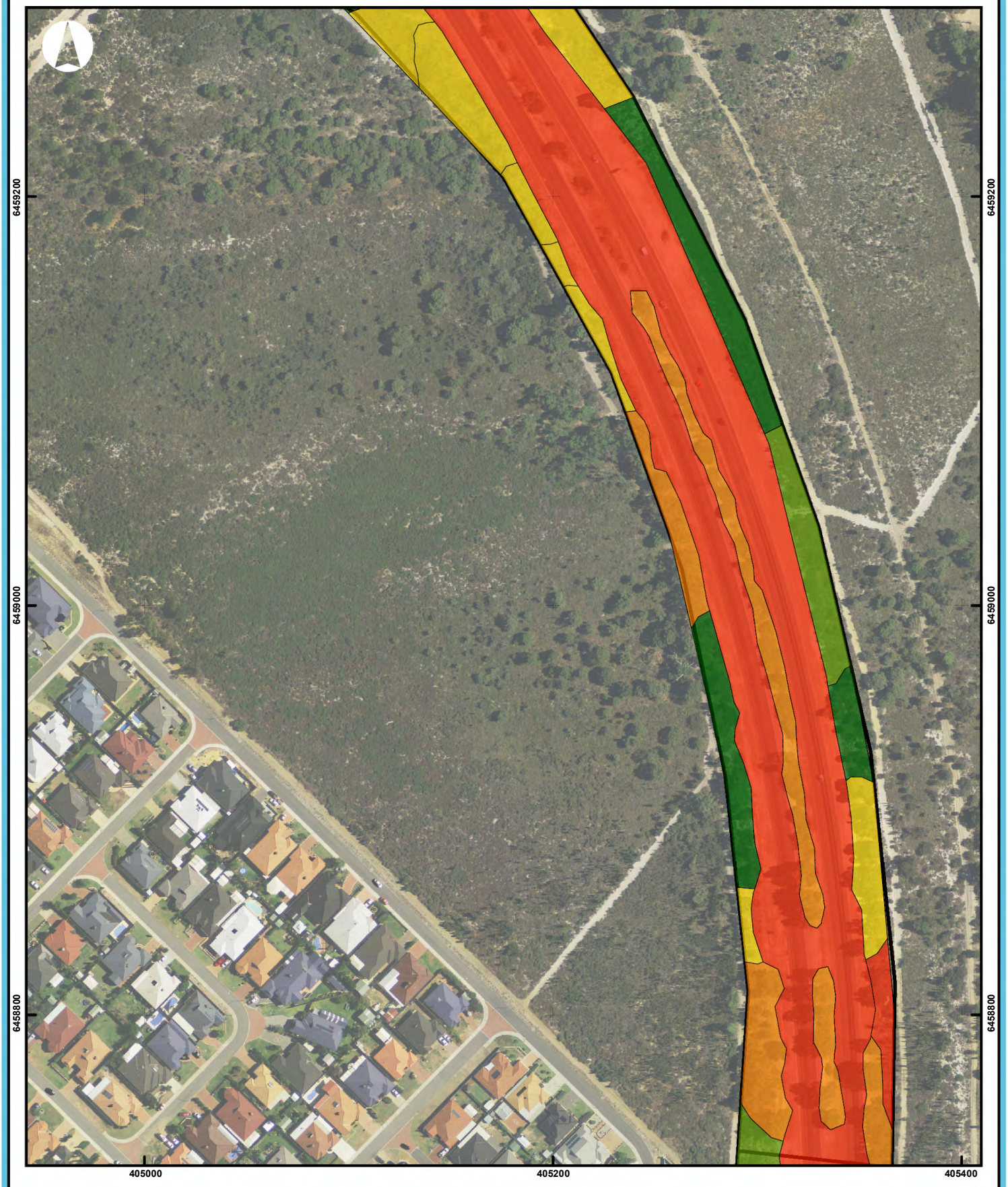


Fauna Habitat Condition

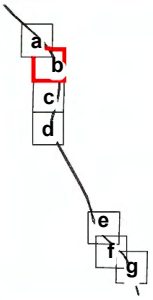
Tonkin Grade Separation
Biological Survey

Figure 9b

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded



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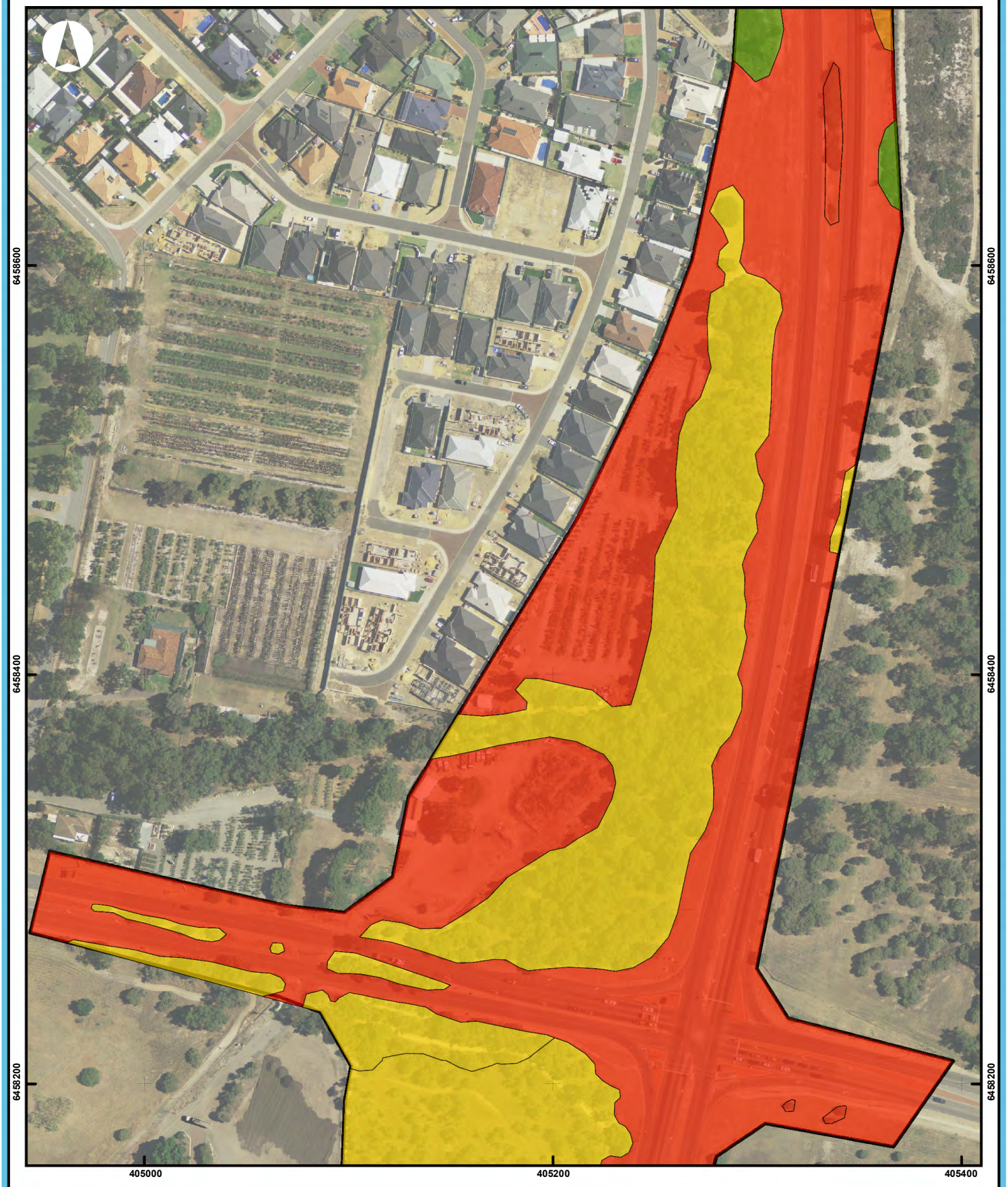


Fauna Habitat Condition

Tonkin Grade Separation
Biological Survey

Figure 9c

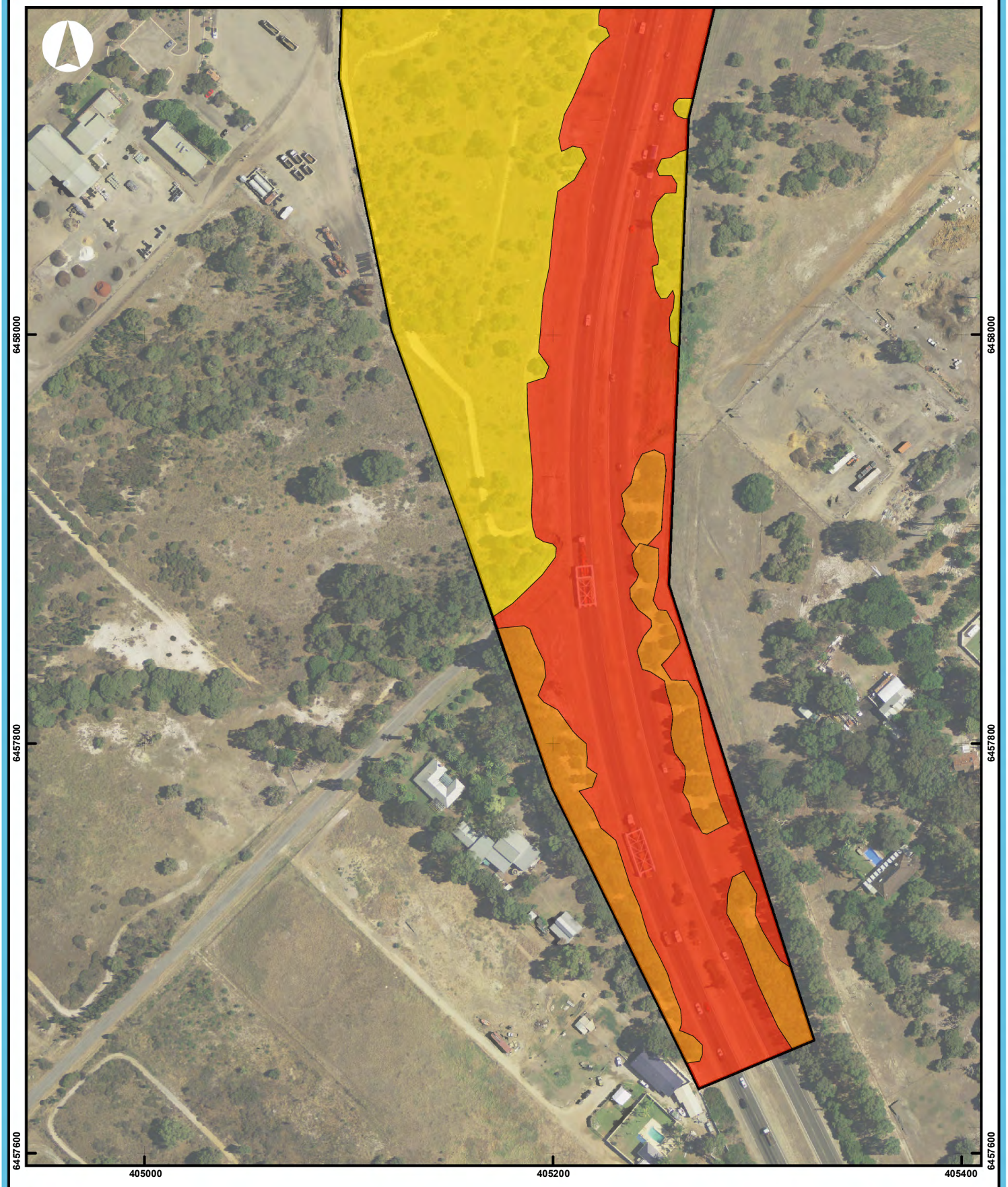
Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded

a b c d e f g

AECOM



Fauna Habitat Condition

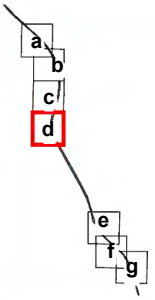
Tonkin Grade Separation
Biological Survey

Figure 9d

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded



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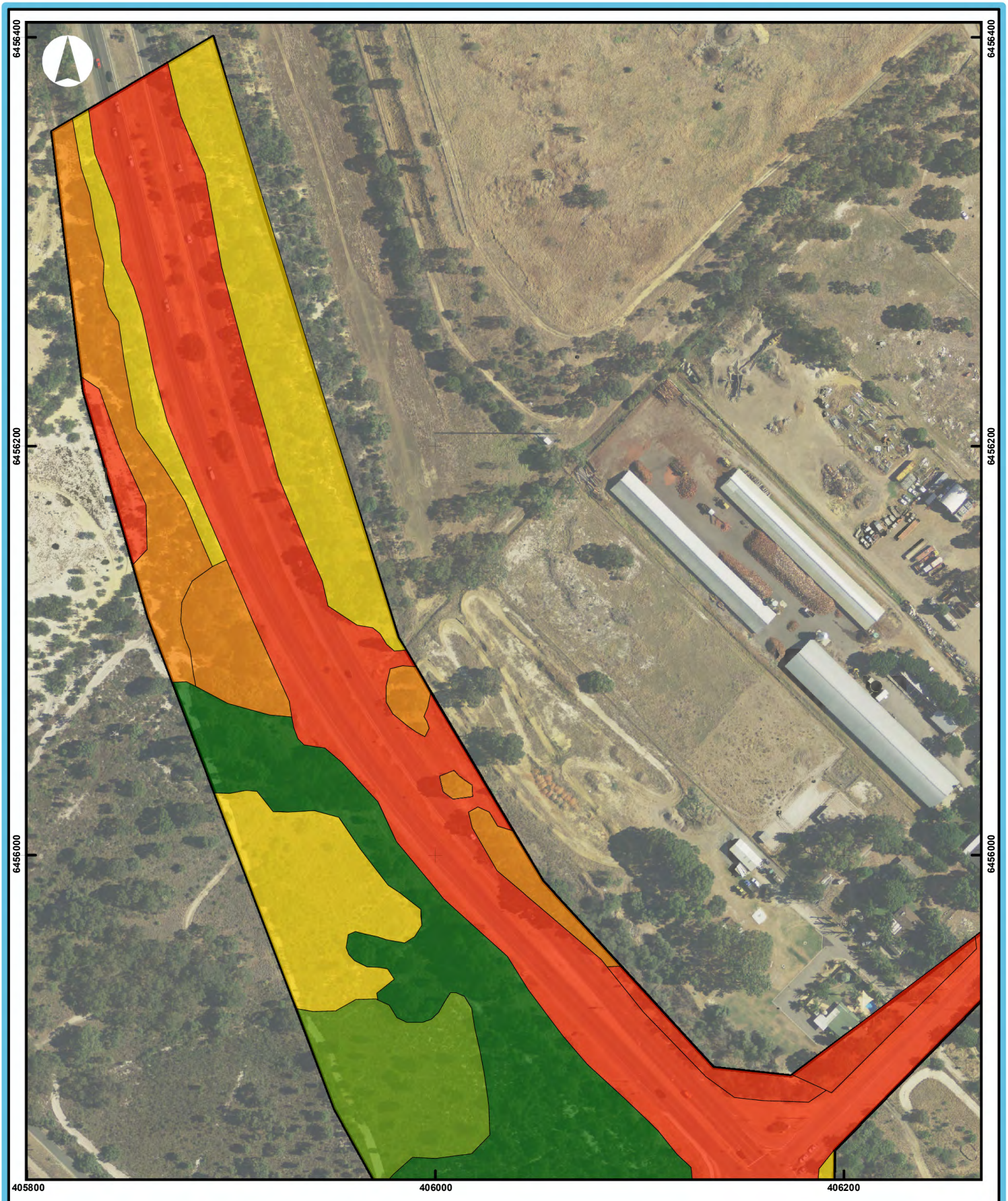


Fauna Habitat Condition

Tonkin Grade Separation
Biological Survey

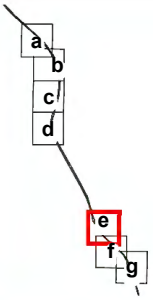
Figure 9e

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres

1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded



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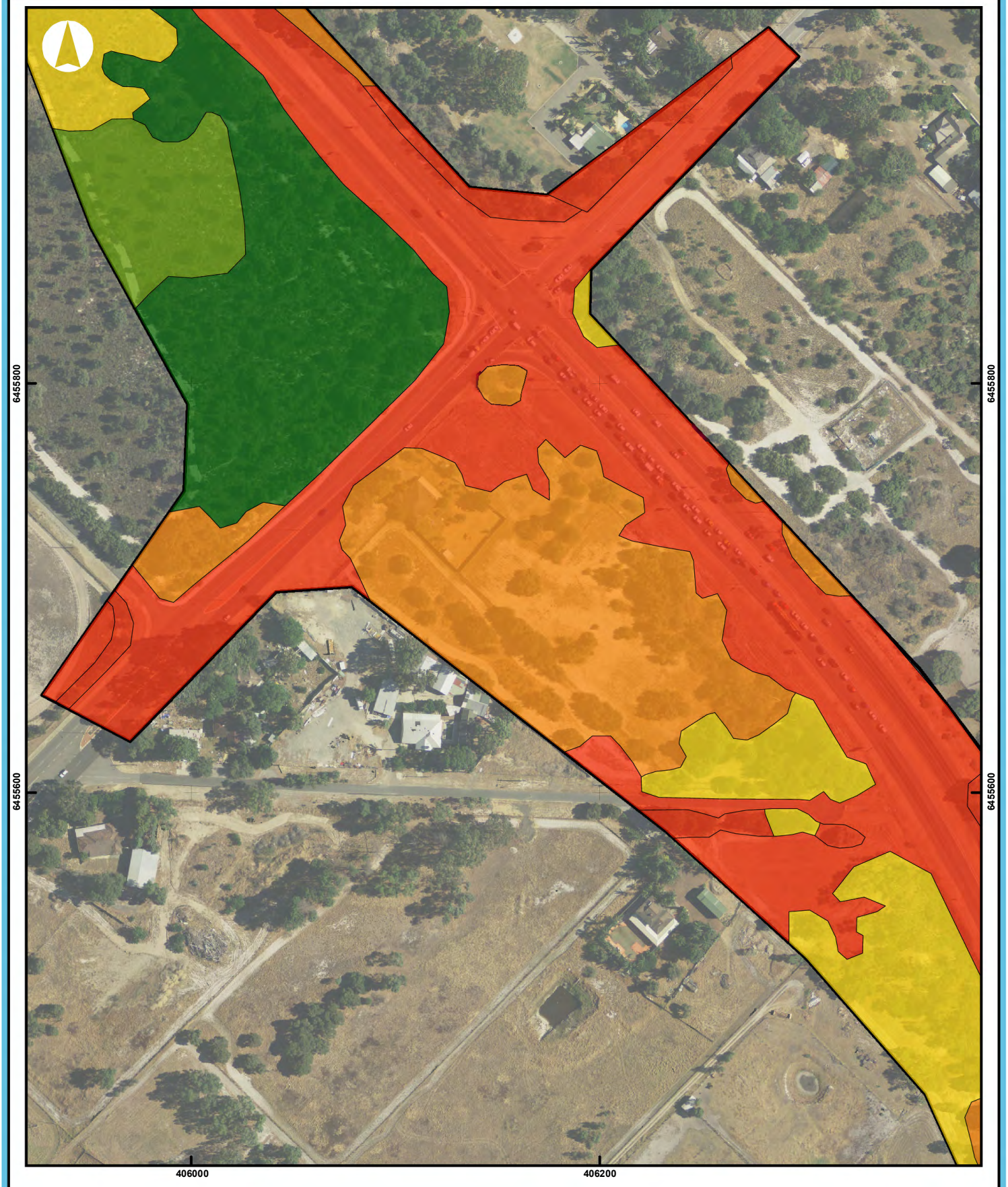


Fauna Habitat Condition

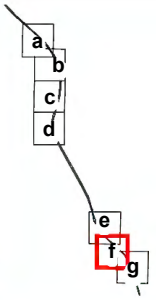
Tonkin Grade Separation
Biological Survey

Figure 9f

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded



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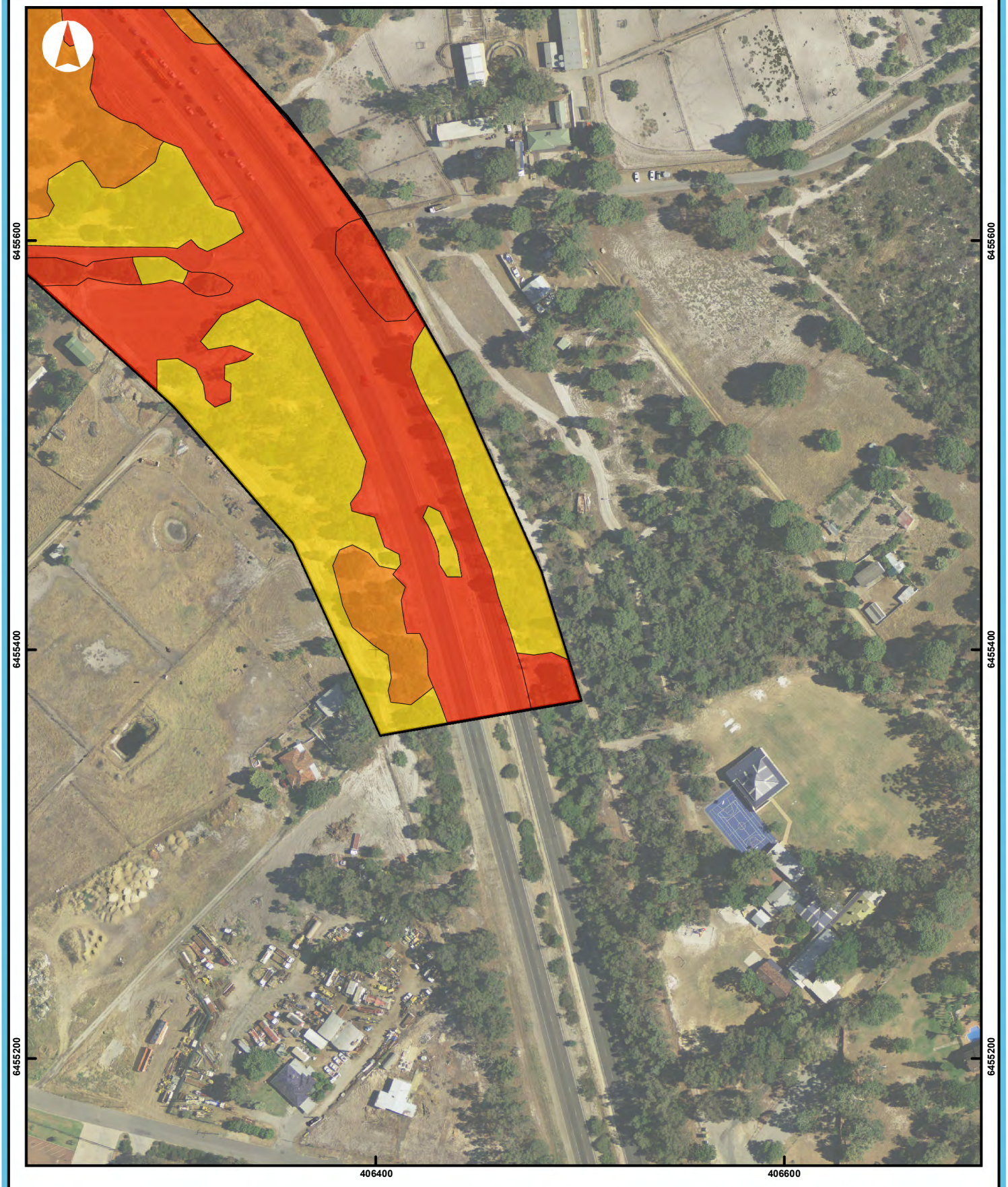

Fauna Habitat Condition

Tonkin Grade Separation
Biological Survey

Figure 9g

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80
Metres
1:2,500 (A4)

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded

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5.4 Wetland Assessment

Twelve Geomorphic Wetlands occur within the Project Area (Figure 10). This total comprises six Conservation Category Wetlands, five Multiple Use Wetlands and one Resource Enhancement Wetland as categorised by the Geomorphic Wetland Dataset.

Of these, six were subject to a Preliminary Evaluation using the DPaW (2013b) methodology and five were subject to a Secondary Assessment. The remaining six wetlands not assessed were considered to be an accurate reflection of their current management category.

A key finding was that a portion of wetland UFI 15116 which is currently classified as a Multiple Use Wetland should be considered as Conservation management category. This wetland had seven triggers for automatic classification as Conservation management which was further supported by the high score during the Secondary Evaluation.

There were four Conservation Category Wetlands that showed attributes, functions and values equivalent to Rehabilitation potential – Geomorphic. These wetlands were all mapped as being Degraded. They mostly had infestations of *Watsonia meriana* and other common grass weeds. Native understorey vegetation was largely displaced.

A summary of the results are provided in Table 17 with the complete Wetlands Assessment in accordance with DPaW (2013b) provided in Appendix G.

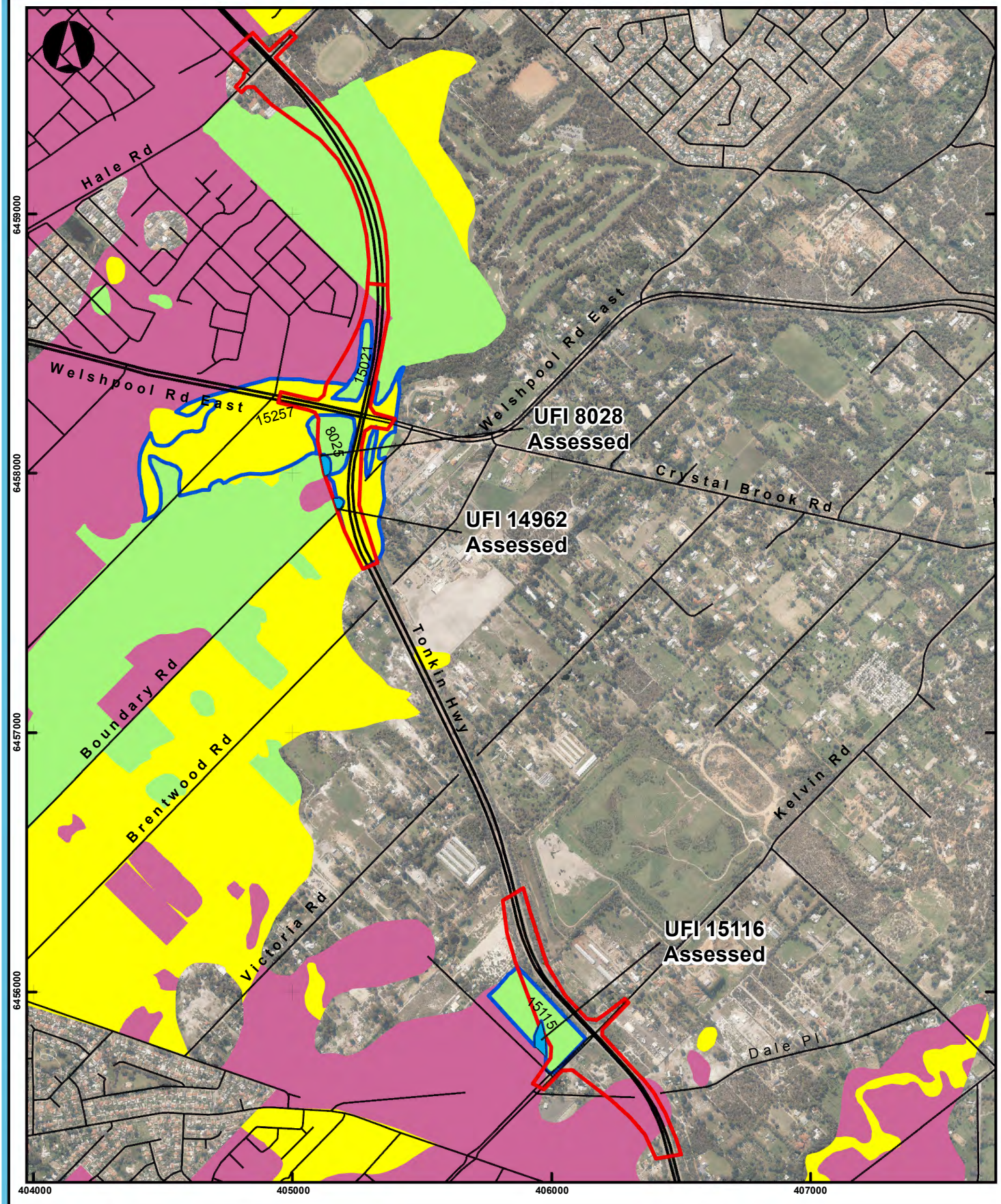
Table 17 Summary of Categories of Wetlands occurring within the Project Area

UFI and Details	Preliminary Evaluation Triggers	Secondary Evaluation Score	Comments
UFI 8025 Palusplain Conservation Category	Yes, foraging/breeding habitat for Black Cockatoos.	Rehabilitation potential – Geomorphology	Wetland UFI 8025 was subject to a wetland assessment including Preliminary Evaluation and Secondary Evaluation. The condition of this wetland is mapped as Degraded. There are no TECs/PECs or Threatened or Priority flora that are known to occur within the boundary of the wetland. UFI 8025 is highly modified. The vegetation is devoid of intact native understorey and is heavily infested with *Watsonia meriana*. The fauna survey identified Forest Red-tailed Black Cockatoo flying over the area. Furthermore, the area is likely to provide suitable habitat for the Priority 5 Southern Brown Bandicoot is likely to occur. This wetland forms part of Bush Forever Site 387 - Greater Brixton Street Wetlands and has been reported to contain numerous Threatened flora and TEC Floristic community type 10a – *Shrublands on dry clay flats*. None of these identified through field assessment. Due to Degraded vegetation this did not trigger automatic Conservation classification in the Preliminary Assessment.
UFI 8028 Sumpland Conservation Category	None	Rehabilitation potential – Geomorphology	Wetland UFI 8028 was subject to a partial wetland assessment (0.21 ha). Only where the wetland intersects with the project area was considered (Figure 10). The desktop review showed that Forest Red-tailed Black Cockatoos were observed as flying over the area however no suitable habitat was mapped within the wetland boundary. The wetland is likely to provide suitable habitat for the Priority 5 Southern Brown Bandicoot. No TEC or PECs and no Threatened or Priority flora species were recorded within the wetland boundary. The Preliminary Evaluation showed no triggers for automatic Conservation management category classification. The vegetation is devoid of intact native understorey and is heavily infested with *Watsonia meriana* and other introduced species. This wetland forms part of Bush Forever Site 387 - Greater Brixton Street Wetlands and has been reported to contain numerous Threatened flora and TEC Floristic community type 10a – *Shrublands on dry clay flats*. None of these were identified by the field assessment. Due to Degraded vegetation this did not trigger automatic Conservation category in the Preliminary Assessment.

UFI and Details	Preliminary Evaluation Triggers	Secondary Evaluation Score	Comments
UFI 8030 Palusplain Multiple Use	Not completed	Not completed	Degraded road reserve subject to large degree of disturbance and weed infestation. The existing classification of this wetland is considered appropriate.
UFI 13,619 Palusplain Multiple Use	Not completed	Not completed	UFI 13,619 is highly modified and primarily consists of residential housing. Within the Project Area this wetland has been extensively cleared and contains little to no native vegetation. The existing classification is therefore considered appropriate.
UFI 14,962 Palusplain Conservation	None	Rehabilitation potential – Geomorphology	A partial assessment was done of Wetland UFI 14,962, including only the area of wetland that is located within the Project Area (0.12 ha). The desktop review showed that the Forest Red-tailed Black Cockatoo was observed as flying over the area, however no suitable foraging habitat exists within the wetland boundary. The area is likely to be suitable habitat for the Priority 5 Southern Brown Bandicoot. No TECS or PECs or Threatened or Priority flora were recorded within the wetland boundary. The area was mapped as Degraded and contains dominating weeds that have displaced native vegetation. This wetland forms part of Bush Forever Site 387 - Greater Brixton Street Wetlands and has been reported to contain numerous Threatened flora and TEC Floristic community type 10a – *Shrublands on dry clay flats*. None of these were identified during the field assessment. Due to Degraded vegetation this did not trigger automatic Conservation category in the Preliminary Assessment.
UFI 15020 Palusplain Conservation	Not completed	Not completed	This wetland supports the appropriate values, attributes and functions for a Conservation management category. UFI 15,020 lies within Bush Forever Site 320 (Hartfield Park) which is known to contain two Threatened flora species*, Conospermum undulatum* and *Banksia mimica.* Five *Conospermum undulatum* individuals were recorded within UFI 15020 where it traverses the Project Area. This wetland also provides suitable foraging habitat for Carnaby's cockatoos.

UFI and Details	Preliminary Evaluation Triggers	Secondary Evaluation Score	Comments
UFI 15,021 Palusplain Conservation	Yes, foraging/breeding habitat for Black Cockatoos.	Rehabilitation potential – Geomorphology	Wetland UFI 15,021 is located wholly within the Project Area and was subject to a wetland assessment. The desktop review showed that suitable Black Cockatoo foraging habitat exists within the wetland boundary although it is degraded. Several potential Cockatoo breeding trees were recorded within the wetland. Furthermore, the wetland contains suitable habitat for the Priority 5 Southern Brown Bandicoot. No TECs, PECs, Threatened or Priority flora occur within the wetland boundary. It is unlikely that this wetland, which is considered Degraded and infested with *Watsonia meriana,* exhibits the values of a Conservation management category.
UFI 15,253 Seasonally waterlogged Palusplain Multiple Use	Not completed	Not completed	The vegetation is devoid of native understorey species and is dominated by weeds and introduced species. The existing wetland management category is therefore considered appropriate. Less than 0.5 ha occurs within the Project Area.
UFI 15,257 Palusplain Resource Enhancement	None	Not completed	This wetland is currently mapped as a Resource Enhancement Wetland. Within the project area this wetland is comprised of large main roads. The wetland therefore does not exhibit any of the attributes, functions and values of a wetland within the project area. The desktop assessment showed that 90% of the wetland is considered Completely Degraded, with 10% mapped as Degraded roadside vegetation. There is no suitable Black Cockatoo habitat or Southern Brown Bandicoot habitat within the wetland boundary. No TECs, PECs, Threatened or Priority flora occur within the wetland. The Resource Enhancement management category is considered suitable for this wetland despite it not maintaining visible wetland functions, values and attributes. This is in accordance with the DPaW (2013b) where wetlands have varying areas of value.
UFI 15,115 Palusplain Conservation	Not completed	Not completed	UFI 15,115 lies within Clifford Street Bushland (Bush Forever 53) and is known to contain TECs and Threatened and Priority Flora. During the field assessment over 200 individual *Conospermum undulatum* (Threatened) were recorded within UFI 1511 as well as the adjacent 15,116. This wetland is mapped as a Conservation Category Wetland and represents the appropriate functions, values and attributes for this category.

UFI and Details	Preliminary Evaluation Triggers	Secondary Evaluation Score	Comments
UFI 15,116 Palusplain Multiple Use	Yes: - Bush Forever - Breeding/foraging habitat for Black Cockatoos - TEC present - Threatened flora population - 90% of wetland in good to better condition - <10% wetlands of same type are assigned Conservation category - <10% wetlands within its consanguineous suite assigned Conservation category	Conservation management category – Flora	Less than 0.1 ha of this wetland occurs within the Project Area, however it lies within Clifford Street Bushland (Bush Forever Site 53). A total of 0.35 ha of wetland UFI 15,116 was subject to the wetland assessment. Wetland UFI 15,116 is currently mapped as a Multiple Use Wetland. The area subject to a wetland assessment includes the area that penetrates the Conservation Category Wetland UFI 15,115. The wetland is located within a Bush Forever site and is comprised of native vegetation in Very Good condition. The wetland includes suitable habitat for the Priority 5 Southern Brown Bandicoot and the EPBC Act Migratory Rainbow Bee-eater and the EPBC Threatened Forest Red-tailed Black Cockatoo. In addition, the population of *Conospermum undulatum* recorded in the adjacent wetland (UFI 15,115) extends into UFI 15,116. There is one State-listed TEC and one Federal-listed TEC that occurs directly adjacent to the wetland boundary. The Threatened flora species *Conospermum undulatum* was recorded within the wetland boundary. The Preliminary Evaluation triggered seven 'Yes' answers, automatically categorising this wetland as Conservation management category.
UFI 15,768 Palusplain Multiple Use	Not completed	Not completed	UFI 15,768 occurs within the buffer zone of an Endangered TEC. Based on the degraded nature of the TEC it is considered unlikely for this TEC to occur. No Threatened flora was recorded during field assessment. The existing classification is therefore considered appropriate.



Wetlands

Tonkin Grade Separation Biological Survey

Figure 10

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500

Metres

1:20,000 (A4)

Tonkin Hwy Grade Separation Project Area

UFI Subject to Assessment

Geomorphic Wetlands

Conservation

Multiple Use

Resource Enhancement

AECOM

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6.0 Discussion

AECOM was engaged by MRWA to undertake biological assessments within proposed interchange areas along Tonkin Highway including Tonkin/Hale Road, Tonkin/Welshpool Road East, and Tonkin/Kelvin Road. The biological assessments included a Level 1 Flora and Vegetation Assessment, Level 1 Fauna Assessment and a Wetlands Assessment. Assessments were conducted in spring 2014 and spring 2015.

6.1 Flora

A total of 150 vascular flora species were recorded within the Project Area from 38 families and 102 genera. This total included 110 (73.3%) native species, 33 (22.0%) introduced (weed) species and seven (4.7%) species that have been planted outside of their usual range. Given the highly degraded nature of the majority of the road reserve primarily due to edge effects, this total number of native species (110) is considered to be high. The surveys were conducted during October 2014 (spring), which is considered to be an optimal time to conduct flora surveys on the Swan Coastal Plain. The likelihood of recording a high proportion of the species diversity present within the Project Area during the field survey was therefore high.

6.1.1 Conservation Significant Flora

Two Priority flora species, *Conospermum undulatum* (Threatened – Vulnerable) and *Isopogon drummondii* (Priority 3) were recorded within the Project Area. *Conospermum undulatum* was recorded in the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange as well as in the proposed Tonkin Highway/Kelvin Road interchange area. *Isopogon drummondii* was recorded only from within the proposed Tonkin Highway/Kelvin Road interchange area, although previous records for the species occur within the other sections of the Project Area. One additional species, *Verticordia lindleyi* subsp. *lindleyi* (Priority 4) was identified to occur within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area through database searches but was not recorded by AECOM during the field assessments.

Conospermum undulatum (Vulnerable) is an erect shrub, growing to 1.5 m tall. It has distinctive woolly, white flowers and leaves with characteristic wavy margins. *Conospermum undulatum* is known from 25 population comprising of 83 subpopulations (DEC, 2009) and was initially recorded within Bush Forever Site 53 in 2005. The species is geologically restricted and largely confined to the Swan Coastal Plain with collections in Kenwick, Maida Vale, High Wycombe and Forrestfield. The critical habitat for *Conospermum undulatum* is largely fragmented with all known populations occurring within a 9km radius.

A total of 249 individual plants were recorded during the field survey. Within Bush Forever Site 53, 242 individual plants were recorded (Figure 6). An additional 45 plants from the same population also occur within Bush Forever Site 53 directly outside of the Project Area. DEC (2009) lists threats to the species as:

- land clearing - 23% of known plants are located on subdivided blocks
- degradation of natural habitat,
- road and firebreak maintenance – 16% of plants are located on road reserve and borders of firebreaks
- lack of fire
- weeds
- recreational activities
- rabbit grazing.

Isopogon drummondii (Priority 3) is described as an erect, lignotuberous shrub to 1m tall. DPaW records indicate that there are currently 59 known records of this species ranging from Gingin to Serpentine. It commonly grows in sand in low woodland and flowers between January and May. A total of three individual *Isopogon drummondii* plants were recorded at the proposed Tonkin Highway/Kelvin Road interchange within 20m of the road pavement in degraded vegetation.

Two previous DPaW records of *Verticordia lindleyi* subsp. *lindleyi (*Priority 4) exist within the Project Area although the species was not identified during the field assessments. This species does not generally flower in October so it is possible that the species is present within the Project Area but that it was not identified due to the lack of flowers.

Additional species that were considered likely to occur within the Project Area based on the desktop assessment were not recorded during the field assessment.

6.1.2 Introduced (weed) Species

A total of 33 introduced species were recorded within the Project Area. Three of these are categorised as Declared Pests in accordance with section 22 of the BAM Act, two are listed as WoNS and eight are considered to have a High environmental weed rating by CALM (1999).

The three Declared Pest species are categorised as requiring management. Land managers are also responsible for managing WoNS occurring on their properties. Weeds with a High rating according to CALM (1999) should also be prioritised for control and/or research for management. Weed control measures should therefore be considered at least for these high priority species.

6.2 Vegetation

6.2.1 Threatened Ecological Communities

The EPBC Act Protected Matters search and DPaW Threatened and Priority Ecological Communities database search identified four Threatened Ecological Communities and/or their buffer as occurring or potentially occurring within the Project Area. These TECs are:

- FCT SCP 3b - *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (Vulnerable (WC Act)
- FCT SCP 10a - Shrublands on dry clay flats Plain (Critically Endangered (EPBC Act), Endangered (WC Act))
- FCT SCP 20a – *Banksia attenuata* woodland over species rich dense scrubland (Endangered (WC Act)
- FCT SCP 20c – Shrubland and woodlands of the eastern side of the Swan Coastal Plain (Endangered (EPBC Act), Critically Endangered (WC Act)).

Species composition of the vegetation communities recorded within the Project Area has been analysed and compared to the Gibson *et al.* (1994) dataset to determine FCTs. Sixteen communities described by AECOM were not comparable to FCTs due to the high degree of degradation and a lack of sufficient native species for statistical comparison. Three communities described by AECOM were considered to be equivalent to FCTs classified as TECs under DPaW listing. Communities BAAS, EBWES and AHES represent FCT SCP 20a, a State listed Endangered TEC.

The vegetation community BAAS occurs within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. Community AHES occurs within the proposed Tonkin Highway/Kelvin Road interchange area. Community EBWES occurs in both.

Almost the entire Project Area at the proposed Tonkin Highway/Kelvin Road interchange and a portion of the Tonkin Highway/Welshpool Road East interchange were identified to contain TECs through DPaW database searches (Figure 4). The majority of these areas mapped as TEC have been extensively cleared and are devoid of remnant vegetation. The locations of known TECs are represented by point data, based on confirmed study plots assessed by the DPaW, and thus buffers for these points intersect the Project Area. The buffers of DPaW point data are sized so that the radius extends to the furthest point of the community to ensure that the 'buffer' area encompasses at least the entire TEC. Therefore, occasionally buffers may extend across vegetation community boundaries into communities and cleared roads that do not represent TEC vegetation, but may still fall within a buffer.

No Priority Ecological Communities are known to occur within close proximity of the Project Area.

6.2.2 Bush Forever

State Planning Policy 2.8: *Bushland Policy for the Perth Metropolitan Region* recognises the protection and management of significant bushland areas such as Bush Forever in the planning process, as well as integrating environmental, social and economic considerations (WAPC 2010). Bush Forever identifies regionally significant bushland to be retained and protected wherever possible. Three Bush Forever sites (53, 320 and 387) are located within or adjacent to the Project Area.

Clifford Street Bushland (Bush Forever Site 53) occurs partially within the Project Area at the proposed Tonkin Highway/Kelvin Road interchange. Small sections of Hartfield Park Bushland (Bush Forever Site 320) and Brixton Street Wetland (Bush Forever Site 387) intersect the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. All these Bush Forever sites are considered to be of conservation significance as each has been reported to contain Threatened or Priority Flora and/or TECS.

State Planning Policy 2.8 seeks to protect regionally significant bushland except where a proposal is within existing reserves for regional or local roads (WAPC, 2010). The policy does not prevent development or clearing within regionally significant bushland such as Bush Forever, where a proposal or decision is consistent with existing approved uses or existing planning/environmental commitments or approvals such as upgrades to the road transport network within the existing MRS road reserve (WAPC, 2010).

6.2.3 Vegetation Condition

The condition of the vegetation within the Project Area ranges from 'Completely Degraded' to 'Very Good'. The majority of the Project Area vegetation is 'Completely Degraded' (52.29%) or 'Degraded' (36.60%). This is heavily influenced by the presence of weeds within the vegetation, which are largely associated with edge effects. Generally, the proportion of weeds decreases and the subsequent vegetation condition increases with distance from the edge of the existing road. Only 11% of the vegetation within the Project Area is in Good or Very Good condition.

6.2.4 Locally, Regionally and Nationally Significant Vegetation

EPA (2000) lays out a series of constraints which relate to biodiversity. One of them is to protect at least 30% of the original extent of vegetation complexes in unconstrained areas and 10% in constrained areas (i.e. urban zoned regions). The survey area is considered a constrained area; therefore the 10% protection target applies. The remaining extents of the Southern River and Forrestfield complexes exceeds the minimum 10% target for the retention of vegetation complexes in constrained areas on the Swan Coastal Plain (EPA, 2000).

Criteria outlined in Position Statement 2 indicate that vegetation is considered to be endangered if less than 10% of pre European extents remain. Based on this, the Guildford Complex is considered to be Endangered, with only 5.9% of the original extent remaining.

Six vegetation communities described by AECOM are considered to be locally, regionally or nationally significant. Vegetation communities EBWES, AHES, AEBS, VHS and CEW are considered to be of national significance as they support populations of EPBC Act listed species *Conospermum undulatum*.

Three vegetation communities (EBWES, AHES and BAAS) are considered to be of regional significance as they support State listed TEC SCP 20a. Vegetation communities are considered to be locally significant where they support populations of Priority Flora and therefore EBWES is also considered to be locally significant.

Locally, Regionally and Nationally significant vegetation communities occur in both interchange areas of the Project Area.

6.3 Wetlands

Twelve Geomorphic Wetlands traverse the Project Area, comprising of six Conservation Category Wetlands (CCW), five Multiple Use Wetlands and one Resource Enhancement Wetland. CCW's are relatively undisturbed wetlands that retain high ecological values. Three wetlands occur at the Tonkin Highway/Kelvin Road interchange area, whilst the remaining nine occur at the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area.

Two wetlands (UFI 8028 and 14962) are currently classified as CCW however Preliminary and Secondary Evaluation classified them in the Rehabilitation potential – Geomorphology management category. These wetlands comprised of open to closed overstorey of native species over an infestation of *Watsonia meriana*. Lack of native species and no triggers in the Preliminary Evaluation have resulted in the downgrading of their classification.

Two wetlands (UFI 8025 and 15021) are also classified as CCW wetlands. They both have Preliminary Evaluation triggers that ensure they maintain this status, even though the Secondary Evaluation indicates they reflect the functions, values and attributes of a Rehabilitation potential – Geomorphic management category. In both cases the trigger was presence of potential Black Cockatoo foraging and/or breeding habitat.

Wetland UFI 15116 was partially assessed. This wetland is currently mapped as a Multiple Use Wetland near the corner of Kelvin Road and Tonkin Highway. The part of this wetland subject to an assessment consists of native vegetation in Very Good condition, located within a larger block of native vegetation. Within this area there are known TECs and a population of Threatened *Conospermum undulatum.* The wetland also provides habitat for the Migratory Rainbow Bee-eater and Threatened Black Cockatoo species. Several Preliminary Evaluation triggers show this wetland as suitable for a Conservation management category. The Secondary Evaluation further confirmed this assessment with a score of 20 in the High category.

Geomorphology was the common attribute that scored high on the Secondary Evaluations. This is due to the large amount of clearing conducted within consanguineous wetland groups, and on the Swan Coastal Plain in general. Geomorphology was not usually altered. Low scores were attributed to weed infestation, no linkage, minimal habitat, low flora diversity, and no cultural or scientific and educational values.

The disturbance of a CCW through construction activities has the potential to further degrade the wetland and damage habitat vital to flora and fauna species. Resource Enhancement Wetlands are considered to have been partly modified but still support substantial functions and attributes (EPA, 2008). Management priorities for Resource Enhancement Wetlands are to restore the wetland through maintenance and enhancement of functions and attributes by sustainable management. Multiple Use Wetlands are considered to have few attributes which still provide important wetland functions (EPA, 2008). In the case of Multiple Use Wetlands, reasonable measures are to be taken to retain the wetland's hydrological function and, where possible, other wetland functions (EPA, 2008).

6.4 Fauna

Three conservation significant species were recorded in the Project Area and are discussed below. Species considered likely to occur in the Project Area but not recorded are also discussed in this section.

The Forest Red-tailed Black Cockatoo, recorded in the Project Area, is listed as 'fauna that is rare or likely to become extinct' (Schedule 1) under the WC Act and listed as Vulnerable under the EPBC Act. This subspecies of *Calyptorhynchus banksii* is endemic to the south-west of Western Australia and breeding has been recorded between February to December, peaking between October and December (Johnstone *et al.*, 2010). Forest Red-tailed Black Cockatoo's diet consists mainly of seeds from Marri, Jarrah, *E. caesia*, *E. erythrocorys* and Flooded Gum (*E. rudis*). There are 42 potential breeding habitat trees and 7.15 ha of suitable foraging habitat as classified by Commonwealth of Australia (2012) within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. There are 23 potential breeding habitat trees and 7.56 ha of suitable foraging habitat within the proposed Tonkin Highway/Kelvin Road interchange area. No signs of nesting or breeding were observed within the Project Area. Key threatening processes to this species of Black Cockatoo are habitat loss, nest hollow shortage, competition, illegal shooting and fire (DotE, 2014).

The Quenda or Southern Brown Bandicoot is a Priority 5 species and was recorded within the proposed Tonkin Highway/Hale Road to Tonkin Highway/Welshpool Road interchange area as well as the proposed Tonkin Highway/Kelvin Road interchange area. The Priority 5 classification is given to fauna that is considered by DPaW as not threatened but is under a specific conservation program. If not viewed directly, clues to its existence lie in the presence of conical holes left after feeding in soils. It is found in woodland, heath and shrub communities, often adjacent to or near water, on the Swan Coastal Plain and prefers a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008). Key threatening processes for the Quenda include habitat loss and degradation, road trauma and predation by introduced carnivores.

The Rainbow Bee-eater was recorded during the survey and may possibly utilise sandy banks and tracks for breeding, however no breeding activity was recorded. Most habitats in the Project Area provide some potential breeding habitat for this species given the sandy substrate present. The Rainbow Bee-eater is a common and widespread species however it is protected under the bilateral migratory bird agreement with Japan (JAMBA) and thus, consideration should be given to mitigating impacts to the species.

The species discussed below were not recorded during the field survey but can be expected to occur based on factors such as distribution, suitable habitat and records in the area.

Baudin's Cockatoo was not recorded during the survey but is expected to occur within the Project Area. Habitat critical to the survival of this species includes forests of Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*); in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, south through Armadale and towards the coast until Lake Clifton where it ranges along the coastline to east of Albany (Johnstone *et al.,* 2010).

Carnaby's Cockatoo is a postnuptial nomad and typically moves west soon after breeding. This species nests in hollows of smooth-barked eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*) but is not limited to these Eucalypts. Diet consists of an array of Proteaceous and Eucalypt species prevalent on the Swan Coastal Plain. Foraging habitat, including *Banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al.,* 2010).

Foraging and potential breeding habitat described above for the Forest Red-tailed Black Cockatoo is also suitable habitat for Baudin's Cockatoo and Carnaby's Cockatoo.

The Eastern Great Egret, protected under the international agreements JAMBA and CAMBA, is a common and widespread species. Almost its entire breeding habitat is located in the Top End of the Northern Territory, with some minor breeding recorded in the south west of Western Australia in *Melaleuca* swamps (DotE, 2014). No habitat within the Project Area is expected to be critical breeding habitat for this species. Non-breeding individuals have been recorded over much of Australia and can be expected to occur in the Project Area following sustained periods of rainfall when wetlands in the area are wet.

The Cattle Egret is a migratory and widespread species. The heaviest distribution of this species in WA is in the north east, and into the Northern Territory where breeding populations have been recorded. No breeding habitat occurs within the Project Area so impacts to this species should be low.

During construction, management actions designed to mitigate the spread of introduced mammals and feral bees should be considered. Introduced pests affect primary production, increase spread of disease, cause degradation of natural ecosystems and threaten rare or endangered animals and plants (Cowan, 1996). As such, management actions to control the populations such as baiting, feral bee control and waste management (particularly food waste) should be encouraged.

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7.0 Assessment against the Ten Clearing Principles

In assessing whether each of the interchange upgrades is likely to have a significant impact on the environment, each interchange was assessed against the ten clearing principles (EP Act, Schedule 5). Results of these assessments are presented below. It is important to note that the final design is not yet available so the assessments have been based on the assumption that the entire Project Area will be cleared for the proposed upgrades. Detailed design may result in a reduction of impacts if the clearing footprint is smaller than the entire Project Area and, as such, these assessments will need to be repeated once the final design is available.

7.1 Tonkin Highway/Hale Road Interchange to Tonkin Highway/Welshpool Road East Interchange

A clearing assessment for the clearing of native vegetation at the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road east interchange is summarised in Table 18. The clearing within this interchange is considered to be **at variance** with three principles, **likely to be at variance** with two principles, **may be at variance** with one principle and **not likely to be at variance** with four principles.

Table 18 Assessment against Ten Clearing Principles – proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange

Clearing Principle	Rationale	Likelihood of Variance
a) Native vegetation should not be cleared if it comprises a high level of biological diversity	EPBC Protected Matters and DPaW database searches identified a total of 60 Threatened or Priority Flora species to potentially occur within the vicinity of the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. This comprised of 21 species listed under the EPBC Act, 21 species listed under the WC Act, five Priority 1, six Priority 2, 19 Priority 3 and nine Priority 4 species. Two of these species, *Conospermum undulatum* listed as Vulnerable under both the EPBC and the WC Act, and *Isopogon drummondii* (Priority 3) have been previously recorded within the proposed interchange area. The field assessment identified the presence of five individual *Conospermum undulatum* (Vulnerable) plants. Vegetation communities supporting this species within the interchange area are considered to be regionally significant. The interchange traverses two Bush Forever Sites; the Greater Brixton Street Wetlands (Bush Forever Site 387) and Hartfield Park Bushland (Bush Forever Site 320). Both are known to contain numerous Threatened and Priority Flora and Commonwealth and State listed TECs. Hartfield Park Bushland (Bush Forever Site 320) is considered to contain a high level of biodiversity. A total of 21 vegetation communities were described and mapped within the entire Project Area. Of these, 16 occur within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange and comprised of nine Woodland communities and five shrubland communities and two rehabilitation communities. Two communities occurring within the proposed interchange (BAAS and EBWES) are inferred to be equivalent to FCT SCP 20a, a State listed TEC. The clearing of native vegetation is at variance with this Principle.	At variance

Clearing Principle	Rationale	Likelihood of Variance
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	A total of 27 Threatened, Terrestrial Migratory and Priority fauna species were identified through EPBC Protected Matters search and DPaW database searches to potentially occur within the Project Area. Of these species, seven are considered likely to occur, three birds may overfly the Interchange Area and 17 are considered unlikely to occur. The species considered likely to occur are listed below: - Forest Red-tailed Cockatoo - *Calyptorhynchus banksii* subsp. *naso* (Vulnerable (EPBC Act) & Schedule 1 (WC Act)) - Baudin's Cockatoo - *Calyptorhynchus baudinii* (Vulnerable (EPBC Act) & Schedule 1 (WC Act)) - Carnaby's Cockatoo - *Calyptorhynchus latirostris* (Endangered (EPBC Act) & Schedule 1 (WC Act)) (Confirmed) - Rainbow Bee-eater - *Merops ornatus* (Migratory (EPBC Act) & Schedule 3 (WC Act)) - Eastern Great Egret - *Ardea modesta* (Migratory (EPBC Ac)t & Schedule 3 (WC Act)) - Cattle Egret - *Ardea ibis* (Migratory (EPBC Act) & Schedule 3 (WC Act)) - Southern Brown Bandicoot or Quenda - *Ardea modesta* (Migratory (EPBC Ac)t & Schedule 3 (WC Act)) Numerous suitable Black Cockatoo breeding habitat or trees with the potential to form suitable hollows (>500mm DBH) were identified during the initial site inspection. Good quality remnant vegetation occurs within the proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area which is considered to be suitable foraging habitat for the three black cockatoo species (Commonwealth of Australia, 2012). The three black cockatoos have been previously recorded within Jarrah and Marri Forest near High Wycombe and are likely to frequent the interchange Area. Some black cockatoo foraging habitat of greater than 1 ha will be cleared as a result of the project. This is considered by DotE to be significant as it may adversely affect habitat critical to the survival of the species. Remnant vegetation in the adjoining Hartfield Park Bushland is likely to provide suitable foraging area. The clearing of native vegetation may be at variance with this Principle. The clearing of native vegetation may be at variance with this Principle.	May be at variance

Clearing Principle	Rationale	Likelihood of Variance
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora	Desktop searches of the DPaW Threatened and Priority Flora Databases and the *Environment Protection and Biodiversity Conservation Act, 1999* Protected Matters Search Tool for the Project Area identified 21 species listed under the EPBC Act and 21 species listed under the WC Act to occur within close proximity of the Project Area. There are two known DPaW records of *Conospermum undulatum,* listed as Vulnerable under both the EPBC and the WC Act occurring within the interchange area. An additional five individuals were recorded during the field assessment. The clearing of native vegetation within the Project Area is at variance with this Principle.	At variance
d) Native vegetation should not be cleared if it comprises whole or a part of, or is necessary for the maintenance of a Threatened Ecological Community	Database searches identified two Commonwealth listed and four State listed Threatened Ecological Communities to occur within 5km of the Project Area. These are: - Commonwealth Critically Endangered and WA Endangered TEC - SCP10a - Shrublands on dry clay flats - Commonwealth Endangered and WA Critically Endangered TEC - SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain - WA Critically Endangered TEC - SCP3b *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain - WA Endangered TEC - SCP20a - *Banksia attenuata* woodland over species rich dense scrublands. Statistic analysis of vegetation communities described by AECOM against the Gibson *et al.*(1994) dataset determined that two vegetation communities are considered to be equivalent to State listed TEC SCP 20a. Clearing of native vegetation is at variance with this principle.	At variance

Clearing Principle	Rationale	Likelihood of Variance
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	The *National Objectives and Targets for Biodiversity Conservation 2001 – 2005* (Commonwealth of Australia, 2001) recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biodiversity is to be protected. This level is in keeping with the *EPA Position Statement No 2 on Environmental Protection of Native Vegetation in Western Australia* (EPA, 2000). The objective is also to protect at least 30% of the original extent of each vegetation complex in unconstrained areas and 10% in constrained areas (i.e. Urban Zoned regions). Vegetation complexes within the Interchange Area, as defined by Heddle *et al.* (1980), are based on vegetation in association with landforms and underlying geology. The majority of native vegetation occurring within the Interchange Area forms part of the Southern River Complex and a small southern portion forms part of the Guildford Complex. The remaining extent of the Southern River Complex exceeds the minimum 10% target for the retention of vegetation complexes in constrained areas on the Swan Coastal Plain (EPA, 2000). Criteria outlined in Position Statement 2 indicate that vegetation is considered to be endangered if less than 10% of pre European extents remain. Based on this, the Guildford Complex is therefore considered to be Endangered, with only 5.9% of the original extent remaining. Two vegetation communities (CEPW and AMS) lie within the Guilford Complex at the Interchange Area. Both communities consist of highly degraded vegetation within existing road reserve devoid of native understorey species. It is therefore considered that these vegetation communities are not representative of remnant vegetation of the Guildford Complex. The clearing of native vegetation not likely to be at variance with this Principle	Not likely to be at variance
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	Nine Geomorphic Wetlands traverse the Project Area, comprising five Conservation Category Wetlands (CCW), three Multiple Use Wetlands and one Resource Enhancement Wetland. CCWs are relatively undisturbed wetlands that retain high ecological values. Four CCW Wetlands were assessed at this interchange. The results showed two of these wetlands automatically triggered Conservation category classification due to the presence of potential breeding/foraging habitat for Threatened Black Cockatoos. The other two wetlands were considered suited to Rehabilitation potential – Geomorphology. Clearing of native vegetation in association with several wetlands will occur. The clearing of native vegetation is likely to be at variance with this Principle.	Likely to be at variance

Clearing Principle	Rationale	Likelihood of Variance
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	The Project Area is located within the Perth Metropolitan Area and occurs directly adjacent to remnant vegetation and residential development. The Project Area occurs along a major transport route and as a result has previously been subject to disturbance. With the current proportion of remnant vegetation remaining directly adjacent to the Project Area, the proportion of vegetation required to be cleared for project works is not considered likely to cause appreciable land degradation. Drainage structures will be designed to limit erosion. The clearing of native vegetation within the Project Area is unlikely to result in appreciable land degradation. The SLIP database indicates that the Project Area has a Moderate to Low risk of Acid Sulfate Soil occurrence. Sulfides react with oxygen to form sulphuric acid which could potentially kill vegetation, leach into groundwater or kill aquatic organisms. The potential for ASS within the Project Area may lead to a decline in environmental values. Construction work and excavation within the Project Area is considered unlikely to cause any impacts associated with ASS. It is not anticipated that ASS will cause appreciable land degradation. The clearing of native vegetation is not likely to be at variance with this Principle.	Not likely to be at variance
h) Native vegetation should not be cleared if it is likely to have an impact on the environmental values of any adjacent or nearby conservation area	Bush Forever identifies areas for protection of regionally significant bushland and associated wetlands (GOW, 2000a & 2000b) and focuses on the Swan Coastal Plain portion of the Perth Metropolitan region. Listings of Bush Forever sites take into consideration regional attributes, land forms, soils, vegetation, wetlands and threatened ecological communities (Shire of Kalamunda, 2014). The proposed Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area traverses two Bush Forever sites. The Greater Brixton Street Wetland (Bush Forever Site 387), which encompasses 126.7ha of bushland has been previously reported to contain Floristic Community Type SCP 10a- *Shrublands on dry clay flats* (Gibson *et. al,* 1994), a Commonwealth listed Critically Endangered TEC and a State listed Endangered TEC. This bushland is part of a regionally significant fragmented bushland and wetland linkage. Hartfield Park Bushland (Bush Forever Site 320) encompasses 73.6ha of Bushland. It has been previously reported to contain Floristic Community Type SCP20a - *Banksia attenuata* woodland over species rich dense scrublands (Gibson *et. al,* 1994), a State listed Endangered TEC. This bushland is part of a regionally significant fragmented bushland and wetland linkage The clearing of native vegetation is likely to be at variance with this Principle.	Likely to be at variance

Clearing Principle	Rationale	Likelihood of Variance
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or ground water	Clearing has the potential to impact on the quality of surface water or groundwater where vegetation associated with surface water features (i.e. riparian and wetland vegetation) or groundwater (wetland and groundwater dependent vegetation) is cleared. The Project Area does not fall within a Public Drinking Water Supply Catchment. The clearing of native vegetation is not likely to be at variance with this Principle.	Not Likely to be at variance
j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause or exacerbate the incidence or intensity of flooding	Given that the majority of the Project Area will be utilised for road infrastructure, it is considered unlikely that the clearing of vegetation for the proposed Project will cause or exacerbate the incidence and intensity of flooding, if suitable drainage is incorporated into the road design. The clearing of native vegetation is not likely to be at variance with the Principle.	Not likely to be at variance

7.2 Tonkin Highway/Kelvin Road Interchange

A clearing assessment for the clearing of native vegetation at the Tonkin Highway/Kelvin Road interchange is summarised in Table 19. The clearing within this interchange is considered to be **at variance** with four principles, **likely to be at variance** with two principles, **may be at variance** with one principle and **not likely to be at variance** with three principles.

Table 19 Assessment against Ten Clearing Principles – Tonkin Highway/Kelvin Road Interchange

Clearing Principle	Rationale	Likelihood of Variance
a) Native vegetation should not be cleared if it comprises a high level of biological diversity	EPBC Protected Matters and DPaW database searches identified a total of 60 Threatened or Priority Flora species were identified to potentially occur within the Study Area. This comprised of 21 species listed under the EPBC Act, 21 species listed under the WC Act, five Priority 1, six Priority 2, 19 Priority 3 and nine Priority 4 species. One of these species, *Conospermum undulatum* listed as Vulnerable under both the EPBC and the WC Act has been previously recorded at two locations within the Project Area, near or within Clifford Street Bushland (Bush Forever Site 53). The field assessment identified the presence of 244 individual *Conospermum undulatum* (Vulnerable) plants within the proposed Tonkin Highway/Kelvin Road interchange area. An additional 45 plants were record outside the boundary of the interchange area however still within Clifford Street Bushland. Vegetation communities supporting this species within the interchange area are considered to be regionally significant. The Project Area traverses one Bush Forever Site; the Clifford Street Bushland (Bush Forever Site 53). This site is known to contain Threatened and Priority Flora and Commonwealth and State listed TECs. Vegetation within the Project Area broadly consists of *Eucalyptus* and/or *Banksia* Woodland, Corymbia over Adenanthos and or Allocasuarina Shrubland and Tall Melaleuca Shrublands in wetland depressions. Excluding Bush Forever Site 53, which is considered to be of Very Good Condition, the interchange area consisted of degraded remnant vegetation devoid of native understorey species with high proportion of weeds. The clearing of native vegetation is at variance with this Principle, due to the known presence of Threatened flora.	At variance

Clearing Principle	Rationale	Likelihood of Variance
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	A total of 27 Threatened, Terrestrial Migratory and Priority fauna species were identified through EPBC Protected Matters search and DPaW database searches to potentially occur within the Project Area (Appendix b). Of these species, seven are considered likely to occur, three birds may overfly the area and 17 are considered unlikely to occur. The species considered likely to occur are listed below: - Forest Red-tailed Cockatoo - *Calyptorhynchus banksii* subsp. *naso* (Vulnerable (EPBC Act) & Schedule 1 (WC Act)) - Baudin's Cockatoo - *Calyptorhynchus baudinii* (Vulnerable (EPBC Act) & Schedule 1 (WC Act)) - Carnaby's Cockatoo - *Calyptorhynchus latirostris* (Endangered (EPBC Act) & Schedule 1 (WC Act)) (Confirmed) - Rainbow Bee-eater - *Merops ornatus* (Migratory (EPBC Act) & Schedule 3 (WC Act)) - Eastern Great Egret - *Ardea modesta* (Migratory (EPBC Ac)t & Schedule 3 (WC Act)) - Cattle Egret - *Ardea ibis* (Migratory (EPBC Act) & Schedule 3 (WC Act)) - Southern Brown Bandicoot or Quenda - *Ardea modesta* (Migratory (EPBC Ac)t & Schedule 3 (WC Act)) Numerous trees with the potential to form suitable hollows (>500mm DBH) were observed on the western side of Tonkin Highway, which may provide suitable nesting habitat for the three Black Cockatoo species. The majority of the Project Area is considered to also contain suitable foraging habitat for Black Cockatoos and suitable fauna habitat for Rainbow Bee eater and Quenda. The Project Area contains two vegetation types that would be likely to support Black Cockatoos. Jarrah and Marri Woodland over introduced grass and *Eucalyptus* woodlands over *Allocasuarina* and *Melaleuca* shrublands would provide suitable cockatoo nesting and foraging habitat. Black Cockatoos were observed flying over the Project Area during the site inspection. Cockatoo foraging habitat of greater than 1 ha will be cleared as a result of the project. This is considered to be significant as it may adversely affect habitat critical to the survival of the species. Quenda are likely to use some areas within the Project Area, and have been previously recorded within Clifford Street Bushland (GoW, 2000b). Quenda utilise a variety of habitat types including forests, woodlands, heaths and shrub communities. Preferred habitats usually consist of a combination of sandy soils and dense healthy vegetation (Van Dyck & Strahan, 2008). This species is known to occur within degraded road reserves. The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil. It is possible that this species will occupy open woodland areas within the Project Area. This species is not restricted for nesting habitat in the Perth region, as they build nesting tunnels in sandy slopes in a variety of areas, including disturbed sites. The clearing of native vegetation may be at variance with this Principle.	May be at variance

Clearing Principle	Rationale	Likelihood of Variance
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora	Desktop searches of the DPaW Threatened and Priority Flora Databases and the *Environment Protection and Biodiversity Conservation Act, 1999* Protected Matters Search Tool for the Project Area identified 21 species listed under the EPBC Act and 21 species listed under the WC Act to occur within close proximity of the Project Area. *Conospermum undulatum* listed as Vulnerable under both the EPBC and the WC Act occurs at two locations within the Project Area. The field assessment identified the presence of 244 individual *Conospermum undulatum* (Vulnerable) plants within the proposed Tonkin Highway/Kelvin Road interchange area. An additional 45 plants were recorded outside the boundary of the interchange area, however still within Clifford Street Bushland. Vegetation communities supporting this species within the interchange area are considered to be regionally significant. The clearing of native vegetation within the Project Area is at variance with this Principle.	At variance
d) Native vegetation should not be cleared if it comprises whole or a part of, or is necessary for the maintenance of a Threatened Ecological Community	Database searches identified two Commonwealth listed and three State listed Threatened Ecological Communities to occur within 5km of the proposed Tonkin Highway/Kelvin Road interchange area. These are: - Commonwealth Endangered and WA Critically Endangered TEC - SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain. - WA Critically Endangered TEC - SCP3b *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain. - WA Endangered TEC - SCP20a - *Banksia attenuata* woodland over species rich dense scrublands. Statistical analysis of vegetation communities described by AECOM against the Gibson *et al*. (1994) dataset determined that two vegetation communities are considered to be equivalent to State listed TEC SCP 20a. Clearing of native vegetation is at variance with this principle.	At variance

Clearing Principle	Rationale	Likelihood of Variance
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	The *National Objectives and Targets for Biodiversity Conservation 2001 – 2005* (Commonwealth of Australia, 2001) recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biodiversity is to be protected. This level is in keeping with the *EPA Position Statement No 2 on Environmental Protection of Native Vegetation in Western Australia* (EPA, 2000). The objective is also to protect at least 30% of the original extent of each vegetation complex in unconstrained areas and 10% in constrained areas (i.e. Urban Zoned regions). Vegetation complexes within the proposed Tonkin Highway/Kelvin Road interchange area, as defined by Heddle *et al.* (1980), are based on vegetation in association with landforms and underlying geology. Native vegetation within the Project Area is comprised of the Guildford Complex and the Forrestfield Complex (Heddle *et al.*, 1980). There is currently 11.9% of the Forrestfield complex remaining on the Swan Coastal Plain. The remaining extent of the Forrestfield Complex only just exceeds the minimum threshold level of 10% target for the retention of vegetation complexes in constrained areas on the Swan Coastal Plain (EPA, 2000). The Guildford Complex only has 5.9% of the original extent remaining on the Swan Coastal Plain. Based on criteria outline in Position Statement 2 vegetation is considered to be endangered if less than 10% of pre European extents remain. The Guildford Complex is therefore considered to be Endangered with only 5.9% of the original extent remaining. The majority of the Tonkin Highway/Kelvin Road interchange area within the Guildford Complex contains good quality remnant vegetation which would be comparable to this complex. The clearing of native vegetation is at variance with this Principle.	At variance

Clearing Principle	Rationale	Likelihood of Variance
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	The Project Area traverses three Geomorphic Wetlands, UFI 15115, 15116 and 15768. This consists of one Conservation Category Wetland (CCW) and two Multiple Use Wetlands. The wetland assessment showed that one of the Multiple Use Wetlands (UFI 15116) reflects the attributes, functions and values of a Conservation management category wetland. The presence of TECs, Threatened flora (*Conospermum undulatum*), and habitat for Threatened and Migratory species (Rainbow Bee-eater and Black Cockatoo) have supported this assessment. CCW's are relatively undisturbed wetlands that retain high ecological values. Approximately 20% of the wetlands remaining in the Swan Coastal Plain are considered to be CCW (DPaW, 2014b). The disturbance of a CCW through construction activities has the potential to further degrade the wetland and damage habitat vital to flora and fauna species. Multiple Use Wetlands are considered to have few attributes which still provide important wetland functions (WAPC, 2005). In the case of multiple use wetlands, reasonable measures are to be taken to retain the wetlands hydrological function and where possible other wetland functions (EPA, 2008). Clearing of native vegetation in association with all three wetlands will occur. The clearing of native vegetation is likely to be at variance with this Principle.	Likely to be at variance
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	The Project Area is located within the Perth Metropolitan Area and occurs adjacent to conservation reserve and industrial area. Land directly adjacent to the Project Area is largely comprised of cleared paddocks with isolated pockets of remnant vegetation. Approximately 3.7ha (47.8%) of the Clifford Street Bushland occurs within the Project Area. The proportion of Bush Forever vegetation that is required to be cleared as a result of project work may cause appreciable land by altering hydrological regimes within the CCW. The SLIP database indicates that the Project Area has a Moderate to Low risk of Acid Sulfate Soil occurrence. Sulfides react with oxygen to form sulphuric acid which could potentially kill vegetation, leach into groundwater or kill aquatic organisms. The potential for ASS within the Project Area may lead to a decline in environmental values. Construction work and excavation within the Project Area is considered unlikely to cause any impacts associated with ASS. It is not anticipated that ASS will cause appreciable land degradation. The clearing of native vegetation is not likely to be at variance with this Principle.	Not likely to be at variance

Clearing Principle	Rationale	Likelihood of Variance
h) Native vegetation should not be cleared if it is likely to have an impact on the environmental values of any adjacent or nearby conservation area	Bush Forever identifies areas for protection of regionally significant bushland and associated wetlands (GOW, 2000a & 2000b) and focuses on the Swan Coastal Plain portion of the Perth Metropolitan region. Listings of Bush Forever sites take into consideration regional attributes, land forms, soils, vegetation, wetlands and threatened ecological communities (Shire of Kalamunda, 2014). The Project Area traverses one Bush Forever site. The Clifford Street Bushland (Bush Forever Site 53) encompasses 7.74ha of bushland of which 3.7ha (47.8%) lies within the Project Area. This site is known to contain three TECs. It also contains a population of over 300 *Conospermum undulatum*, of which 45 occur outside of the interchange area. The clearing of native vegetation is likely to be at variance with this Principle.	Likely to be at variance
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or ground water	Clearing has the potential to impact on the quality of surface water or groundwater where vegetation associated with surface water features (i.e. riparian and wetland vegetation) or groundwater (wetland and groundwater dependent vegetation) is cleared. The Project Area does not fall within a Public Drinking Water Supply Catchment. The clearing of native vegetation is not likely to be at variance with this Principle.	Not Likely to be at variance
j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause or exacerbate the incidence or intensity of flooding	Given that the majority of the Project Area will be utilised for road infrastructure, it is considered unlikely that the clearing of vegetation for the proposed Project will cause or exacerbate the incidence and intensity of flooding, if suitable drainage is incorporated into the road design. The clearing of native vegetation is not likely to be at variance with the Principle.	Not likely to be at variance

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8.0 Conclusions and Recommendations

8.1 Conclusions

The significance of any potential impacts as a result of the project will directly correlate with the amount of vegetation that will be required to be cleared. A considerable majority of the Project Area is considered to be 'Completely Degraded' (52.29%) or 'Degraded' (36.60%), primarily due to previous clearing for existing infrastructure and the presence of weeds. There is one section of 'Very Good' vegetation located in the western quadrant of the Tonkin Highway/Kelvin Road interchange which possesses high environmental values.

One Threatened Flora and two Priority Flora species have been previously recorded within the Project Area. Five individuals of *Conospermum undulatum* (Threatened - Vulnerable) were recorded by AECOM within one of the patches of good condition vegetation within the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. The AECOM survey also recorded 244 individuals of *Conospermum undulatum* and three individuals of *Isopogon drummondii (*Priority 3) within the Tonkin Highway/Kelvin Road interchange. Most of these records corresponded with the section of 'Very Good' quality vegetation within this interchange. *Verticordia lindleyi* subsp. *lindleyi* (Priority 4) was not recorded by AECOM during the field assessment despite it having previously been recorded within the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area.

Three of the introduced flora species recorded within the Project Area are categorised as Declared Pests in accordance with section 22 of the *Biosecurity and Agriculture Management Act 2007*. Of these, two are also listed as Weeds of National Significance.

A total of 21 vegetation communities were described within the Project Area. Of these, three communities (BAAS, EBWES and AHES) are considered to be equivalent to the SCP 20a State listed Endangered Threatened Ecological Community. The vegetation community BAAS occurs within the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. Community AHES occurs within the Tonkin Highway/Kelvin Road interchange area. Community EBWES occurs in both.

Three conservation significant fauna species were recorded during the field survey, the Forest Red-tailed Black Cockatoo (Vulnerable EPBC Act and Schedule 1 WC Act), Rainbow Bee-eater (Migratory EPBC Act and Schedule 1 WC Act) and the Quenda (Priority 5 DPaW).

A total of 42 potential breeding habitat trees and 7.15 ha of suitable foraging habitat for black cockatoos, as classified by the Australian Government (2012), were recorded within the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. A further 23 potential breeding habitat trees and 7.56 ha of suitable foraging habitat were recorded within the Tonkin Highway/Kelvin Road interchange area. No signs of nesting or breeding were observed within the Project Area.

Ten fauna habitats were delineated within the Project Area. Of these, five provide foraging habitat potential for Threatened black cockatoos, comprising 7.56 ha in the Tonkin Highway/Kelvin Road interchange and 7.15 ha in the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. Four of the fauna habitat types also provide suitable habitat for the Quenda.

Twelve Geomorphic Wetlands traverse the Project Area including six Conservation Category Wetlands. Three wetlands occur at the Tonkin Highway/Kelvin Road interchange area, whilst the remaining nine occur at the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area. One wetland currently mapped as a Multiple Use Wetland had seven triggers in the Preliminary Evaluation that considered it as a Conservation management category wetland. This should be taken into account during impact assessments.

8.2 Recommendations

8.2.1 Management

Based on the above conclusions, the following impact minimisation and management measures are recommended:

- Design infrastructure to avoid direct impacts on Threatened or Priority Flora populations and habitat for Threatened species were possible.
- Liaise with DPaW with regards to disturbance of Commonwealth and State listed TECs.
- Develop a Wetland and Vegetation Management Plan that addresses the management of:
    - flora and vegetation
    - dieback and weeds
    - groundwater licencing
    - noise and vibration
    - dust
    - hazardous materials and emergency response.
- Develop and implement a Site Hygiene Plan for dieback and weeds, with particular reference to management of the following weeds:
    - **Asparagus asparagoides*
    - **Echium plantagineum*
    - **Opuntia stricta.*
- Develop a fauna management plan to mitigate impacts on native fauna and prevent the introduction of feral species to the Project Area.

8.2.2 Relevant Approvals

This section provides a summary of environmental and heritage approvals that are considered likely to be required based on the outcomes of the ecological factors for each of the proposed interchange upgrades.

8.2.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

Referral pursuant to the EPBC Act is likely to be required for both of the proposed interchange area upgrades. An action that will have or is likely to have a significant impact on a matter of National Environmental Significance must be referred to the Commonwealth Minister for the Environment for a decision on whether assessment is required pursuant to the EPBC Act.

Clearing at both proposed interchanges has the potential to have a significant impact upon the three black cockatoo species as it may adversely affect habitat critical to the survival of the species when considered pursuant to the Commonwealth of Australia (2012) *EPBC Act referral guidelines for three threatened black cockatoo species*. Additionally, construction of both interchange upgrades has the potential to significantly impact *Conospermum undulatum,* particularly in the case of the Tonkin Highway/Kelvin Road interchange where 244 individuals of the species were recorded.

Once detailed design has been finalised, it is recommended that the potential impacts of each of the proposed intersection upgrades be considered with reference to the Department of the Environment *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013b) and the black cockatoo referral guidelines (Commonwealth of Australia, 2012) to determine whether referral under the EPBC Act is required.

8.2.2.2 *Environmental Protection Act 1986*

Given the extent of potential ecological impacts identified within this report, it is considered to be likely that referral under the EP Act will be required for upgrading of both of the interchange areas.

Section 38 (Part IV) of the EP Act provides that any person may refer a significant proposal (one that is likely to have a significant effect on the environment) to the Environmental Protection Authority (EPA). The EP Act also states that where the environmental impact of a proposal can be adequately assessed and managed through other legislative mechanisms the proposal is unlikely to require formal environmental impact assessment.

The proposed upgrade of the Tonkin Highway/Hale Road interchange to Tonkin Highway/Welshpool Road East interchange area has the potential to have an environmental impact associated with:

- Direct clearing of Hartfield Park Bushland (Bush Forever Site 320) and Greater Brixton Street Wetlands (Bush Forever Site 387)
- Direct clearing of Conservation Category Wetland
- Direct clearing of under-represented vegetation communities
- Direct clearing of *Conospermum undulatum* (Threatened – Vulnerable)
- Direct clearing of Black cockatoo potential breeding and foraging habitat
- Noise

The proposed upgrade of the Tonkin Highway/Kelvin Road interchange has the potential to have an environmental impact associated with:

- Direct clearing of Clifford Street Bushland (Bush Forever Site 53)
- Direct clearing of Conservation Category Wetland
- Direct clearing of under-represented vegetation communities
- Direct clearing of *Conospermum undulatum (*Threatened - Vulnerable*)* and *Isopogon drummondii* (Priority 3)
- Direct clearing of Black cockatoo potential breeding and foraging habitat
- Noise.

Once detailed design has been finalised, it is recommended that the potential impacts of each of the proposed intersection upgrades be considered against the *Environmental Impact Assessment Administrative Procedures 2010* to determine whether referral under the EP Act is required.

8.2.2.3 Part V EP Act Native Vegetation Clearing Permit

If either of the proposals are not formally assessed by the EPA under Part IV of the EP Act, a Part V Native Vegetation Clearing Permit will be required for both proposed upgrades.

Main Roads Purpose Permit (CPS 818/11) may be used to conduct the clearing, subject to the conditions of the permit. Additional stakeholder consultation is required under CPS 818/11, and as the clearing at both interchange areas is at variance with at least three of the clearing principles, the following will be required:

- Preliminary Clearing Impact Assessment (PCIA) or a Clearing Impact Assessment (CIA)
- Vegetation Management Plan (VMP)
- Rehabilitation Plan
- Offset Plan.

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Appendix A

Threatened and Priority Flora Conservation Categories

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Appendix A – Conservation Categories

1.0 Threatened and Priority Flora and Fauna

1.1 Western Australia

Plants and animals that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Wildlife Conservation Act* (WC Act). These categories are defined in Table 1. Any species identified as Threatened under the WC Act is assigned a threat category using the International Union for Conservation of Nature (IUCN) Red List categories and criteria.

Species that have not yet been adequately surveyed to warrant being listed under Schedule 1 or 2 are added to the Priority Flora or Fauna Lists under Priority 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4 and require regular monitoring. Conservation Dependent species and ecological communities are placed in Priority 5. Categories and definitions of Priority Flora and Fauna species are provided in Table 2.

Table 1 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950*

Conservation Code	Category
T	Threatened species – specially protected under the WC Act, listed under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). Species* which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. Threatened Fauna and Flora are further recognised by the Department according to their level of threat using IUCN Red List criteria. Critically Endangered: considered to be facing an extremely high risk of extinction in the wild. Endangered: considered to be facing a very high risk of extinction in the wild. Vulnerable: considered to be facing a high risk of extinction in the wild.
X	Presumed extinct species – specially protected under the WC Act, listed under Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora (which may also be referred to as Declared Rare Flora). Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
IA	Migratory birds protected under international agreement – specially protected under the WC Act, listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice. Birds that are subject to an agreement between governments of Australia and Japan, China and The Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
S	Other specially protected fauna – specially protected under the WC Act, listed under Schedule 4 of the Wildlife Conservation Policy (Specially Protected Fauna) Notice.

Table 2 Conservation codes for WA flora and fauna (DPaW 2014)

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

1.2 Commonwealth

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Australia's central piece of environmental legislation which provides for the listing of nationally Threatened native species and ecological communities, native migratory species and marine species.

Threatened fauna and flora may be listed in any one of seven categories as defined in Section 179 of the EPBC Act. These categories are defined in Table 3.

Table 3 Categories of Species Listed under Schedule 179 of the EPBC Act 1999 [Commonwealth]

Conservation	Code Category
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time: a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered b) the following subparagraphs are satisfied: i. the species is a species of fish ii. the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised iii. the plan of management is in force under a law of the Commonwealth or of a State or Territory iv. cessation of the plan of management would adversely affect the conservation status of the species.

2.0 Threatened and Priority Ecological Communities

2.1 Western Australia

State listed TECs are not protected under any legislation, rather they are endorsed by the Environment Minister. Categories of TECs are defined in Table 4. Priority Ecological Communities are endorsed by the Environment Minister as having insufficient information available to be considered a TEC, or which are rare but not currently threatened. Categories are described in Table 5.

Table 4 Conservation codes for state-listed Threatened Ecological Communities

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

Conservation Code	Category
	of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C). A) The geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 20 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 20 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 20 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 20 years).
VU	Vulnerable An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatened processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the4 basis of the best available information by it meeting any one or more of the following criteria (A, B, or C). A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium or long term future because of existing or impending threatening processes.

Table 5 Categories for Priority Ecological Communities

Conservation Code	Category
P1	Priority One: poorly-known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: poorly-known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: poorly known ecological communities i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation ii. communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat iii. communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

2.2 Commonwealth

Communities can be classified as TECs under the *Environment Protection and Biodiversity Conservation Act 1999*. The EPBC act protects Australia's ecological communities by providing for:

- Identification and listing of ecological communities as threatened
- Development of conservation advice and recovery plans for listed ecological communities
- Recognition of key threatening processes
- Where appropriate, reducing the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 6.

Table 6 Categories of TECs that are listed under the EPBC Act

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

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Appendix B

Flora Species by Community Matrix, Tonkin Highway Project, October 2014

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APPENDIX B - FLORA SPECIES BY COMMUNITY MATRIX, TONKIN HIGHWAY, OCTOBER 2014

NB: *Denotes introduced weed species; #Denotes planted species

		Site																				
		1	4	6	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28/29	31	32	33	5
FAMILY	Species	CWAAS	BAAS	PVS	CEW	CEPW	CWCS	LS	EW	EBWES	MS1	VHS	AHES	MTS	AMS	EWMS	ABHS	CEW	ATS	AEBS	ErWMS	CWMHS	MS2
ANACARDIACEAE	* *Schinus terebinthifolius*							+										+					
ANARTHRIACEAE	*Lyginia barbata*		+																				
	Lyginia imberbis			+																			
APIACEAE	* *Daucus carota*				+																		
ASPARAGACEAE	* *Asparagus asparagoides*																				3		
	Lomandra preissii	+																					
ASTERACEAE	* *Arctotheca calendula*				+																	<1	
	* *Hypochaeris glabra*				+							+											
	* *Ursinia anthemoides*		+	+					10	<1		+	+				<1		10	1		5	
BIGNONIACEAE	* *Jacaranda mimosifolia*						+																
BORAGINACEAE	* *Echium plantagineum*													+				+					
CACTACEAE	* *Opuntia stricta*								+														
CASUARINACEAE	*Allocasuarina ?fraseriana*																						
	Allocasuarina fraseriana					+	+				+				100	+							
	Allocasuarina humilis	+								10			+										
	Allocasuarina sp.		+																				
	Allocasuarina ?campestris				+					5			+										
COLCHICACEAE	*Burchardia congesta*		+							<1			+						+				
CUPRESSACEAE	*Callitris pyramidalis*				+												+					30	
CYPERACEAE	*Cyperaceae* sp.									2			+										
	Lepidosperma ?squamatum		+																				
	Lepidosperma sp.																		5	10			
	Lepidosperma tenue									1			+										
	Mesomelaena pseudostygia		+				+			+			+										
	Mesomelaena tetragona									+		10	+										
	Tetraria capillaris									2			+										
DASYPOGONACEAE	*Dasypogon bromeliifolius*	+	+							+	+		+				1			3			
DILLENIACEAE	*Hibbertia hypericoides*		+							9			+										
DROSERACEAE	*Drosera macrantha*		+							<1			+										
	Drosera zonaria																						
ERICACEAE	*Astroloma xerophyllum*		+																				
	Lysinema elegans									1			+										
EUPHORBIACEAE	* *Euphorbia terracina*	+																			+		
	Ricinocarpos sp.				+																		
	* *Ricinus communis*				+																		
	Stachystemon vermicularis		+																				
FABACEAE	# *Acacia iteaphylla*				+	+	+																
	Acacia pulchella	+	+							+		30	+			+						+	
	Acacia saligna				+																	+	
	Bossiaea eriocarpa	+																					
	* *Chamaecytisus palmensis*				+													+					
	Daviesia ?decurrens		+							1		+	+										

APPENDIX B - FLORA SPECIES BY COMMUNITY MATRIX, TONKIN HIGHWAY, OCTOBER 2014

NB: *Denotes introduced weed species; #Denotes planted species

		Site																				
		1	4	6	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28/29	31	32	33	5
FAMILY	**Species**	**CWAAS**	**BAAS**	**PVS**	**CEW**	**CEPW**	**CWCS**	**LS**	**EW**	**EBWES**	**MS1**	**VHS**	**AHES**	**MTS**	**AMS**	**EWMS**	**ABHS**	**CEW**	**ATS**	**AEBS**	**ErWMS**	**CWMHS**	**MS2**
	Daviesia hakeoides									+			+										
	Daviesia nudiflora subsp. *nudiflora*		+																				
FABACEAE	* *Erythrina variegata*																	+					
(continued)	*Gompholobium confertum*									+			+							1			
	Gompholobium tomentosum		+																1				
	Hardenbergia ?comptoniana	+																			<1		
	Isotropis cuneifolia subsp. *cuneifolia*		+																				
	Jacksonia floribunda		+							1			+							<1			+
	Jacksonia sternbergiana															5							
	Kennedia coccinea		+																				
	* *Lupinus cosentinii*				+		+		+								<1						
	Sphaerolobium medium		+																				
	Sphaerolobium sp.															+							
	* *Trifolium dubium*				+			+							+								
	Viminaria juncea											20											
GERANIACEAE	* *Pelargonium capitatum*		+																+				
GOODENIACEAE	*Dampiera linearis*		+							<1			+										
	Scaevola canescens		+																				
HAEMODORACEAE	*Anigozanthos manglesii* subsp. *manglesii*		+																				
	Anigozanthos rufus																		+				
	Conostylis aculeata subsp. *aculeata*		+																	2			
	Conostylis aurea									<1			+							1			
HEMEROCALLIDACEAE	*?Tricoryne elatior*									<1			+						1				
	Agrostocrinum scabrum			+																			
	Caesia micrantha									<1			+										
IRIDACEAE	* *Gladiolus caryophyllaceus*	+	+	+						<1			+									+	
	Patersonia occidentalis		+							1			+						+				
	* *Watsonia meriana* var. *meriana*	+								+	+		+	+		100	1	+				+	+
LAMIACEAE	*Hemiandra pungens*		+							1			+										
	Hemiphora bartlingii		+																				
LORANTHACEAE	*Nuytsia floribunda*			+																			
MORACEAE	* *Morus nigra*								+														
MYRTACEAE	*Babingtonia camphorosmae*											+											
	Beaufortia elegans																40		+	25			
	Callistemon phoeniceus				+	+	+																+
	Calothamnus ?sanguineus						+																
	Calothamnus sanguineus				+	+																	+
	Calytrix leschenaultii									+			+										
	Chamelaucium uncinatum				+	+	+				+												
	Corymbia calophylla	+	+		+	+	+			+			+			20		+					
	# *Corymbia citriodora*					+																	
	# *Corymbia eximia*					+																	
	# *Corymbia ?eximia*					+																	
	# *Corymbia ficifolia*					+																	
	Eremaea pauciflora subsp. *pauciflora*									8			+						1	25			
	Eucalyptus marginata	+			+	+										20		+					+
	# *Eucalytpus robusta*					+																	
	Eucalyptus rudis													+		20		+			20		
	# *Eucalyptus sideroxylon*					+																	
	Eucalyptus sp.																						+

APPENDIX B - FLORA SPECIES BY COMMUNITY MATRIX, TONKIN HIGHWAY, OCTOBER 2014

NB: *Denotes introduced weed species; #Denotes planted species

		Site																				
		1	4	6	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28/29	31	32	33	5
FAMILY	**Species**	**CWAAS**	**BAAS**	**PVS**	**CEW**	**CEPW**	**CWCS**	**LS**	**EW**	**EBWES**	**MS1**	**VHS**	**AHES**	**MTS**	**AMS**	**EWMS**	**ABHS**	**CEW**	**ATS**	**AEBS**	**ErWMS**	**CWMHS**	**MS2**
	Eucalyptus todtiana								5	5													
	Hypocalymma angustifolium																11		+	1		10	
	* *Leptospermum laevigatum*				+	+	+	60	5	1	+		+			+	+						+
	Melaleuca ?parviceps									1			+										
	# *Melaleuca* aff. *nesophila*						+				+												
	Melaleuca huegelii					+	+																
	Melaleuca lanceolata													+									
MYRTACEAE	*Melaleuca preissiana*													10	10								
(continued)	*Melaleuca rhaphiophylla*								1					80		5					20		
	Melaleuca sp.	+																		5	20		
	Melaleuca viminea						+															10	
	Pericalymma ellipticum		+	+																			
	Regelia ciliata		+																				
	Verticordia sp.			+																			+
OXALIDACEAE	* *Oxalis pes-caprae*	+			+		+																
PAPAVERACEAE	* *Fumaria capreolata*	+						+							+								
PINACEAE	* *Pinus pinaster*				+																		
POACEAE	*Amphipogon turbinatus*									2			+										
	* *Arundo donax*																	+					
	Austrostipa compressa																		10				
	* *Avena barbata*						+																
	* *Briza maxima*	+	+	+						<1			+						10				
	* *Bromus diandrus*								+														
	* *Cynodon dactylon*				+																10		
	* *Ehrharta calycina*		+				+		+						+				+		<1		
	* *Ehrharta longiflora*	+	+						+										+				
	* *Eragrostis curvula*	+			+			+														5	+
	* *Lagurus ovatus*				+			50											+				
	Poaceae sp.									<1			+										
PROTEACEAE	*Adenanthos cygnorum*	+	+		+		+			+	+		+				5		60	4	30		+
	Banksia attenuata		+		+		+			5													
	Banksia menziesii		+				+			5													
	Banksia nivea subsp. *nivea*		+									+					2		3	10			
	Banksia sessilis		+																				
	Banksia sp.																						+
	Conospermum undulatum (T)									<1			+							<1			
	Grevillea bipinnatifida subsp. *bipinnatifida*											+											
	Grevillea leucopteris																						+
	Grevillea preissii				+																		
	Hakea lissocarpha											20											
	Hakea sp.																+						
	Hakea varia															+							
	Isopogon drummondii (P3)									+													
	Petrophile linearis		+							1			+										
	Petrophile rigida									+			+										
	Stirlingia latifolia		+														<1		1	10		<1	
RESTIONACEAE	*Chaetanthus aristatus*																					30	
	Desmocladus fasciculatus		+							5			+										
	Desmocladus flexuosus		+																	<1			
	Hypolaena exsulca			+													1						
	Meeboldina cana																					5	
RHAMNACEAE	*Cryptandra ?pungens*									+			+										
	Spyridium ?globulosum				+																		
	Trymalium odoratissimum subsp. *odoratissimum*															5							

APPENDIX B - FLORA SPECIES BY COMMUNITY MATRIX, TONKIN HIGHWAY, OCTOBER 2014

NB: *Denotes introduced weed species; #Denotes planted species

		Site																				
		1	4	6	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28/29	31	32	33	5
FAMILY	Species	CWAAS	BAAS	PVS	CEW	CEPW	CWCS	LS	EW	EBWES	MS1	VHS	AHES	MTS	AMS	EWMS	ABHS	CEW	ATS	AEBS	ErWMS	CWMHS	MS2
RUTACEAE	*Philotheca spicata*									<1			+										
SALICACEAE	* *Salix babylonica*																	+					
THYMELAEACEAE	*Pimelea angustifolia*																			<1			
	Pimelea sulphurea									+			+										
XANTHORRHOEACEAE	*Xanthorrhoea preissii*	+	+							2	+	50	+				1		2				

Appendix C

Threatened and Priority Flora recorded within Tonkin Highway Project Area

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Appendix C Threatened and Priority Flora recorded within Tonkin Highway Project Area

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	404857	6459491		1	1	
Conospermum undulatum (T)	404962	6459430		1	1	
Conospermum undulatum (T)	404973	6459416	1		1	
Conospermum undulatum (T)	404980	6459417	1		1	
Conospermum undulatum (T)	404983	6459419	1		1	
Conospermum undulatum (T)	405064	6459336	1		1	
Conospermum undulatum (T)	405064	6459338	1		1	
Conospermum undulatum (T)	405884	6456112	1			1
Conospermum undulatum (T)	405893	6456114	1			1
Conospermum undulatum (T)	405910	6456011		1		1
Conospermum undulatum (T)	405965	6455854	1			1
Conospermum undulatum (T)	405987	6455838	1			1
Conospermum undulatum (T)	405988	6455811	1			1
Conospermum undulatum (T)	405994	6455822	1			1
Conospermum undulatum (T)	405995	6455800	1			1
Conospermum undulatum (T)	405995	6455822	1			1
Conospermum undulatum (T)	405995	6455822	1			1
Conospermum undulatum (T)	405998	6455856	1			1
Conospermum undulatum (T)	405999	6455832	1			1
Conospermum undulatum (T)	406000	6455767	1			1
Conospermum undulatum (T)	406000	6455820	1			1
Conospermum undulatum (T)	406000	6455857	1			1
Conospermum undulatum (T)	406001	6455776	1			1
Conospermum undulatum (T)	406001	6455820	1			1
Conospermum undulatum (T)	406002	6455819	1			1
Conospermum undulatum (T)	406002	6455820	1			1
Conospermum undulatum (T)	406002	6455842	1			1
Conospermum undulatum (T)	406004	6455787	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406004	6455821	1			1
Conospermum undulatum (T)	406005	6455789	1			1
Conospermum undulatum (T)	406005	6455820	1			1
Conospermum undulatum (T)	406005	6455820	1			1
Conospermum undulatum (T)	406005	6455820	1			1
Conospermum undulatum (T)	406006	6455820	1			1
Conospermum undulatum (T)	406007	6455816	1			1
Conospermum undulatum (T)	406008	6455776	1			1
Conospermum undulatum (T)	406009	6455775	1			1
Conospermum undulatum (T)	406012	6455776	1			1
Conospermum undulatum (T)	406012	6455785	1			1
Conospermum undulatum (T)	406012	6455796	1			1
Conospermum undulatum (T)	406012	6455797	1			1
Conospermum undulatum (T)	406013	6455783	1			1
Conospermum undulatum (T)	406013	6455798	1			1
Conospermum undulatum (T)	406013	6455799	1			1
Conospermum undulatum (T)	406013	6455844	1			1
Conospermum undulatum (T)	406014	6455777	1			1
Conospermum undulatum (T)	406014	6455785	1			1
Conospermum undulatum (T)	406014	6455843	1			1
Conospermum undulatum (T)	406014	6455873	1			1
Conospermum undulatum (T)	406015	6455815	1			1
Conospermum undulatum (T)	406015	6455837	1			1
Conospermum undulatum (T)	406016	6455835	1			1
Conospermum undulatum (T)	406016	6455873	1			1
Conospermum undulatum (T)	406017	6455779	1			1
Conospermum undulatum (T)	406017	6455782	1			1
Conospermum undulatum (T)	406017	6455785	1			1
Conospermum undulatum (T)	406017	6455830	1			1
Conospermum undulatum (T)	406018	6455782	1			1
Conospermum undulatum (T)	406018	6455785	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406018	6455845	1			1
Conospermum undulatum (T)	406018	6455848	1			1
Conospermum undulatum (T)	406019	6455785	1			1
Conospermum undulatum (T)	406019	6455800	1			1
Conospermum undulatum (T)	406019	6455857	1			1
Conospermum undulatum (T)	406020	6455742	1			1
Conospermum undulatum (T)	406020	6455742	1			1
Conospermum undulatum (T)	406020	6455836	1			1
Conospermum undulatum (T)	406022	6455800	1			1
Conospermum undulatum (T)	406022	6455800	1			1
Conospermum undulatum (T)	406022	6455829	1			1
Conospermum undulatum (T)	406022	6455835	1			1
Conospermum undulatum (T)	406023	6455802	1			1
Conospermum undulatum (T)	406023	6455803	1			1
Conospermum undulatum (T)	406024	6455836	1			1
Conospermum undulatum (T)	406025	6455804	1			1
Conospermum undulatum (T)	406026	6455917	1			1
Conospermum undulatum (T)	406027	6455805	1			1
Conospermum undulatum (T)	406028	6455769	1			1
Conospermum undulatum (T)	406028	6455777	1			1
Conospermum undulatum (T)	406029	6455842	1			1
Conospermum undulatum (T)	406029	6455845	1			1
Conospermum undulatum (T)	406030	6455785	1			1
Conospermum undulatum (T)	406030	6455806	1			1
Conospermum undulatum (T)	406030	6455806	1			1
Conospermum undulatum (T)	406030	6455841	1			1
Conospermum undulatum (T)	406030	6455842	1			1
Conospermum undulatum (T)	406030	6455847	1			1
Conospermum undulatum (T)	406030	6455847	1			1
Conospermum undulatum (T)	406031	6455742	1			1
Conospermum undulatum (T)	406031	6455839	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406032	6455770	1			1
Conospermum undulatum (T)	406032	6455778	1			1
Conospermum undulatum (T)	406032	6455841	1			1
Conospermum undulatum (T)	406032	6455842	1			1
Conospermum undulatum (T)	406033	6455768	1			1
Conospermum undulatum (T)	406033	6455779	1			1
Conospermum undulatum (T)	406033	6455807	1			1
Conospermum undulatum (T)	406033	6455831	1			1
Conospermum undulatum (T)	406034	6455842	1			1
Conospermum undulatum (T)	406034	6455843	1			1
Conospermum undulatum (T)	406034	6455847	1			1
Conospermum undulatum (T)	406036	6455777	1			1
Conospermum undulatum (T)	406036	6455809	1			1
Conospermum undulatum (T)	406036	6455831	1			1
Conospermum undulatum (T)	406036	6455848	1			1
Conospermum undulatum (T)	406037	6455776	1			1
Conospermum undulatum (T)	406037	6455866	1			1
Conospermum undulatum (T)	406039	6455811	1			1
Conospermum undulatum (T)	406039	6455846	1			1
Conospermum undulatum (T)	406040	6455769	1			1
Conospermum undulatum (T)	406041	6455767	1			1
Conospermum undulatum (T)	406041	6455770	1			1
Conospermum undulatum (T)	406041	6455772	1			1
Conospermum undulatum (T)	406042	6455770	1			1
Conospermum undulatum (T)	406042	6455773	1			1
Conospermum undulatum (T)	406042	6455811	1			1
Conospermum undulatum (T)	406042	6455850	1			1
Conospermum undulatum (T)	406043	6455838	1			1
Conospermum undulatum (T)	406043	6455838	1			1
Conospermum undulatum (T)	406043	6455870	1			1
Conospermum undulatum (T)	406045	6455792	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406046	6455788	1			1
Conospermum undulatum (T)	406047	6455800	1			1
Conospermum undulatum (T)	406047	6455800	1			1
Conospermum undulatum (T)	406047	6455852	1			1
Conospermum undulatum (T)	406048	6455854	1			1
Conospermum undulatum (T)	406049	6455800	1			1
Conospermum undulatum (T)	406049	6455852	1			1
Conospermum undulatum (T)	406049	6455856	1			1
Conospermum undulatum (T)	406049	6455857	1			1
Conospermum undulatum (T)	406050	6455801	1			1
Conospermum undulatum (T)	406050	6455837	1			1
Conospermum undulatum (T)	406051	6455780	1			1
Conospermum undulatum (T)	406051	6455836	1			1
Conospermum undulatum (T)	406051	6455840	1			1
Conospermum undulatum (T)	406051	6455852	1			1
Conospermum undulatum (T)	406052	6455779	1			1
Conospermum undulatum (T)	406052	6455801	1			1
Conospermum undulatum (T)	406053	6455766	1			1
Conospermum undulatum (T)	406053	6455787	1			1
Conospermum undulatum (T)	406053	6455843	1			1
Conospermum undulatum (T)	406053	6455843	1			1
Conospermum undulatum (T)	406053	6455844	1			1
Conospermum undulatum (T)	406054	6455792	1			1
Conospermum undulatum (T)	406055	6455794	1			1
Conospermum undulatum (T)	406055	6455842	1			1
Conospermum undulatum (T)	406055	6455845	1			1
Conospermum undulatum (T)	406055	6455854	1			1
Conospermum undulatum (T)	406056	6455847	1			1
Conospermum undulatum (T)	406056	6455851	1			1
Conospermum undulatum (T)	406056	6455853	1			1
Conospermum undulatum (T)	406056	6455876	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406057	6455779	1			1
Conospermum undulatum (T)	406057	6455797	1			1
Conospermum undulatum (T)	406058	6455814	1			1
Conospermum undulatum (T)	406058	6455854	1			1
Conospermum undulatum (T)	406058	6455855	1			1
Conospermum undulatum (T)	406058	6455858	1			1
Conospermum undulatum (T)	406061	6455843	1			1
Conospermum undulatum (T)	406061	6455854	1			1
Conospermum undulatum (T)	406062	6455817	1			1
Conospermum undulatum (T)	406063	6455809	1			1
Conospermum undulatum (T)	406064	6455784	1			1
Conospermum undulatum (T)	406064	6455845	1			1
Conospermum undulatum (T)	406065	6455858	1			1
Conospermum undulatum (T)	406066	6455780	1			1
Conospermum undulatum (T)	406066	6455808	1			1
Conospermum undulatum (T)	406066	6455819	1			1
Conospermum undulatum (T)	406066	6455823	1			1
Conospermum undulatum (T)	406066	6455852	1			1
Conospermum undulatum (T)	406066	6455855	1			1
Conospermum undulatum (T)	406067	6455805	1			1
Conospermum undulatum (T)	406067	6455806	1			1
Conospermum undulatum (T)	406068	6455804	1			1
Conospermum undulatum (T)	406068	6455805	1			1
Conospermum undulatum (T)	406068	6455806	1			1
Conospermum undulatum (T)	406068	6455826	1			1
Conospermum undulatum (T)	406069	6455805	1			1
Conospermum undulatum (T)	406069	6455814	1			1
Conospermum undulatum (T)	406069	6455827	1			1
Conospermum undulatum (T)	406069	6455832	1			1
Conospermum undulatum (T)	406070	6455885	1			1
Conospermum undulatum (T)	406071	6455882	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406071	6455886	1			1
Conospermum undulatum (T)	406072	6455880	1			1
Conospermum undulatum (T)	406073	6455806	1			1
Conospermum undulatum (T)	406073	6455818	1			1
Conospermum undulatum (T)	406073	6455820	1			1
Conospermum undulatum (T)	406073	6455837	1			1
Conospermum undulatum (T)	406073	6455881	1			1
Conospermum undulatum (T)	406074	6455817	1			1
Conospermum undulatum (T)	406074	6455841	1			1
Conospermum undulatum (T)	406074	6455880	1			1
Conospermum undulatum (T)	406074	6455882	1			1
Conospermum undulatum (T)	406075	6455835	1			1
Conospermum undulatum (T)	406075	6455836	1			1
Conospermum undulatum (T)	406075	6455837	1			1
Conospermum undulatum (T)	406075	6455840	1			1
Conospermum undulatum (T)	406076	6455785	1			1
Conospermum undulatum (T)	406076	6455807	1			1
Conospermum undulatum (T)	406076	6455814	1			1
Conospermum undulatum (T)	406076	6455845	1			1
Conospermum undulatum (T)	406076	6455880	1			1
Conospermum undulatum (T)	406077	6455842	1			1
Conospermum undulatum (T)	406078	6455842	1			1
Conospermum undulatum (T)	406079	6455811	1			1
Conospermum undulatum (T)	406079	6455845	1			1
Conospermum undulatum (T)	406079	6455866	1			1
Conospermum undulatum (T)	406080	6455809	1			1
Conospermum undulatum (T)	406080	6455817	1			1
Conospermum undulatum (T)	406081	6455817	1			1
Conospermum undulatum (T)	406082	6455817	1			1
Conospermum undulatum (T)	406082	6455818	1			1
Conospermum undulatum (T)	406083	6455819	1			1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406083	6455850	1			1
Conospermum undulatum (T)	406084	6455823	1			1
Conospermum undulatum (T)	406085	6455812	1			1
Conospermum undulatum (T)	406086	6455850	1			1
Conospermum undulatum (T)	406087	6455850	1			1
Conospermum undulatum (T)	406088	6455809	1			1
Conospermum undulatum (T)	406088	6455811	1			1
Conospermum undulatum (T)	406089	6455802	1			1
Conospermum undulatum (T)	406090	6455793	1			1
Conospermum undulatum (T)	406090	6455804	1			1
Conospermum undulatum (T)	406090	6455809	1			1
Conospermum undulatum (T)	406091	6455825	1			1
Conospermum undulatum (T)	406092	6455825	1			1
Conospermum undulatum (T)	406093	6455806	1			1
Conospermum undulatum (T)	406093	6455858	1			1
Conospermum undulatum (T)	406094	6455801	1			1
Conospermum undulatum (T)	406094	6455801	1			1
Conospermum undulatum (T)	406094	6455856	1			1
Conospermum undulatum (T)	406094	6455861	1			1
Conospermum undulatum (T)	406098	6455860	1			1
Conospermum undulatum (T)	406100	6455859	1			1
Conospermum undulatum (T)	406101	6455850	1			1
Conospermum undulatum (T)	406102	6455859	1			1
Conospermum undulatum (T)	406103	6455837	1			1
Conospermum undulatum (T)	406104	6455847	1			1
Conospermum undulatum (T)	406105	6455845	1			1
Conospermum undulatum (T)	406106	6455844	1			1
Conospermum undulatum (T)	406109	6455861	1			1
Conospermum undulatum (T)	406110	6455858	1			1
Conospermum undulatum (T)	406110	6455860	1			1
Conospermum undulatum (T)	406111	6455855		1		1

Species	Easting (mE)	Northing (mN)	AECOM record	DPaW record	Tonkin Highway / Hale Road interchange to Tonkin Highway / Welshpool Road East interchange	Tonkin Highway / Kelvin Road interchange
Conospermum undulatum (T)	406112	6455860	1			1
Conospermum undulatum (T)	406113	6455833	1			1
Conospermum undulatum (T)	406113	6455852	1			1
Conospermum undulatum (T)	406114	6455854	1			1
Conospermum undulatum (T)	406117	6455833	1			1
Conospermum undulatum (T)	406117	6455835	1			1
Conospermum undulatum (T)	406119	6455838	1			1
Conospermum undulatum (T)	406121	6455842	1			1
Isopogon drummondii (P3)	404857	6459491		1	1	
Isopogon drummondii (P3)	406119	6455842	1			1
Isopogon drummondii (P3)	406120	6455840	1			1
Isopogon drummondii (P3)	406121	6455839	1			1
Verticordia lindleyi subsp. lindleyi (P4)	405316	6459076		1	1	
Verticordia lindleyi subsp. lindleyi (P4)	405316	6459077		1	1	

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Appendix D

Fauna Field Survey Results

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Appendix D Fauna field survey results

Genus	Species	Subspecies	Vernacular	Conservation Status
Threskiornis	*molucca*		Australian White Ibis	
Columba	*livia*		Domestic Pigeon	Introduced
Phaps	*chalcoptera*		Common Bronzewing	
Streptopelia	*senegalensis*		Laughing Turtle-Dove	Introduced
Gerygone	*fusca*		Western Gerygone	
Smicrornis	*brevirostris*		Weebill	
Coracina	*novaehollandiae*		Black-faced Cuckoo-shrike	
Corvus	*coronoides*		Australian Raven	
Cracticus	*tibicen*		Australian Magpie	
Cracticus	*torquatus*		Grey Butcherbird	
Grallina	*cyanoleuca*		Magpie-lark	
Rhipidura	*leucophrys*		Willie Wagtail	
Malurus	*splendens*		Splendid Fairy-wren	
Merops	*ornatus*		Rainbow Bee-eater	Migratory EPBC Act and Schedule 1 WC Act
Anthochaera	*carunculata*		Red Wattlebird	
Lichmera	*indistincta*		Brown Honeyeater	
Pachycephala	*rufiventris*		Rufous Whistler	
Pardalotus	*striatus*		Striated Pardalote	
Cacatua	*roseicapilla*		Galah	
Calyptorhynchus	*banksii*	*naso*	Forest Red-tailed Black Cockatoo	Threatened – Vulnerable EPBC Act & WC Act
Platycercus	*zonarius*		Australian Ringneck	
Trichoglossus	*haematodus*	*moluccanus*	Rainbow Lorikeet	
Canis	*lupus*	*familiaris*	Dog	Introduced
Felis	*catus*		Cat	Introduced
Oryctolagus	*cuniculus*		Rabbit	Introduced
Isoodon	*obesulus*	*fusciventer*	Southern Brown Bandicoot, Quenda	Priority 5
Cryptoblepharus	*buchananii*			
Menetia	*greyii*		Australian White Ibis	

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Appendix E

Carnaby's Cockatoo Potential Breeding and Roosting Habitat

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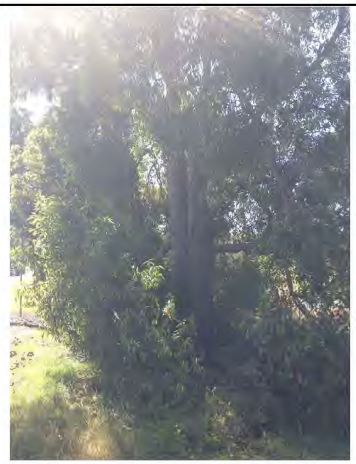
Appendix E – Black Cockatoo Potential Breeding Habitat Trees

ID	1
Latitude	-32.028570
Longitude	116.005294
DBH (cm)	53
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	

ID	2
Latitude	-32.028495
Longitude	116.005231
DBH (cm)	110
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	



ID	3
Latitude	-32.028467
Longitude	116.005151
DBH (cm)	65
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	

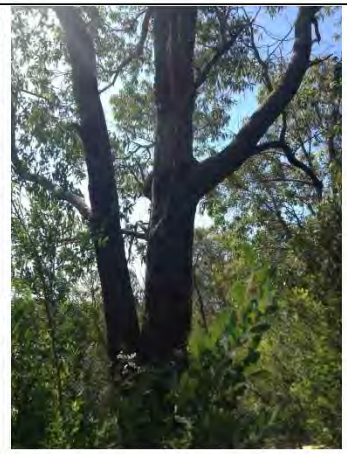
ID	4
Latitude	-32.028287
Longitude	116.004956
DBH (cm)	63
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

ID	5
Latitude	-32.028127
Longitude	116.004818
DBH (cm)	70
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

ID	6
Latitude	-32.027946
Longitude	116.004649
DBH (cm)	80
Tree Height (m)	10
Number of hollows	0
Tree Type	Marri
Comments	

ID	7
Latitude	-32.026199
Longitude	116.003746
DBH (cm)	56
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

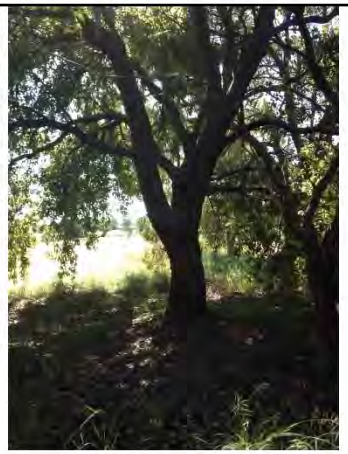
ID	8
Latitude	-32.025670
Longitude	116.003611
DBH (cm)	52
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	



ID	9
Latitude	-32.031962
Longitude	116.008640
DBH (cm)	75
Tree Height (m)	10
Number of hollows	0
Tree Type	Marri
Comments	

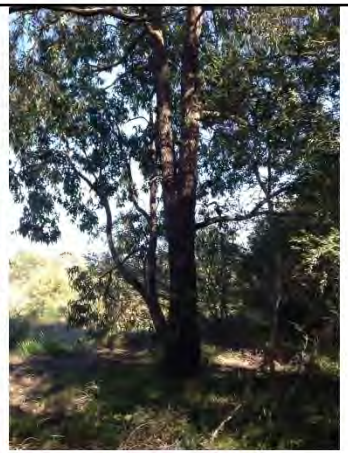
ID	10
Latitude	-32.033202
Longitude	116.009324
DBH (cm)	50
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

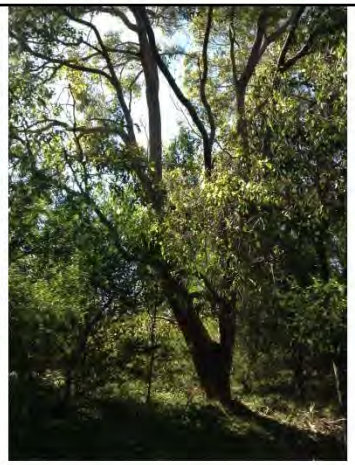
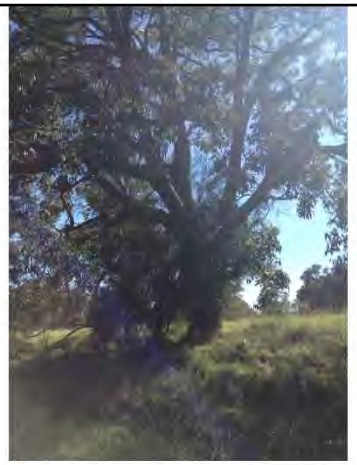
ID	11
Latitude	-32.033583
Longitude	116.008769
DBH (cm)	70
Tree Height (m)	10
Number of hollows	0
Tree Type	Marri
Comments	



ID	12
Latitude	-32.033455
Longitude	116.008641
DBH (cm)	80
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

ID	13		**ID**	14	
Latitude	-32.033365		**Latitude**	-32.028881	
Longitude	116.008693		**Longitude**	116.004885	
DBH (cm)	90		**DBH (cm)**	57	
Tree Height (m)	9		**Tree Height (m)**	11	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**		

ID	15		**ID**	16	
Latitude	-32.028824		**Latitude**	-32.028653	
Longitude	116.004815		**Longitude**	116.004652	
DBH (cm)	84		**DBH (cm)**	57	
Tree Height (m)	12		**Tree Height (m)**	12	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**		

ID	17		**ID**	18	
Latitude	-32.028679		**Latitude**	-32.028051	
Longitude	116.004680		**Longitude**	116.004181	
DBH (cm)	75		**DBH (cm)**	92	
Tree Height (m)	11		**Tree Height (m)**	12	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**		

ID	19		**ID**	20	
Latitude	-32.028001		**Latitude**	-32.027884	
Longitude	116.004090		**Longitude**	116.003769	
DBH (cm)	50		**DBH (cm)**	60	
Tree Height (m)	11		**Tree Height (m)**	10	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**		

ID	21
Latitude	-32.027722
Longitude	116.003523
DBH (cm)	74
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

ID	22
Latitude	-32.026924
Longitude	116.003280
DBH (cm)	60
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

ID	23
Latitude	-32.026307
Longitude	116.003057
DBH (cm)	53
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

ID	24
Latitude	-32.008061
Longitude	115.995441
DBH (cm)	76
Tree Height (m)	10
Number of hollows	0
Tree Type	Stag
Comments	

ID	25
Latitude	-32.008122
Longitude	115.995850
DBH (cm)	60
Tree Height (m)	10
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	26
Latitude	-32.008198
Longitude	115.995854
DBH (cm)	56
Tree Height (m)	9
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	27
Latitude	-32.011556
Longitude	115.996062
DBH (cm)	na
Tree Height (m)	Various heights
Number of hollows	0
Tree Type	Introduced Eucalypts
Comments	

ID	28
Latitude	-32.012814
Longitude	115.996644
DBH (cm)	53
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

ID	29
Latitude	-32.007704
Longitude	115.995402
DBH (cm)	60
Tree Height (m)	9
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	30
Latitude	-32.007451
Longitude	115.996225
DBH (cm)	70
Tree Height (m)	10
Number of hollows	0
Tree Type	Flooded gum
Comments	

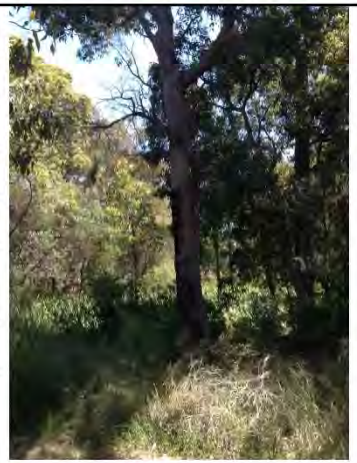
ID	31
Latitude	-32.007534
Longitude	115.996349
DBH (cm)	60
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

ID	32
Latitude	-32.007470
Longitude	115.996483
DBH (cm)	51
Tree Height (m)	12
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	33
Latitude	-32.007196
Longitude	115.996783
DBH (cm)	70
Tree Height (m)	13
Number of hollows	0
Tree Type	Marri
Comments	

ID	34
Latitude	-32.007144
Longitude	115.996827
DBH (cm)	62
Tree Height (m)	12
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	35
Latitude	-32.007221
Longitude	115.997051
DBH (cm)	53
Tree Height (m)	13
Number of hollows	0
Tree Type	Marri
Comments	



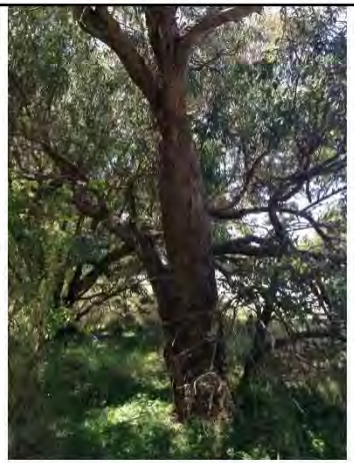
ID	36
Latitude	-32.007050
Longitude	115.996998
DBH (cm)	80
Tree Height (m)	14
Number of hollows	0
Tree Type	Flooded gum
Comments	No hollows but could form

ID	37
Latitude	-32.006950
Longitude	115.996781
DBH (cm)	>50
Tree Height (m)	12
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	38
Latitude	-32.006992
Longitude	115.996753
DBH (cm)	55
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

ID	39
Latitude	-32.006592
Longitude	115.997001
DBH (cm)	80
Tree Height (m)	14
Number of hollows	0
Tree Type	Flooded gum
Comments	

ID	40
Latitude	-32.006437
Longitude	115.997254
DBH (cm)	53
Tree Height (m)	12
Number of hollows	0
Tree Type	Flooded gum
Comments	

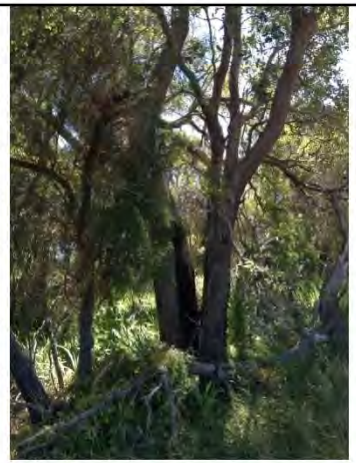


ID	41
Latitude	-32.006237
Longitude	115.997223
DBH (cm)	57
Tree Height (m)	13
Number of hollows	0
Tree Type	Marri
Comments	

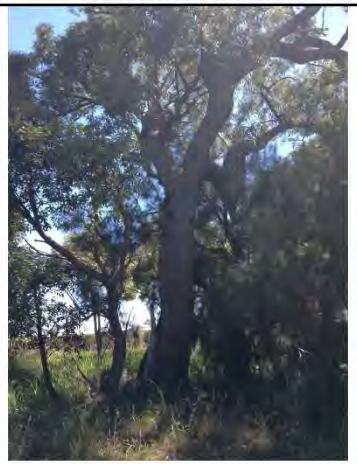
ID	42
Latitude	-32.005905
Longitude	115.997316
DBH (cm)	53
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	

ID	43
Latitude	-32.005866
Longitude	115.997305
DBH (cm)	63
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	

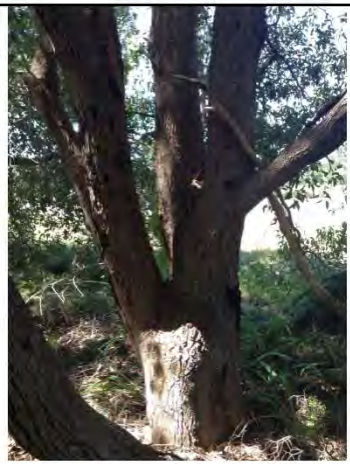
ID	44
Latitude	-32.005726
Longitude	115.997368
DBH (cm)	67
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	



ID	45
Latitude	-32.005232
Longitude	115.997379
DBH (cm)	110
Tree Height (m)	14
Number of hollows	0
Tree Type	Jarrah
Comments	Likely to form hollows



ID	46
Latitude	-32.005017
Longitude	115.997409
DBH (cm)	55
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	



ID	47
Latitude	-32.004881
Longitude	115.997439
DBH (cm)	55
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	

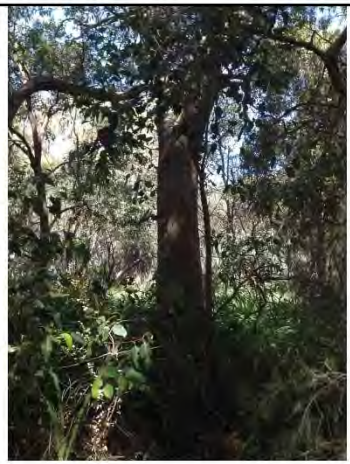
ID	48
Latitude	-32.004913
Longitude	115.997217
DBH (cm)	60
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	

ID	49		**ID**	50 – No Record	
Latitude	-32.005378				
Longitude	115.997205				
DBH (cm)	60				
Tree Height (m)	13				
Number of hollows	0				
Tree Type	Jarrah				
Comments					

ID	51		**ID**	52	
Latitude	-32.005653		**Latitude**	-32.005983	
Longitude	115.997172		**Longitude**	115.996899	
DBH (cm)	53		**DBH (cm)**	110	
Tree Height (m)	15		**Tree Height (m)**	12	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**	Likely to form hollows	

ID	53
Latitude	-32.006770
Longitude	115.996806
DBH (cm)	70
Tree Height (m)	20
Number of hollows	0
Tree Type	Marri
Comments	

ID	54
Latitude	-32.006732
Longitude	115.996826
DBH (cm)	63
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	



ID	55
Latitude	-32.006769
Longitude	115.996876
DBH (cm)	60
Tree Height (m)	12
Number of hollows	0
Tree Type	Marri
Comments	55

ID	56
Latitude	-32.012141
Longitude	115.997010
DBH (cm)	65
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	56

ID	57
Latitude	-32.012292
Longitude	115.997074
DBH (cm)	64
Tree Height (m)	11
Number of hollows	0
Tree Type	Marri
Comments	57

ID	58
Latitude	-31.995739
Longitude	115.992082
DBH (cm)	100
Tree Height (m)	14
Number of hollows	0
Tree Type	Flooded gum
Comments	

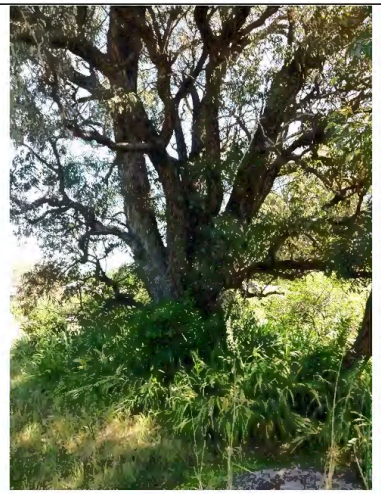
ID	59
Latitude	-31.995796
Longitude	115.992114
DBH (cm)	80
Tree Height (m)	15
Number of hollows	0
Tree Type	Marri
Comments	

ID	60
Latitude	-31.995618
Longitude	115.992107
DBH (cm)	95
Tree Height (m)	14
Number of hollows	0
Tree Type	Flooded gum
Comments	Likely to form hollows

ID	61		**ID**	62	
Latitude	-31.995369		**Latitude**	-31.995354	
Longitude	115.992408		**Longitude**	115.992226	
DBH (cm)	110		**DBH (cm)**	90	
Tree Height (m)	15		**Tree Height (m)**	15	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Marri		**Tree Type**	Marri	
Comments			**Comments**		

ID	63		**ID**	64	
Latitude	-31.995423		**Latitude**	-31.995388	
Longitude	115.992067		**Longitude**	115.992696	
DBH (cm)	82		**DBH (cm)**	120	
Tree Height (m)	11		**Tree Height (m)**	25	
Number of hollows	0		**Number of hollows**	0	
Tree Type	Flooded gum		**Tree Type**	Marri	
Comments			**Comments**	Likely to form hollows	

ID	65
Latitude	-31.995668
Longitude	115.992433
DBH (cm)	130
Tree Height (m)	11
Number of hollows	0
Tree Type	Flooded gum
Comments	



ID		66
Latitude		-31.995858
Longitude		115.992495
DBH (cm)		77
Tree Height (m)		8
Number of hollows		1
Tree Type		Flooded gum
Comments	**Height above ground (m)**	8
Feral Bees on main trunk	**Diameter of hollow opening (cm)**	12
	Direction	West

ID	67
Latitude	-31.998795
Longitude	115.995820
DBH (cm)	57
Tree Height (m)	15
Number of hollows	0
Tree Type	Flooded Gum
Comments	

ID	68
Latitude	-31.997986
Longitude	115.995319
DBH (cm)	60
Tree Height (m)	25
Number of hollows	0
Tree Type	Introduced Eucalypts
Comments	Potential Roosting

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Appendix F

Fauna Desktop Assessment Results

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Appendix F - Desktop Fauna Assessment Results

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Birds				
Australian Painted Snipe *Rostratula australis*	Endangered, Marine, Migratory (CAMBA))	Threatened - Endangered	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It is a cryptic bird that is hard to see and often overlooked. It is usually recorded at the water's edge and on mudflats, taking invertebrates, such as insects and worms. It nests on the ground amongst tall reed-like vegetation near water. Usually only single birds are seen, though larger groups of up to 30 have been recorded.	Unlikely to Occur - No suitable habitat present in Project Area.
Baudin's Cockatoo *Calyptorhynchus baudinii*	Vulnerable	Threatened - Endangered	Habitat critical to the survival of this species includes forests of Karri (E. diversicolor), Jarrah (E. marginata) and Marri (C. calophylla); in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and continues south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone et al, 2010).	Likely to occur - The species has been previously recorded near Gooseberry Hill during 2003.
Carnaby's Cockatoo *Calyptorhynchus latirostris*	Endangered	Threatened - Endangered	Carnaby's Cockatoo is a postnuptial nomad and typically moves west soon after breeding. The species nests in hollows of smooth-barked eucalypts, particularly Salmon Gum (Eucalyptus salmonophloia) and Wandoo (E. Wandoo) but is not limited to these eucalypts. Diet consists of an array of Proteaceous and Eucalypt species prevalent on the Swan Coastal Plain. Foraging habitat, including Banksia woodlands, is considered to be habitat critical to the survival of the species (Johnstone et al, 2010).	Likely to occur - This species have been previously recorded within close proximity to the Project Area.

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Cattle Egret *Ardea ibis*	Marine, Migratory (CAMBA, JAMBA)	IA	The Cattle Egret is a small egret weighing only 390g and standing 70 cm tall. The heaviest distribution of this species in WA is in the north east, and into the Northern Territory. In the non-breeding season, it can be found throughout most of Australia (DotE, 2014).	Likely to occur. Records nearby and suitable habitat within the Project Area
Common Greenshank *Tringa nebularia*	Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. This species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats.	May overfly the area - Suitable habitat occurs within close proximity to Project Area
Common Sandpiper *Actitis hypoleucos*	Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	IA	This species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. The common sandpiper has been recorded in estuaries and deltas of streams as well as on banks farther upstream, around lakes, pools, billabongs and reservoirs. The species generally forage in shallow water and on bare soft mud at the edges of wetlands.	Unlikely to Occur - No suitable habitat present in Project Area.
Eastern Great Egret *Ardea modesta*	Marine, Migratory (CAMBA, JAMBA)	IA	The Eastern Great Egret is a large bird (~100cm, 1kg) with white plumage and black or yellow bill. The species occurs individually or in small groups when foraging, but roosts in large flocks. Non-breeding individuals have been recorded throughout Australia. Almost all breeding colonies are located in the Top End of the Northern Territory (DotE, 2014). Non breeding individuals have been recorded across much of the Australian continent (DotE, 2014).	Likely to occur - numerous previous records within close proximity to Project Area from Welshpool and High Wycombe Area.
Forest Red-tailed Black Cockatoo *Calyptohynchus banksii* subsp. *naso*	Vulnerable	Threatened - Vulnerable	Requires tree hollows to nest and breed, occurs in forests of Karri (E. diversicolor), Jarrah (E. marginata) and Marri (Corymbia calophylla), with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone et al, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range.	Likely to occur - The species has been previously recorded near Kenwick and High Wycombe during 2012.

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Malleefowl *Leipoa ocellata*	Vulnerable	Threatened - Vulnerable	This species mainly occurs within the southern arid and semiarid zones of Western Australia. Mallefowl commonly occurs within scrubs and thickets of mallee Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla, also other dense litter forming shrublands.	Unlikely to Occur - Range has diminished substantially since European arrival and does not occur here
Muirs Corella *Cacatua pastinator* subsp. *pastinator*	Vulnerable	S	Muirs Corella is confined to the extreme south west of Western Australia (Schodde and Mason, 1997). Its habitat is severely fragmented with much of the original habitat lost due to clearing, processes associated with dieback and degradation (Chapman et al. 2005; Garnett and Crowley 2000; Mawson and Johnstone 1997; Mawson and Long, 1994).	Unlikely to occur - Not recorded along the Swan River since 1900. Most recent historic record occurs from 1835.
Peregrine Falcon *Falco peregrinus*		S	The peregrine falcon is found on every continent and major island group except Antarctica and New Zealand. They occur throughout Australia however are absent for treeless and waterless deserts and dense forest.	May overfly the area - Suitable habitat occurs within close proximity to Project Area
Rainbow Bee-eater *Merops ornatus*	Marine, Migratory (JAMBA)	IA	The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests. It is possible that this species will occupy open woodland areas within the survey area. The Rainbow Bee-eater avoids heavy forest that would hinder the pursuit of its insect prey (Morcombe, 2003).	Likely to occur - Suitable habitat may occur within the Project Area.
White-bellied Sea Eagle *Haliaeetus leucogaster*	Marine, Migratory (CAMBA)	IA	The White-bellied Sea-Eagle is a large raptor that is widespread throughout coastal Australia. The White Bellied Sea-Eagle occupies a wide range of habitats, usually in close proximity to a large body of water (including the ocean). Breeding usually occurs in tall open woodlands overlooking bodies of water (DotE, 2014).	May overfly the area - Suitable habitat occurs within close proximity to Project Area

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Mammals				
Chuditch *Dasyurus geoffroii*	Vulnerable	Threatened - Vulnerable	Following European settlement the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The majority of records are found in the contiguous Jarrah forests of the south west of Western Australia (DotE, 2014). Recent records exist within the Gnangara pine forest and Walyunga National Park.	Unlikely to occur - Due to degraded nature of vegetation
Quokka *Setonix brachyurus*	Vulnerable	Threatened - Vulnerable	The Quokka prefers early seral (young) vegetation stages that have been burned within the previous ten years. The quokka currently inhabits dense low vegetation that provides refuge from predation by owls, foxes and cats.	Unlikely to occur - No suitable habitat present within the Project Area
Southern Brown Bandicoot *Isoodon obsesulus* subsp. *fusciventer*	-	Priority 5	The Quenda or Southern Brown Bandicoot exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	Likely to occur. Records nearby and suitable habitat within the Project Area
Southern Brush-tailed Phascogale, Wambenger *Phascogale tapoatafa* subsp. *tapoatafa*	-	Threatened - Vulnerable	This species occurs in dry sclerophyll forests and open woodlands that contain hollow bearing trees.	Unlikely to occur - Known from historic collections
Water-rat *Hydromys chrysogaster*	-	Priority 4	This species lives in burrows on the banks of rivers, lakes and estuaries and feeds on aquatic insects, fish, crustaceans, mussels, snails, frogs, birds eggs and water birds.	Unlikely to occur - No suitable habitat present within the Project Area
Western Brush Wallaby *Macropus irma*	-	Priority 4	This species is found in the southwest coastal region of Western Australia from Kalbarri all the way down to Cape Arid, particularly centralized near the Swan River.	Unlikely to occur - Historic collection from Forrestfield area in 1963

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Western Ringtail Possum *Pseudocheirus occidentalis*	Vulnerable	Threatened - Vulnerable	The Western Ringtail Possum has a patchy distribution in predominantly two areas: near Bunbury to Leeuwin-Naturaliste National Park (with a small translocated population near Dawesville); and near Albany. Populations on the Swan Coastal Plain are associated with stands of myrtaceous trees (usually Peppermint Tree (Agonis flexuosa)) growing near swamps, water courses or floodplains, and at topographic low points which provide cooler often more fertile conditions	Unlikely to Occur - Closest known record is from 1958 in Midland.
Woylie *Bettongia penicillata* subsp. *ogilbyi*	Endangered	Threatened - Critically Endangered	Gastrolobium thickets provide refuge for Woylies against introduced predators. Gastrolobium thickets provide the woylie with refuge from introduced predators, partly because of the ability to physically hide in the bushes but also the local reduction in predator numbers caused by secondary poison present within Gastrolobium species.	Unlikely to occur - No suitable habitat present within the Project Area
Reptiles				
Black-striped Snake *Neelaps calonotos*	-	Priority 3	The Black-striped Snake is typically found in sand plain habitat in association with Banksia species, having a very limited distribution exclusive to the Swan Coastal Plain. This taxon is particularly difficult to locate, and is infrequently collected during biological surveys on the Swan Coastal Plain.	Unlikely to occur - Due to previous disturbance.
Carpet Python *Morelia spilota* subsp. *imbricata*	-	S	The carpet python grows to a length of 2.3m from snout to vent. It occurs in coastal areas, woodland, heathland and semiarid areas often in woodlands of Eucalyptus and Banksia or amongst grasses or low growing shrubs.	Unlikely to occur - due to degraded nature of vegetation
Dell's Ctenotus, Darling Range Heath Ctenotus *Ctenotus delli*	-	Priority 4	This species is only found in a small portion of the Darling Range in small heath patches and dense shrub understorey. May be present regionally but scarce.	Unlikely to occur - due to degraded nature of vegetation

Species	National EPBC Act	State *Wildlife Conservation Act 1950*	Habitat	Likelihood of Occurrence in Study Area
Invertebrates				
Native Bee *Leioproctus bilobatus*	-	Priority 2	Insufficient information	Unlikely to occur - Historic collection from Kenwick area in 1981
Native Bee *Leioproctus douglasiellus*	Critically Endangered	Threatened - Endangered	Insufficient information	Unlikely to occur - Other bee species known from one historic collection from Kenwick area in 1981
Scorpion fly *Austromerope poultoni*	-	Priority 2	The scorpion fly is endemic to Western Australia and is found in a variety of habitats, including woodland, Jarrah Forest and sand plain vegetation.	Unlikely to occur - Previous records from Boddington area

EPBC Act Commonwealth Environment Protection and Biodiversity Conservation Act, 1999: EX Extinct, E Endangered, VU Vulnerable M Migratory

WC Act Western Australia Wildlife Conservation Act, 1950: Schedule 1, S2, S3, S4

Priority Species Department of Environment and Conservation's Priority Species List: Priority 1, P2, P3, P4, P5

Appendix G

Wetland Assessment Results

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Appendix G - Wetlands Assessment Results

1.0 UFI 8025 Wetlands Assessment

1.1 General information

Assessor details	
Name	L. Chappell supplemented by L. Van Gorp and F de Wit
Date(s) of site visit	Oct 2014 and 30 Sep 2015
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	Sunny, 30 degrees Celsius.
Land ownership and contact details	
Landowner	Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Tonkin Highway interchange, Wattle Grove
Latitude and longitude or Easting northing	Approx. -32.008439, 115.995979
Wetland details	
Name	Unknown
UFI	8025
Hill et al. (1996) map sheet number and wetland ID number (WIN)	Sheet 2033 I NE, WIN 40461645751
Consanguineous suite	Mungala
Area (ha) subject to this evaluation	0-10 ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Conservation
Wetland type (see table below)	Palusplain

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*
Intermittent inundation	Playa*	Barlkarra*	-	-	Wadi*
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

1.2 Desktop evaluation

Answer the following desktop based questions using the information outlined in Section 1.0 and a preliminary site visit. Once the desktop questions have been completed and the wetland's values verified, the preliminary evaluation can commence.

Land uses	
Current ownership of wetland:	Main Roads Western Australia
Current land use	Vegetated land within road reserve
Past land use:	Welshpool Road East has been a road since at least 1953. Review of historical aerial imagery indicates that surrounding land appears to have been a mixture of bushland and potentially rural land use interspersed with tracks.
Surrounding land use:	Rural, semi-industrial and to the south-west Nature Reserve, some surrounding land zoned for parks and recreation
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Significance	**Y/N**
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N (not area being assessed)
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	Y
Swan Bioplan (Environmental Protection Authority 2010)	N
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N (but adjacent to A Class Reserve R50529/ Kenwick Wetlands Nature Reserve)
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: Areas assessed have been disturbed, however, the Bush Forever listing acknowledges this.	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Direct sighting: recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. Small amount of suitable black cockatoo foraging habitat exists within the mapped geomorphic wetland boundary although it is of degraded fauna habitat condition. Two potential breeding trees exist within boundary	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Diggings recorded at Tonkin Highway/Welshpool Road East interchange (-31.998220, 115.995226) – outside of wetland boundary. Site provides suitable habitat although it is in a degraded fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value		
List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.		
Scientific, geoheritage or geoconservation values	**Significance and observations**	**Source of information (e.g. observatory, literature, DPaW, WA Museum)**

Flora			
Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:			
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**	
Pristine			
Excellent			
Very Good			
Good			
Degraded	Approx. 100%	Approx. 90%	
Completely Degraded	Approx. 0%	Approx. 10%	
Using this information, is the wetland dominated by vegetation in a good or better condition:		No	
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Southern River Complex	
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Southern River Complex: 10-30 %	
List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:			
Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Not within wetland boundary – approx.. 1.2km away	DPaW database search results AECOM Biological Survey 2014

Flora			
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	DPaW TEC buffer occurs partially within wetland boundary, however, vegetation survey undertaken in 2014 identified that this TEC does not occur within the surveyed area	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Not within wetland boundary – at least 1.1km to south of wetland boundary at its closest point	DPaW database search results AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Not within wetland boundary – approx. 1.2km away	DPaW database search results AECOM Biological Survey 2014

List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:

Species	Significance (e.g. Declared Rare, Priority 1)	Population measure (number, single record, abundance comment)	Observations (e.g. habitat type, flowering season)	Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)
Grevillea thelemanniana subsp. *thelemanniana*	P2		Approx. 250 m to the to the west of the wetland boundary	DPaW
Conospermum undulatum	Threatened - Vulnerable		Approx. 150 m to the to the east of the wetland boundary	DPaW
Verticordia lindleyi subsp. *lindleyi*	P4		At least 850m to the north of the wetland boundary	WA Herbarium

Representativeness	
Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:	
	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	3.8
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	4.1

Representativeness	
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

1.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: - *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6* - *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	 N N N N N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950). Contains potential breeding trees for black cockatoos	Y
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 N N N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 N N N N

2.0 UFI 8028 Wetlands Assessment

2.1 General information

Assessor details	
Name	L. Chappell (supplemented by L. Van Gorp and F de Wit)
Date(s) of site visit	Oct 2014 and 30 Sep 2015
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	
Land ownership and contact details	
Landowner	Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Tonkin Highway interchange, Wattle Grove
Latitude and longitude or Easting northing	Approx. -32.007909, 115.997438
Wetland details	
Name	Unknown
UFI	8028
Hill et al. (1996) map sheet number and wetland ID number (WIN)	Sheet 2033 I NE, WIN 40461645751
Consanguineous suite	Mungala
Area (ha) subject to this evaluation	0-10 ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Conservation
Wetland type (see table below)	Sumpland

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Intermittent inundation	Playa*	Barlkarra*	-	-	Wadi*
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

2.2 Desktop evaluation

Land uses	
Current ownership of wetland:	Main Roads Western Australia
Current land use	Vegetated land within road reserve
Past land use:	Welshpool Road East has been a road since at least 1953. Review of historical aerial imagery indicates that surrounding land appears to have been a mixture of bushland and potentially rural land use interspersed with tracks.
Surrounding land use:	Rural, semi-industrial and to the south-west Nature Reserve, some surrounding land zoned for parks and recreation
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Significance	**Y/N**
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	Y
Swan Bioplan (Environmental Protection Authority 2010)	N (not area being assessed)
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N (but adjacent to A Class Reserve R50529/ Kenwick Wetlands Nature Reserve)
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: Areas assessed have been disturbed, however, the Bush Forever listing acknowledges this.	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Direct sighting: recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. No suitable black cockatoo foraging habitat exists within the mapped geomorphic wetland boundary.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Diggings recorded at Tonkin Highway/Welshpool Road East interchange (-31.998220, 115.995226) – outside of wetland boundary. Site provides suitable habitat although it is in a degraded fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value		
List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.		
Scientific, geoheritage or geoconservation values	**Significance and observations**	**Source of information (e.g. observatory, literature, DPaW, WA Museum)**

Flora			
Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:			
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**	
Pristine			
Excellent			
Very Good			
Good			
Degraded	Approx. 100%	Approx. 90%	
Completely Degraded	Approx. 0%	Approx. 10%	
Using this information, is the wetland dominated by vegetation in a good or better condition:		No	
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Southern River Complex	
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Southern River Complex: 10-30 %	
List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:			
Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Not within wetland boundary – approx.. 1.2km away	DPaW database search results AECOM Biological Survey 2014

Flora			
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	DPaW TEC buffer occurs partially within wetland boundary, however, vegetation survey undertaken in 2014 identified that this TEC does not occur within the surveyed area	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Not within wetland boundary – at least 1.1km to south of wetland boundary at its closest point	DPaW database search results AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Not within wetland boundary – approx. 1.2km away	DPaW database search results AECOM Biological Survey 2014

List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:

Species	Significance (e.g. Declared Rare, Priority 1)	Population measure (number, single record, abundance comment)	Observations (e.g. habitat type, flowering season)	Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)
Grevillea thelemanniana subsp. *thelemanniana*	P2		Approx. 130 m to the to the west of the wetland boundary	DPaW
Conospermum undulatum	Threatened - Vulnerable		Approx. 150 m to the to the east of the wetland boundary	DPaW
Verticordia lindleyi subsp. *lindleyi*	P4		At least 1km to the north of the wetland boundary	WA Herbarium

Representativeness

Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:

	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	37.0
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2

Representativeness	
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	28.8
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

2.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: - *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6* - *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	 N N N N N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	N
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 N N N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 N N N N

3.0 UFI 8025 and 8028 Secondary Evaluation

The evaluation has used the precautionary principle in that where values of one wetland were higher than the other, the higher value was selected. This was only necessary for the geomorphology section of the secondary assessment.

Plate 1 **UFI 8025 and 8028 representative photographs**

No.	General criteria	Criteria	Score
Geomorphology			
1	*Representativeness*	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H
5	*Naturalness*	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 **H** I L
6	*Scarcity*	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
Wetland processes			
8	*Representativeness*	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	H **I** L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H
10	*Naturalness*	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	H **I** L

No.	General criteria	Criteria	Score
11	*Scarcity*	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
Linkages			
12	*Representativeness*	The wetland is a hydrological link in a larger or more complex and intact system.	**H**
13	*Naturalness*	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	H **I** L
14	*Scarcity*	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
Habitats			
15	*Representativeness*	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	*Naturalness*	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	H **I** L
19	*Scarcity*	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H
Flora			
20	*Representativeness*	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	H I **L**

No.	General criteria	Criteria	Score
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	 **H** **19.69%** I
22	*Naturalness*	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	 H I **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H I **L**
24	*Scarcity*	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	H
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	I
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
Fauna			
28	*Representativeness*	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	H **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H I
30	*Naturalness*	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	H I

No.	General criteria	Criteria	Score
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	**L**
32	*Scarcity*	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. *EPBC Act 1999*, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the *Wildlife Conservation Act 1950*).	H
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	H
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
Cultural			
36	*Representativeness*	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	**I**
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant. The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	I **L**
Scientific and educational			
42	*Representativeness*	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics. The wetland has the potential to be used as a study or research site.	H I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

Attributes/functions /values	Scores		
	High	Intermediate	Low
Geomorphology	4		
Wetland processes		2	
Linkages	1	1	
Habitats		1	
Flora	1	3	
Fauna		1	1
Cultural		1	1
Scientific and educational			
Total Score	6	9	2
Defining attributes/ functions/values	Rehabilitation potential		
Applicable management category	Geomorphology		

4.0 UFI 14962 Wetlands Assessment

4.1 General information

Assessor details	
Name	L. Chappell (supplemented by L. Van Gorp and F de Wit)
Date(s) of site visit	Oct 2014 and 30 Sep 2015
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	
Land ownership and contact details	
Landowner	Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Tonkin Highway interchange, Wattle Grove
Latitude and longitude or Easting northing	Approx. -32.011105, 115.996093
Wetland details	
Name	Unknown
UFI	14962
Hill et al. (1996) map sheet number and wetland ID number (WIN)	Sheet 2033 I NE, WIN 40461645751
Consanguineous suite	Mungala
Area (ha) subject to this evaluation	0-10 ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Conservation
Wetland type (see table below)	Palusplain

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Intermittent inundation	Playa*	Barlkarra*	-	-	Wadi*
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

4.2 Desktop evaluation

Land uses	
Current ownership of wetland:	Main Roads Western Australia
Current land use	Vegetated land within road reserve, drainage line
Past land use:	Welshpool Road East has been a road since at least 1953. Review of historical aerial imagery indicates that surrounding land appears to have been a mixture of bushland and potentially rural land use interspersed with tracks.
Surrounding land use:	Rural, semi-industrial and to the west Nature Reserve, some surrounding land zoned for parks and recreation
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance

Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.

Conservation Significance	Y/N
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	N (not area being assessed)
Swan Bioplan (Environmental Protection Authority 2010)	N (not area being assessed)

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N (but adjacent to A Class Reserve R50529/ Kenwick Wetlands Nature Reserve)
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: n/a	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Direct sighting: recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. No suitable black cockatoo foraging habitat exists within the mapped geomorphic wetland boundary.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Diggings recorded at Tonkin Highway/Welshpool Road East interchange (-31.998220, 115.995226) – outside of wetland boundary. Site provides suitable habitat although it is in a degraded fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value

List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.

Scientific, geoheritage or geoconservation values	Significance and observations	Source of information (e.g. observatory, literature, DPaW, WA Museum)

Flora			
Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:			
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**	
Pristine			
Excellent			
Very Good			
Good			
Degraded	Approx. 100%	Approx. 90%	
Completely Degraded	Approx. 0%	Approx. 10%	
Using this information, is the wetland dominated by vegetation in a good or better condition:		No	
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Southern River Complex	
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Southern River Complex: 10-30 %	
List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:			
Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Not within wetland boundary – approx.. 1.2km away	DPaW database search results AECOM Biological Survey 2014
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	DPaW TEC buffer occurs partially within wetland boundary, however, vegetation survey undertaken in 2014 identified that this TEC does not occur within the surveyed area	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Not within wetland boundary – at least 1.1km to south of wetland boundary at its closest point	DPaW database search results AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Not within wetland boundary – approx. 1.2km away	DPaW database search results AECOM Biological Survey 2014
List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:			

Species	Significance (e.g. Declared Rare, Priority 1)	Population measure (number, single record, abundance comment)	Observations (e.g. habitat type, flowering season)	Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)
Grevillea thelemanniana subsp. *thelemanniana*	P2		Approx. 140 m to the to the west of the wetland boundary	DPaW
Conospermum undulatum	Threatened - Vulnerable		Approx. 150 m to the to the east of the wetland boundary	DPaW
Verticordia lindleyi subsp. *lindleyi*	P4		At least 1km to the north of the wetland boundary	WA Herbarium

Representativeness	
Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:	
	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	3.8
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	4.1
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

4.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: - *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6*	 N N

No.	Criteria	Y/N
	- *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	N N N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	N
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 N N N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 N N N N

4.4 Secondary evaluation

Plate 2 **UFI 14962 representative photographs**

No.	General criteria	Criteria	Score
Geomorphology			
1	*Representativeness*	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H

No.	General criteria	Criteria	Score
5	*Naturalness*	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 **H** I L
6	*Scarcity*	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
Wetland processes			
8	*Representativeness*	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	H **I** L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H
10	*Naturalness*	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	H **I** L
11	*Scarcity*	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
Linkages			
12	*Representativeness*	The wetland is a hydrological link in a larger or more complex and intact system.	**H**

No.	General criteria	Criteria	Score
13	*Naturalness*	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	H **I** L
14	*Scarcity*	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
Habitats			
15	*Representativeness*	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	*Naturalness*	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	H **I** L
19	*Scarcity*	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H
Flora			
20	*Representativeness*	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	H I **L**
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	**H** **19.69%** I

No.	General criteria	Criteria	Score
22	*Naturalness*	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	 H I **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H **I** L
24	*Scarcity*	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	H
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	**I**
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
Fauna			
28	*Representativeness*	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	H **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H **I**
30	*Naturalness*	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	H **I**
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L
32	*Scarcity*	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. *EPBC Act 1999*, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the *Wildlife Conservation Act 1950*).	H

No.	General criteria	Criteria	Score
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	H
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
Cultural			
36	*Representativeness*	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	I
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant. The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	I **L**
Scientific and educational			
42	*Representativeness*	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics. The wetland has the potential to be used as a study or research site.	H I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

Attributes/functions /values	Scores		
	High	Intermediate	Low
Geomorphology	4		
Wetland processes		2	
Linkages	1	1	
Habitats		1	

Attributes/functions /values	Scores		
Flora	1	2	2
Fauna		3	
Cultural			1
Scientific and educational			
Total Score	6	9	3
Defining attributes/ functions/values	Rehabilitation potential		
Applicable management category	Geomorphology		

5.0 UFI 15021 Wetlands Assessment

5.1 General information

Assessor details	
Name	L. Chappell (supplemented by L. Van Gorp and F de Wit)
Date(s) of site visit	Oct 2014 and 30 Sep 2015
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	
Land ownership and contact details	
Landowner	Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Tonkin Highway interchange, Wattle Grove
Latitude and longitude or Easting northing	Approx. -32.007348, 115.996722
Wetland details	
Name	Unknown
UFI	15021
Hill et al. (1996) map sheet number and wetland ID number (WIN)	Sheet 2033 I NE, WIN 40515645827
Consanguineous suite	Mungala
Area (ha) of wetland	1.543
Area (ha) subject to this evaluation	0-10 ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Conservation
Wetland type (see table below)	Palusplain

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Intermittent inundation	Playa*	Barlkarra*	-	-	Wadi*
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

5.2 Desktop evaluation

Land uses	
Current ownership of wetland:	Main Roads Western Australia
Current land use	Vegetated land within road reserve
Past land use:	Welshpool Road East has been a road since at least 1953. Review of historical aerial imagery indicates that surrounding land appears to have been a mixture of bushland and potentially rural land use interspersed with tracks.
Surrounding land use:	Rural, semi-industrial and to the south-west Nature Reserve, some surrounding land zoned for parks and recreation
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Significance	**Y/N**
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	N
Swan Bioplan (Environmental Protection Authority 2010)	N
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: n/a	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Direct sighting: recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. Suitable black cockatoo foraging habitat exists within the mapped geomorphic wetland boundary although it is of degraded fauna habitat condition. Several potential breeding trees exist within boundary	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Diggings recorded at Tonkin Highway/Welshpool Road East interchange (-31.998220, 115.995226) – outside of wetland boundary. Site provides suitable habitat although it is in a degraded fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value

List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.

Scientific, geoheritage or geoconservation values	Significance and observations	Source of information (e.g. observatory, literature, DPaW, WA Museum)

Flora

Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:

Flora		
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**
Pristine		
Excellent		
Very Good		
Good		
Degraded	Approx. 100%	Approx. 10%
Completely Degraded	Approx. 0%	Approx. 90%
Using this information, is the wetland dominated by vegetation in a good or better condition:		No
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Southern River Complex
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Southern River Complex: 10-30 %

List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:

Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Not within wetland boundary – approx.. 1.2km away	DPaW database search results AECOM Biological Survey 2014
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	DPaW TEC buffer occurs partially within wetland boundary, however, vegetation survey undertaken in 2014 identified that this TEC does not occur within the surveyed area	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Not within wetland boundary – at least 1.1km to south of wetland boundary at its closest point	DPaW database search results AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Not within wetland boundary – approx. 1.2km away	DPaW database search results AECOM Biological Survey 2014

List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:

Flora				
Species	**Significance (e.g. Declared Rare, Priority 1)**	**Population measure (number, single record, abundance comment)**	**Observations (e.g. habitat type, flowering season)**	**Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)**
Grevillea thelemanniana subsp. *thelemanniana*	P2		Approx. 400 m to the south-west of the wetland boundary	DPaW
Conospermum undulatum	Threatened - Vulnerable		Approx. 200 m to the to the south-east of the wetland boundary	DPaW
Verticordia lindleyi subsp. *lindleyi*	P4		Approx. 500 m to the north of the wetland boundary	WA Herbarium

Representativeness	
Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:	
	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	3.8
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	4.1
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

5.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural	

No.	Criteria	Y/N
	values under one or more of the following: - *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6* - *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	 N N N N N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	Y
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 N N N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 N N N N

5.4 Secondary evaluation

Plate 3 **UFI 15021 representative photographs**

No.	General criteria	Criteria	Score
Geomorphology			
1	*Representativeness*	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H
5	*Naturalness*	Alteration to the wetland's geomorphology by % area: < 25% altered	**H**

No.	General criteria	Criteria	Score
		25-75% altered > 75% altered.	I L
6	*Scarcity*	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
Wetland processes			
8	*Representativeness*	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	H I L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H
10	*Naturalness*	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	H I L
11	*Scarcity*	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
Linkages			
12	*Representativeness*	The wetland is a hydrological link in a larger or more complex and intact system.	H
13	*Naturalness*	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or	H I

No.	General criteria	Criteria	Score
		highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	L
14	*Scarcity*	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
Habitats			
15	*Representativeness*	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	*Naturalness*	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	H **I** L
19	*Scarcity*	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H
Flora			
20	*Representativeness*	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	H **I** L
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	**H** **19.69%** I
22	*Naturalness*	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	 H I **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land	H I

No.	General criteria	Criteria	Score
		dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	 **L**
24	*Scarcity*	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	H
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	I
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
Fauna			
28	*Representativeness*	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	H **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H **I**
30	*Naturalness*	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	H **I**
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L
32	*Scarcity*	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. *EPBC Act 1999*, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the *Wildlife Conservation Act 1950*).	H
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	H
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
Cultural			
36	*Representativeness*	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H

No.	General criteria	Criteria	Score
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	I
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant. The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	I L
Scientific and educational			
42	*Representativeness*	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics. The wetland has the potential to be used as a study or research site.	H I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

Attributes/functions /values	Scores		
	High	Intermediate	Low
Geomorphology	4		
Wetland processes		2	
Linkages		1	
Habitats		1	
Flora	1	1	2
Fauna		3	
Cultural			
Scientific and educational			
Total Score	5	8	2
Defining attributes/ functions/values	Rehabilitation potential		
Applicable management category	Geomorphology		

6.0 UFI 15116 Wetlands Assessment

6.1 General information

Assessor details	
Name	L. Chappell (supplemented by L. Van Gorp and F de Wit)
Date(s) of site visit	Oct 2014 and 30 Sep 2015
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	
Land ownership and contact details	
Landowner	Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Kelvin Road interchange, Maddington
Latitude and longitude or Easting northing	Approx. -32.030078, 116.003982
Wetland details	
Name	Unknown
UFI	15116
Hill et al. (1996) map sheet number and wetland ID number (WIN)	2133 IV NW, WIN 40578645569
Consanguineous suite	Mungala
Area (ha) subject to this evaluation	0-10 ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Multiple Use
Wetland type (see table below)	Palusplain

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*
Intermittent inundation	Playa*	Barlkarra*	-	-	Wadi*

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

6.2 Desktop evaluation

Land uses	
Current ownership of wetland:	Main Roads Western Australia
Current land use	Vegetated land within road reserve
Past land use:	Review of historical aerial imagery suggests that the site has previously been cleared at some stage more than 60 years ago. The existing Clifford Street, Kelvin Road and tracks that bisect the area have been there since at least 1953. Surrounding land appears to have been primarily used for rural land uses.
Surrounding land use:	Immediately surrounding the site is bushland that forms part of Conservation Category Wetland (UFI 15115). Adjacent to this are roadways, rural and industrial land uses. Further to the west, there are urban land uses and to the north-west there are several nature reserves.
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Significance	**Y/N**
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	Y
Swan Bioplan (Environmental Protection Authority 2010)	N

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: yes, presence of TECs and significant flora (i.e. *Conospermum undulatum)*	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Suitable black cockatoo foraging habitat exists within proximity to the surveyed section, in good to very good fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Tracks recorded at Tonkin Highway/Kelvin Road interchange (-32.030490, 116.004498) in close proximity to wetland. Site provides suitable habitat in good to very good fauna habitat condition.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Rainbow Bee-eater	EPBC Act and WC Act Migratory Species	Rainbow Bee-eater calls recorded in proximity to the assessed site (at -32.028283, 116.003604). Suitable habitat likely to occur within and in close proximity to the assessed wetland area.	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value

List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.

Scientific, geoheritage or geoconservation values	Significance and observations	Source of information (e.g. observatory, literature, DPaW, WA Museum)

Flora			
Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:			
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**	
Pristine			
Excellent			
Very Good	Approx. 100%	Approx. 100%	
Good			
Degraded			
Completely Degraded			
Using this information, is the wetland dominated by vegetation in a good or better condition:		Yes	
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Partially Guildford Complex and partially Forrestfield Complex	
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Guildford Complex: <10 % Forrestfield Complex: 10-30 %	
List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:			
Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Located in close proximity to the wetland	DPaW database search and Wetlands branch results, AECOM Biological Survey 2014
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	Not within wetland boundary – at least 2.5 km away from the interchange.	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Occurs within or immediately adjacent to wetland boundary	DPaW database search and Wetlands branch results, AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Occurs within or immediately adjacent to wetland boundary	DPaW database search and Wetlands branch results, AECOM Biological Survey 2014
List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:			

Flora				
Species	**Significance (e.g. Declared Rare, Priority 1)**	**Population measure (number, single record, abundance comment)**	**Observations (e.g. habitat type, flowering season)**	**Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)**
Isopogon drummondii	P3		Located in close proximity to wetland boundary – approx. 100 m away	AECOM survey 2014 and follow up wetland assessment 2014
Conospermum undulatum	Threatened - Vulnerable		Located within and/or immediately adjacent to wetland boundary	DPaW, AECOM survey 2014 and follow up wetland assessment 2014

Representativeness	
Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:	
	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	3.8
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	4.1
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

6.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following:	

No.	Criteria	Y/N
	- *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6* - *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	N N N N Y
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	Y
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 Y N Y
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	Y
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 Y N Y N

6.4 Secondary evaluation

The evaluation was conducted for a small portion of UFI 15116.

Plate 4 **UFI 15116 representative photographs**

No.	General criteria	Criteria	Score
Geomorphology			
1	*Representativeness*	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H

No.	General criteria	Criteria	Score
5	*Naturalness*	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 **H** I L
6	*Scarcity*	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
Wetland processes			
8	*Representativeness*	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	**H** I L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H
10	*Naturalness*	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	**H** I L
11	*Scarcity*	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
Linkages			
12	*Representativeness*	The wetland is a hydrological link in a larger or more complex and intact system.	H
13	*Naturalness*	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or	H **I**

No.	General criteria	Criteria	Score
		highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	L
14	*Scarcity*	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
Habitats			
15	*Representativeness*	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	**H**
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	*Naturalness*	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	**H** I L
19	*Scarcity*	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	**H**
Flora			
20	*Representativeness*	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	**H** I L
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	**H** **5.87%** I
22	*Naturalness*	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	**H** I L
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land	**H** I

No.	General criteria	Criteria	Score
		dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	 L
24	*Scarcity*	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	**H**
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	I
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	**H**
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
Fauna			
28	*Representativeness*	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	**H** I
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H **I**
30	*Naturalness*	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	**H** I
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L
32	*Scarcity*	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. *EPBC Act 1999*, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the *Wildlife Conservation Act 1950*).	**H**
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	**H**
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	**H**
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
Cultural			
36	*Representativeness*	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H

No.	General criteria	Criteria	Score
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	I
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant. The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	I L
Scientific and educational			
42	*Representativeness*	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics. The wetland has the potential to be used as a study or research site.	H I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

Attributes/functions /values	Scores		
	High	Intermediate	Low
Geomorphology	4		
Wetland processes	2		
Linkages		1	
Habitats	3		
Flora	6		
Fauna	5	1	
Cultural		2	
Scientific and educational		1	
Total Score	20	5	
Defining attributes/ functions/values	Conservation		
Applicable management category	Flora		

7.0 UFI 15257 Wetlands Assessment

7.1 General information

Assessor details	
Name	L. Chappell (supplemented by L. Van Gorp)
Date(s) of site visit	Oct 2014
Company	AECOM
Contact number	08 6208 0203
Email address	Lyn.vangorp@aecom.com
Weather during visit	
Land ownership and contact details	
Landowner	Partially Main Roads Western Australia
Land manager (if different to owner)	
Consultant (if applicable)	AECOM
Contact for site visit	
Landowner permission received for site access	Yes
Property details	
Location (lot/street/suburb)	Welshpool Rd East and Tonkin Highway interchange, Wattle Grove
Latitude and longitude or Easting northing	Approx. -32.007909, 115.997438
Wetland details	
Name	Unknown
UFI	15257
Hill et al. (1996) map sheet number and wetland ID number (WIN)	Sheet 2033 I NE, WIN 400436645765
Consanguineous suite	Mungala
Area (ha) subject to this evaluation	>100ha
Is wetland being assessed as a portion of a wetland with varying degrees of value?	Yes
Mapped management category	Rehabilitation Potential/Resource Enhancement
Wetland type (see table below)	Palusplain

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
Permanent inundation	Lake	-	-	-	River*
Seasonal inundation	Sumpland	Floodplain*	-	-	Creek*
Intermittent	Playa*	Barlkarra*	-	-	Wadi*

Water permanence	Host landform				
	Basin	Flat	Slope	Highland	Channel
inundation					
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont*	Trough*

*Wetland types not applicable to this evaluation methodology.

7.2 Desktop evaluation

Land uses	
Current ownership of wetland:	Partially Main Roads Western Australia
Current land use	Partially Main Roads road reserve and road verge (partially vegetated but largely previously cleared), partially existing roadway
Past land use:	Welshpool Road East has been a road since at least 1953. Review of historical aerial imagery indicates that surrounding land appears to have been a mixture of bushland and potentially rural land use interspersed with tracks.
Surrounding land use:	Rural and to the west Nature Reserve, some parks and recreation
Existing management:	No known management
Fire history/regime:	No evidence of recent fire

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Significance	**Y/N**
Ramsar Convention on Wetlands (Ramsar 1971)	N
Directory of Important Wetlands in Australia (Environment Australia 2001)	N
Register of National Estate (Commonwealth of Australia 2007)	N
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	n/a
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	N
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	N
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost et al. 1987)	N
Bush Forever (Government of Western Australia 2000)	N
Swan Bioplan (Environmental Protection Authority 2010)	N
Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	N
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	N

International, national or regional significance	
Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.	
Conservation Estate (e.g. National Park, Nature Reserve, A Class Reserve)	N (but adjacent to A Class Reserve R50529/ Kenwick Wetlands Nature Reserve)
Other (list):	
Does the wetland retain the values for which it was originally registered or listed, describe: n/a	

Fauna

Note the presence (recorded or observed) or evidence of fauna in or surrounding the wetland which is listed by the Commonwealth (e.g. Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA) or State (e.g. Threatened or Specially Protected Fauna under the Wildlife Conservation Act 1950) or Priority Fauna or Priority or Threatened Ecological Communities related to fauna which are listed by DPaW.

Species / name of ecological community	Significance (e.g. EPBC Act, CAMBA)	Observations (e.g. population size, age, evidence, activities, habitat requirements)	Source of information (e.g. observatory, literature, DPaW, WA Museum)
Forest Red-tailed Black Cockatoo	Threatened (WC Act and EPBC Act)	Direct sighting: recorded flying over the Tonkin Highway/Welshpool Road East interchange in a flock of approximately twelve individuals. Some suitable black cockatoo foraging habitat exists within the mapped geomorphic wetland boundary although it is of degraded to completely degraded fauna habitat condition	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.
Southern Brown Bandicoot	DPaW Priority	Diggings recorded at Tonkin Highway/Welshpool Road East interchange (-31.998220, 115.995226) – outside of wetland boundary. Very small amount of suitable habitat (degraded) potentially located in the southern portion of the site	Field observations as part of Level 1 Fauna survey undertaken for the project, 2014.

Scientific value		
List any scientific values including geoheritage or geoconservation values (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations) that the wetland may contain.		
Scientific, geoheritage or geoconservation values	**Significance and observations**	**Source of information (e.g. observatory, literature, DPaW, WA Museum)**

Flora			
Use aerial photography and a site visit to determine and confirm the condition of the vegetation within and 50 metres surrounding the wetland. Using the scale outlined in Appendix B, display the locations of the vegetation conditions in the attached map and calculate their total area:			
Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**	
Pristine			
Excellent			
Very Good			
Good			
Degraded	Approx. 10%	Approx. 10%	
Completely Degraded	Approx. 90%	Approx. 90%	
Using this information, is the wetland dominated by vegetation in a good or better condition:		No	
What vegetation complex (Heddle et al. 1980) does the wetland belong to:		Primarily Southern River Complex. Very small portion at southern tip is in Guildford Complex	
Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain		Southern River Complex: 10-30 % Guildford Complex: < 10 % (Local Biodiversity Program 2013)	
List any occurrences of Priority and Threatened Ecological Communities related to flora and wetland systems which are known to occur within and 5 kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map:			
Name of ecological community	**Significance (e.g. priority, threatened)**	**Observations (e.g. condition, area, habitat type)**	**Source of information (e.g. observatory, literature, DPaW)**
SCP3b – Corymbia calophylla – Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	State (Vulnerable)	Not within wetland boundary – approx.. 1.2km away	DPaW database search results AECOM Biological Survey 2014

Flora			
SCP10a - Shrublands on dry clay flats	Commonwealth – Critically Endangered State: Endangered	DPaW TEC buffer occurs partially within wetland boundary, however, vegetation survey undertaken in 2014 identified that this TEC does not occur within the surveyed area	DPaW database search results AECOM Biological Survey 2014
SCP20a - Banksia attenuata woodland over species rich dense scrublands	State – Endangered	Not within wetland boundary – approx. 500 m to north of wetland boundary at its closest point	DPaW database search results AECOM Biological Survey 2014
SCP20c - Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Commonwealth – Endangered State – Critically Endangered	Not within wetland boundary – approx. 1.2km away	DPaW database search results AECOM Biological Survey 2014

List any occurrences of Declared Rare flora or Priority flora known to occur within and 1 kilometre surrounding the wetland and display their location in the attached map:

Species	Significance (e.g. Declared Rare, Priority 1)	Population measure (number, single record, abundance comment)	Observations (e.g. habitat type, flowering season)	Source of information (e.g., literature, DPaW, surveyed population, Herbarium record)
Grevillea thelemanniana subsp. *thelemanniana*	P2		Approx. 145 m to the to the west of the wetland boundary	DPaW
Conospermum undulatum	Threatened - Vulnerable		Within or just adjacent to boundary of wetland (but not within area being mapped)	DPaW
Verticordia lindleyi subsp. *lindleyi*	P4		At least 700m to the north of the wetland boundary	WA Herbarium

Representativeness

Using the wetlands data outlined in section 4.3, Appendix D and available on DPaW's website record the corresponding area:

	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain	3.8
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category	10.2

Representativeness	
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category	4.1
Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):	N

7.3 Preliminary evaluation

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: - The Ramsar Convention on Wetlands - State government endorsed candidate sites for the Ramsar Convention on Wetlands - Directory of Important Wetlands in Australia - National Heritage List - Or equivalent.	 N N N N N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: - *Conservation Reserves for Western Australia Systems* 1, 2, 3, 5 - *Conservation Reserves for Western Australia, The Darling System – System 6* - *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* - *The Environmental Significance of Wetlands in the Perth to Bunbury Region* - *Bush Forever, Swan Bioplan or equivalent.*	 N N N N N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	N
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: - An occurrence of a Threatened Ecological Community - A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community - A confirmed occurrence of a Declared Rare (Threatened) flora species.	 N N N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N

No.	Criteria	Y/N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: - ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) - ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) - ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) - best representative of its type within its consanguineous suite domain.	 N N N N

7.4 Secondary evaluation

No secondary evaluation was completed for this wetland. The wetland within the project area is predominantly located within road reserve and is completely devoid of native vegetation.