Main Roads Western Australia

Environmental Impact Assessment Report: Tonkin Highway Extension – Thomas Road to South Western Highway

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1. Summary

1.1 Project information

Project title: Tonkin Highway Extension – Thomas Road to South Western Highway.

Project location(s): Tonkin Highway (H017) -, Shire of Serpentine Jarrahdale, WA.

Project purpose / components:

Main Roads Western Australia (Main Roads) are proposing to extend Tonkin Highway from Thomas Road in Oakford, to South Western Highway in Mundijong (the Project). The Project will improve freight efficiency, connectivity and travel time within the existing network by relieving congestion pressure and improve road safety for all users.

The Project footprint comprises a total development area of 409 ha. The preliminary concept includes:

- approximately 14 kilometres of four lane dual carriageway (with future allowance for six lanes) from Thomas Road to South Western Highway;
- construction/upgrades to intersections at Thomas Road, Orton Road, Mundijong Road and South Western Highway (allowing for ultimate design of grade separated interchanges); and
- a grade separated interchange at Bishop Road catering for the Perth to Bunbury rail line and any future freight rail realignment at Mundijong.

Area proposed to be cleared: 258 ha Project area consisting of 25.2 ha of native vegetation.

Temporary clearing required: None

1.2 Impacts to key environmental aspects

The following impacts to key environmental aspects were identified during this assessment:

1. Flora and Vegetation
    a. The Project area is likely to contain vegetation associated with Threatened Ecological Communities (TECs), of which one is listed as Critically Endangered, and Threatened or Priority flora species;
    b. The Project area exists in an extensively cleared local landscape. There is potential that some of the vegetation being impacted is considered significant as remnant vegetation in an extensively cleared landscape;
    c. The Project has the potential to impact vegetation associated with Conservation Category Wetlands (CCW). This may be a potential significant environmental constraint;
    d. The Project has the potential to impact on riparian vegetation associated with the Mandejal Brook;
    e. The Project has the potential to impact threatened flora species *Synaphea* sp. Serpentine and *Synaphea* sp. Pinjarra Plain.
2. Terrestrial Fauna
    a. The Project has the potential to impact Black Cockatoo species through the removal of up to 351 suitable diameter at breast height (DBH) trees and up 33 ha of foraging habitat.

3. Surface water/ drainage

    a. The Project is within the Birriga Main Drain catchment. This drain, which is 7 km west of the DE, is fed by several tributaries which intersect the Project area, including the Mandejal, Cardup and Beenyup Brooks and the Oaklands Creek. The Birriga Main Drain feeds into the Serpentine River. Investigations may be required to determine the potential impacts to surface flows and drainage due to the Project.

A separate referral under the Department of the Environment and Energy (DEE) will be required for the Project due to impacts upon Matters of National Environmental Significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), specifically:

- *Corymbia calophylla – Kingia australis* woodlands on heavy soils threatened ecological community (TEC); EPBC Act listed 'Endangered';
- Clay Pans of the Swan Coastal Plain threatened ecological community (TEC); EPBC Act listed 'Critically Endangered';
- *Synaphea* sp. Serpentine – Critically Endangered;
- *Synaphea* sp. Pinjarra Plain – Endangered;
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) – EPBC Act listed 'Vulnerable';
- *Calyptorhynchus baudinii* (Baudin's Cockatoo) – EPBC Act listed 'Endangered'; and
- *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) – EPBC Act listed 'Endangered'.

1.3 Key environmental management actions

Project specific environmental management actions will be developed to manage all impacts and will be contained within an Environmental Management Plan (EMP). Standard project management actions (e.g. record keeping and monitoring project implementation) will be implemented for the Project. Further details are provided in the EMP.

1.4 Approvals strategy

The approvals strategy for this project is provided in Table 1.1.

Table 1.1: Approvals strategy

Approval type	Applicable	Approval / Reference number
State-wide CPS 818	N/A	
State-wide CPS 817	N/A	
Project Specific Clearing Permit	N/A	
Exemption	Yes	The project is exempt from requiring a clearing permit under Schedule 6 of the EP Act as it was referred under Section 38 of Part IV of the EP Act and has been formally assessed by the Environmental Protection Authority (EPA).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Yes	An EPBC Act referral is currently in preparation for the project.
Environmental Protection Act 1986 (EP Act) – Part IV: Referral of Proposals to the Environmental Protection Authority (EPA) (Section 38)	Yes	Ministerial Statement 595 issued June 2002.
Environmental Protection Act 1986 (EP Act) – Part V: Works Approval and Licences	N/A	
Bed and Banks Permit under the *Rights in Water and Irrigation Act 1999* (RIWI Act)		
Section 18 under the *Aboriginal Heritage Act 1972*		

2. Introduction

This report has been prepared to identify the primary environmental and social impacts associated with the proposed Main Roads Western Australia (Main Roads) extension of the Tonkin Highway from Thomas Road in Oakford, to South Western Highway in Mundijong (hereafter referred to as 'the Project').

The aim of the Environmental Impact Assessment (EIA) is to identify potential environmental constraints relevant to the Project. The EIA involved:

- a desktop analysis of environmental aspects and impacts;
- presenting the outcomes of biological surveys including:
    - Tonkin Highway Extension (Thomas Road to South Western Highway) Reconnaissance flora and vegetation survey – Woodman Environmental, 2019;
    - Mundijong Road Spring Flora Survey – Ecological, 2019;
    - Level 1 fauna survey – Bamford and Associates, 2019 (under development);
    - Black Cockatoo Breeding, feeding and Roosting Habitat Assessment, Tonkin Highway Extension – Tony Kirkby, 2019; and
- identifying areas of environmental significance.

This EIA report includes information and level of detail on:

- the Project;
- methodology;
- stakeholder consultation;
- methodology;
- assessment of native vegetation clearing;
- assessment of Commonwealth Matters of National Environmental Significance (MNES);
- environmental management;
- summary of the assessment; and
- recommendations for further surveys and assessment.

3. Project description

Main Roads Western Australia (Main Roads) are proposing to extend Tonkin Highway from Thomas Road in Oakford, to South Western Highway in Mundijong. The Project area is shown in Figure 1. The Project will improve freight efficiency, connectivity and travel time within the existing network by relieving congestion pressure and improve road safety for all users.

The decision to extend Tonkin Highway was included in the former State Government's Transform WA major capital works program. This announcement, made in early 1998, represented a significant commitment to address growing heavy freight movements affecting the local governments of Gosnells, Armadale and Serpentine-Jarrahdale. The Project will provide a bypass around the urban areas of Kelmscott, Armadale, Byford and Mundijong to reduce the volume of heavy traffic in these areas.

In December 2000, Main Roads Western Australia (Main Roads) referred a Project to the Environmental Protection Authority (EPA) to construct the Tonkin Highway Extension, pursuant to Section 38 of the EP Act, from which the EPA set a level of assessment of Public Environmental Review (PER), with a Ministerial Statement 595 issued in June 2002.

The preliminary concept includes:

- approximately 14 kilometres of six lane dual carriageway from Thomas Road to South Western Highway;
- construction/upgrades to intersections at Thomas Road, Orton Road, Mundijong Road and South Western Highway; and
- a grade separated interchange at Bishop Road, catering for any future freight rail realignment at Mundijong.

The Project comprises of the construction of the following:

- all road pavements;
- drainage basins;
- drains;
- medians;
- ‘at grade' intersections;
- 'grade separated' interchanges;
- associated earth works;
- dual use paths;
- bridges;
- culverts;
- lighting and noise barriers;
- under passes;
- over passes; and
- landscaping and rehabilitation work.

3.1 Project location

The Project is situated approximately 30 km south east of Perth and 4.3 km west of the existing South Western Highway (Figure 1). The South Western Highway is the major north-south road in the South East Corridor for long distance traffic including heavy trucks. The Project extends 32 km and consists of construction of a six-lane highway from Mills Road West to Mundijong Road and six lanes from Mundijong Road to the South Western Highway.

3.2 Local and regional context

The Project footprint traverses the Shire of Serpentine-Jarrahdale Local Government Area (LGA) on the Swan Coastal Plain in Western Australia. The Swan Coastal Plain lies in the south-west portion of the southern Bassian zoogeographic region (Serventy & Whittell, 1976) and in the Darling Botanical District of the mesic South-West Botanical Province (Beard, 1981). The Swan Coastal Plain consists of several geomorphological elements, these are from west to east the Quindalup Dunes, Spearwood Dunes and Bassendean Dunes, occurring in bands roughly parallel to the coast. Further inland and approaching the base of the Darling Scarp these sediments merge into the Pinjarra Plain, with the Ridge Hill Shelf at the edge of the hills.

The majority of the Project area traverses areas of the Pinjarra Plain geomorphological unit. This landform is primarily of alluvial origin, with primarily clay soils with sand (GoWA, 2000). A portion of the road reserve extends into the eastern edge of the Bassendean Dune system, near to Forrestdale Lake. Bassendean dunes tend to be gently undulating, made up of well-bleached white-grey sands (GoWA, 2000).

4. Methodology

4.1 Preliminary desktop study

A desktop assessment of the Project area and potential environmental constraints relevant to the Project was undertaken by viewing ArcGIS shapefiles and reviewing government agency managed databases. A site visit was also undertaken to gain context regarding the receiving environment.

Database searches were undertaken to generate a list of vascular flora and vertebrate fauna previously recorded within, and nearby the Project area with an emphasis on species of conservation significance and introduced species. Five database searches were conducted within a 5 km buffer around a centre point (Table 4.1) (Figure 2).

Table 4.1: Database searches undertaken

Custodian	Database	Taxonomic group	Reference	Buffer (km)
DEE	EPBC Act Protected Matters Search Tool (PMST (Appendix 1).	Flora, Vegetation and Fauna	DoEE 2019b	5
DBCA	NatureMap	Flora and Fauna	DBCA 2007-2019	5
DBCA	DBCA Threatened and Priority flora	Flora, Vegetation	DBCA 2019	5
DBCA	DBCA Threatened and Priority fauna	Fauna	DBCA 2019	5
DBCA	Threatened and Priority Ecological Communities	Flora, Vegetation	DBCA 2019	5

In addition to the above, the Tonkin Highway Extension PER submitted to the EPA (Main Roads, 2001) was reviewed to provide further historical context to environmental and social aspects and impacts associated with the Project.

Further details regarding the outcome of the assessment are provided in Section 5.

4.2 Likelihood of occurrence

A likelihood of occurrence assessment was undertaken to identify conservation significant species that possibly occur within the survey area, identified from a review of key datasets and literature, as specified in Section 4.1 above. Table 4.2 outlines the criteria which were used to assess likelihood of occurrence for conservation significant species.

Table 4.2: Likelihood of occurrence criteria

Likelihood	Description of likelihood criteria
Recorded	The species has previously been recorded within survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
Likely	The species has not previously been recorded from within the survey area. However, to qualify requires one or more of the following criteria to be met: • the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area; and/or • core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally (for example, it may be there are seasonal wetlands present).
Potential	The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met): • targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area; • the survey area has been assessed as having potentially suitable habitat through habitat modelling; • the species is known to be cryptic and may not have been detected despite extensive surveys; • the species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met): • doubt remains over taxonomic identification;

Likelihood	Description of likelihood criteria
	• or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution); and/or • coordinates are doubtful.
Unlikely	One or more of the following criteria is required to be met: • the species has been recorded locally through database searches. However, it has not been recorded within the survey area and it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded; • the species is unlikely to occur due to few historic record/s and no other current collections in the local area; • the species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through database searches; and • the species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
Does not occur	One or more of the following criteria is required to be met: • the species is not known to occur within the IBRA bioregion based on current literature and distribution; • the conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat; • the survey area lacks important habitat for a species that has highly selective habitat requirements; and • the species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing.

4.3 Terrestrial surveys

Biological surveys undertaken and reviewed during the desktop assessment for this EIA are detailed below.

4.3.1 Terrestrial fauna surveys

Terrestrial fauna surveys undertaken include:

- A Level 1 fauna survey of the Project area (Bamford, 2019) is underway in accordance with the *EPA Technical Guidance Statement - Terrestrial fauna surveys* (2004) to identify the potential impacts to fauna and Threatened terrestrial fauna species listed as Threatened under the Commonwealth EPBC Act or the State *Biodiversity Conservation Act 2016* (BC Act); and
- A Black Cockatoo Breeding, feeding and Roosting Habitat Assessment was undertaken throughout the Project area by Tony Kirkby (Kirkby, 2019).

Further details regarding the outcome of the assessment are provided in Section 5.

4.3.2 Terrestrial flora surveys

Terrestrial flora surveys undertaken include:

- Reconnaissance flora and vegetation survey completed by Woodman Environmental (Woodman, 2019); and
- A targeted survey, undertaken by Ecological, for conservation significant flora species listed under the Commonwealth EPBC Act and/or the State BC Act within the Mundijong Road reserve, where it intersects the Project area (Eco, Logical 2019).

Additional flora and vegetation surveys are being carried out in Spring 2019 to further develop understanding of threatened flora and ecological community extents within the Project area and within the local region. This report is expected in early 2020.

4.4 State referral

No State referral is required as the Project has previously been assessed and approved under Part IV of the EP Act, with Ministerial Statement 595 issued in June 2002.

4.5 Commonwealth referral

The decision whether to refer the Project to the Commonwealth Department of the Environment and Energy (DoEE) was based upon whether the Project may have a significant impact upon MNES, which are protected under the EPBC Act. These include; World Heritage properties, National Heritage places, wetlands of international importance (listed under the Ramsar convention), Commonwealth land or marine areas, migratory species protected under international agreements, nuclear actions, nationally threatened species and ecological communities and water resources.

The DoEE Protected Matters Search Tool (PMST) and targeted terrestrial flora and vegetation and fauna surveys were used to determine whether the Project will have a significant impact upon MNES (DoEE, 2019b).

An evaluation of the potential impacts that the Project may have on key environmental aspects is discussed in detail in Section 5.

5. Assessment of aspects and impacts

5.1 Aspects and impacts

Table 5.1 is an evaluation of the potential impacts that the Project may have on environmental aspects.

Table 5.1: Assessment of aspects and impacts

Aspect	Evaluation of Impacts
Aboriginal Heritage	A search of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Search was undertaken (Appendix B). The Project area intersects with five Aboriginal Heritage sites recognised under Section 5 of the Aboriginal Heritage Act 1972 (Figure 14): • Place ID 448 'South-East Corridor 01'; • Place ID 449 'South-East Corridor 02'; • Place ID 450 'South-East Corridor 03'; • Place ID 18187 'Tonkin Highway – Mundijong Road scatter # 11'; and • Place ID 18188 'Tonkin Highway – Mundijong Road scatter # 12'. There are eight 'Other Heritage Places' mapped within the Project area, four of which have been assessed as not meeting the definition of an Aboriginal heritage site as defined in Section 5 of the *Aboriginal Heritage Act* 1972: • Place ID 24991; • Place ID16108; • Place ID 18189; and • Place ID 17923. Information has been received for the remaining four 'Other Heritage Places' (Place ID 23919, 32616, 37117 and 32617) however these have not yet been assessed to determine if they meet the definition of an Aboriginal Heritage site. There is potential that the Project may impact on Registered Heritage Sites, therefore consultation with the South West Aboriginal Land and Sea Council (SWALSC) regarding the Project will be required. A project specific heritage survey is likely to be required to determine presence of any significant aboriginal heritage values. Potential impacts will be managed and mitigated through actions contained within the CEMP. The proposed action will require approval pursuant to Section 18 of the Aboriginal Heritage Act 1972.
Acid Sulphate Soils	The Australian Soil Resource Information System (ASRIS) database indicates that the Project area intersects areas of potential acid sulfate soils (PASS) with a 'moderate to low' risk of acid sulfate soil (ASS) (Figure 12) occurring within 3 m of natural soil surface (ASRIS, 2019). Further investigations will be required prior to dewatering and excavating activities. Potential impacts will be managed through the implementation of the CEMP.
Air quality	The proposed project construction activities are unlikely to cause significant impacts to air quality, however the Project will result in minor air (dust) emissions during construction.

Aspect	Evaluation of Impacts
Contamination	Project activities are located within the road reserve and no known previous land use activities on or adjacent to the Project area have had the potential to create contamination. A search of ArcGIS shapefiles and DWER's contaminated sites database indicates there are no identified contaminated sites within the Project area.
Declared plants (weeds)	A total of 126 weed species were identified during the desktop assessment. Five taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), these include: • *Asparagus asparagoides* (Bridal Creeper); • *Echium plantagineum* (Paterson's Curse); • *Gomphocarpus fruticosus;* • *Moraea flaccida*; and • *Rubus ulmifolius.* The most significant disturbance stated by EcoLogical (2019) in the Mundijong Road reserve was the prevalence of weeds which have altered the natural structure of the remnant vegetation and displaced native species. EcoLogical (2019) found that introduced (weed) species represented almost one third of the total species recorded in the survey area with a total of 27 taxa recorded. Two species are Declared Pests listed under the BAM Act, specifically: • *Gomphocarpus fruticosus*; and • *Moraea flaccida*. One weed species recorded, **Asparagus asparagoides* is a Declared Pest listed under the BAM Act and listed by the Australian Government as a Weed of National Significance (WoNS). The Project has the potential to introduce or spread declared weeds within, or to areas outside of the Proposal area if not managed appropriately.
Dieback	The majority of the Project area is uninterpretable for Dieback as it contains cleared pastoral land and paddocks, however the presence and spread of Dieback is a potential risk given the Project area is in within part of a region that receives more than 400 mm of annual rainfall and is south of the 26th parallel of latitude (CALM, 2003). The Project has the potential to introduce or spread Dieback within, or to areas outside of the Project area. Impacts are most likely within vegetation along Mundijong Road and South West Highway. It is not anticipated that Dieback will be a significant constraint on the Project.
Dust	Dust during construction has the potential to cause nuisance impacts on nearby residential and commercial land uses. These impacts are not considered to be significant and will be managed through the implementation of an EMP and CEMP.
Groundwater	Given the relatively shallow water table within the Project area it is likely that dewatering will be required. Should construction dewatering require a Section 5C licence under the *Rights in Water and Irrigation Act 1914* (RIWI Act), then the potential impacts and mitigation associated with dewatering will be assessed by the Department of Water and Environmental Regulation (DWER) as part of the licence application. It is considered unlikely that there will be significant impacts to groundwater from the proposed re-alignment of the rail line. Any dewatering that is required will be temporary in nature and unlikely to significantly impact the hydrological regime of the local region. The Project is not within any Public Drinking Water Supply Areas.
Heritage (non-indigenous)	A search of the State Heritage Register (spatial database) determined that no State Registered Heritage Sites exist within the Project area. Shire of Serpentine-Jarrahdale Municipal Inventory has indicated that one known site of heritage significance is within the Project area (Figure 13). The site, Mandejal Brook (Number 8482) flows through the Project area, east to west between Bishop and Scott Road, this Brook is also classified as a Conservation Category Wetland (CCW).

Aspect	Evaluation of Impacts
	There is potential for moderate impacts to occur to vegetation associated with this Brook. The implementation of the Wetland Mitigation Strategy and CEMP will avoid any significant impacts.
Land Vesting	Much of land is zoned as 'Rural' under the Shire of Serpentine-Jarrahdale Town Planning Scheme No 2, with some small sections of mixed zoning throughout. The land within the Project area is road reserve owned by Main Roads and there will be no requirement for land acquisitions in order to construct the Project. Within the Metropolitan Region Scheme, the entire Project area is zoned as 'Primary Regional Road'.
Noise and vibration	Construction: "Regular" construction noise with the potential for out-of-hours works. Traffic noise: This proposal will have no impact on road traffic noise from Tonkin Highway. Vibration: Vibration is likely to be an issue for sensitive receivers adjacent to Tonkin Highway during construction works.
Reserves / Conservation areas	The Project area intersects two Bush Forever sites (Figure 6): • Site 360 – Mundijong and Watkins Road Bushland, Mundijong/Peel Estate (Site area 73.8 ha); and • Site 365 – Byford to Serpentine Rail/Road Reserves and Adjacent Bushland (Site area 33.1 ha). Two reserve areas were identified within proximity to the Project area: • Watkins Road Nature Reserve vested in Shire of Serpentine-Jarrahdale is located approximately 550 m north of the southern extent of the Project area; and • Cardup Nature reserve vested in the Conservation Commission is located approximately 800 m east of the of the Project area. Given the proximity of these reserves to the Project area and that clearing for the Project is restricted to the road reserve boundary, direct impacts to the surrounding reserves are unlikely. The Project area includes a section of the Mundijong Road Reserve, vested in Main Roads. The strip of vegetation occurring along Mundijong Road is recognised as a Bush Forever site and is recognised as a Regional Ecological Linkage. The Project has the potential to disrupt fauna movement within the local area, in particular to Watkins Road Nature Reserve. A development approval will be required for the works
Surface water/drainage	The Project area is located within both the Swan-Canning Catchment (Lower Canning and Southern River sub-catchments) and the upper Peel-Harvey Catchment. At the local scale, the Project area is within the Birriga Main Drain catchment. The drain, which is 7 km west of the Project area, is fed by several tributaries which intersect the Project area, including the Mandejal, Cardup and Beenyup Brooks and the Oaklands Creek. The Birriga Main Drain feeds into the Serpentine River (Figure 8). The Mandejal Brook is a perennial stream approximately 11.2 km in length, and initiates from Langford Park, flowing through Whitby Falls and the Mandejal Brook Reserve and discharges into Oaklands drain to the east, ultimately terminating within the Peel-Yalgorup system. The Project has the potential to impact on the riparian vegetation associated with the Mandejal Brook. Furthermore, the Project may also impact the flow of the Brook and disturb any potential aquatic habitat that is present. A drainage mitigation strategy is to be prepared as a requirement of Ministerial Statement 595 to ensure no significant impacts to surface occurs as a result of the Proposed Action.
Visual amenity	The proposed works will result in minor and short-term visual impacts during construction. The impact is considered to be insignificant given that the landform of the Project area is generally flat and low-lying, and the majority of the Project will fit in with existing topography and landform within a context of low to moderate scenic quality.

Aspect	Evaluation of Impacts
	Main Roads will incorporate mechanisms in order to address visual amenity impacts and management associated with the Project, including: • Screening; • Landscaping; • Revegetation; • consideration will be given to the appropriate use of materials; and • the use of low impact colour, texture and form within the design and construction.
Wetlands	A total of seven geomorphic wetlands intersect with the Project area (Figure 11), including: • Multiple Use Wetland 'Armadale Palusplain' (UFI 15797), palusplain; • Multiple Use Wetland (UFI 16021), palusplain; • Conservation Category Wetland 'Abernethy Road Bushland' (UFI 14495), palusplain; • Resource Enhancement Wetland (UFI 14540), creek; • Conservation Category Wetland (UFI 14945), palusplain; • Conservation Category Wetland (UFI 14817), palusplain; and • Conservation Category Wetland (UFI 14985), palusplain. The Project area will impact 208 ha of mapped geomorphic wetlands, comprising of: • 5.5 ha of Conservation Category Wetlands (CCW); • 202.3 ha of Multiple Use Wetlands; and • 0.26 ha of Resource Enhanced Wetlands. The CCW's within the Project area are relatively undisturbed wetlands that retain high ecological values. Resource Enhancement Wetlands are partly modified but still support substantial functions and attributes (EPA, 2008), and Multiple Use Wetlands are considered to have few attributes which still provide important wetland functions. In the case of Multiple Use Wetlands, management priorities should include reasonable measures are to be taken to retain the wetland's hydrological function and, where possible, other wetland functions (EPA, 2008). No other listed or CCWs occur within 1 km of the Project area. Two Wetlands of International Importance were identified from the PMST Report (Figure 10): • Forrestdale and Thomsons Lakes - together these lakes are a Ramsar wetland site; and • Peel-Yalgorup system. Forrestdale Lake and Thomsons Lake are located approximately 5 km and 13 km north-west of the Project area respectively. No wetlands of international importance will be impacted by the Project. Potential impacts to rivers and wetland areas include: • disturbances to hydrological function; • abstraction of surface or groundwater; • bank and soil erosion;

Aspect	Evaluation of Impacts
	• clearing riparian vegetation associated with bridge/culvert and road construction in the riparian zone; • clearing of existing vegetation where road works will occur; • importing of fill material to achieve appropriate levels for the road surface; • potential run off containing contaminants and pollutants into wetlands intersected by, or within close proximity to the Project area; and • severance where existing wetland remnants are crossed by the Proposal. The Project design and construction will minimise, where possible, impacts on wetlands through the implementation of the following measures: • Main Roads will prepare and implement a Wetland Mitigation Strategy which demonstrates a 'no net loss' response to mitigate the impacts on wetlands caused by the Proposal; • existing flow paths and volumes will be maintained through bridge and culvert design, and therefore impacts to hydrological function are not expected; • erosion and suspended material generation will be managed with a range of management measures to stabilise stream banks both during and after construction activities; and • loss of riparian vegetation will be minimised wherever possible and mitigated with the planting of appropriate species in riparian areas and channel banks. In addition, Ministerial Statement 595 requires the development of Construction Environmental Management Plan and Wetland Mitigation Strategy. The implementation of this Strategy along with the management actions contained within the CEMP will reduce the likelihood of significant impacts on wetlands within and adjacent to the Project area.
Vegetation	The reconnaissance flora and vegetation survey conducted by Woodman Environmental (2019) identified 13 vegetation units as intact vegetation, with a further 16 units comprising of highly disturbed vegetation or remnant ingenious trees within the DE. Five units of planted vegetation are also present within the Project area. A full summary of the vegetation units within the DE is provided within Table 12 of the Woodman (2019) report (Figure 3). 37.6 ha of vegetation exists within the Project area, consisting of: • 22.2 ha of native vegetation which ranges in condition from 'Completely Degraded' to 'Very Good' (Figure 4); • 3.4 ha of revegetated road reserve with *Corymbia calophylla, E. wandoo, E. marginata and E. rudis;* • 7.4 ha of planted non-indigenous *Eucalyptus* species; and • 4.6 ha of shelter belt plants consisting of non-indigenous *Eucalyptus* species and *Corymbia calophylla, E. wandoo, E. marginata and E. rudis.* The Project area comprises two Beard (1981) vegetation associations (VA), VA 968 and VA 3. There is respectively 32.02% and 67.76% of these vegetation associations remaining in the IBRA region. Native vegetation complexes as described by Heddle et al. (1980) within the Project area comprise: • Beermullah Complex – Mixture of low open forest of *Casuarina obesa* and open woodland of *Eucalyptus calophylla – E. wandoo – E. marginata*. Minor components include closed scrub of *Melaleuca* spp. and occurrence of *Actinostrobus pyramidalis;* • Guildford Complex – A mixture of open forest to tall open forest of *Eucalyptus calophylla – E. wandoo – E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis – Melaleuca rhaphiophylla*; • Forrestfield Complex – Vegetation ranges from open forest of *Eucalyptus calophylla – E. wandoo – E. marginata* to open forest of *E. marginata – E. calophylla – Allocasuarina fraseriana* – Banksia spp. Fringing woodland of *E. rudis* in the gullies that dissect this landform. The Project has potential to significantly impact on important remnants of native vegetation in a heavily cleared landscape. The Mundijong Road reserve and South West Highway, associated with Bushforever areas 360 and 365, serve as important linkages and support a number of threatened flora species and ecological communities.

Aspect	Evaluation of Impacts
Biodiversity	The desktop assessment determined that within the 5 km study area 18 conservation significant flora species were likely to occur. Field surveys determined that two threatened flora species were within the Project area (Figure 5). These are: • *Synaphea* sp. Serpentine – Critically Endangered; and • *Tetraria australiensis* – Vulnerable. One threatened flora species, *Synaphea* sp. Pinjarra Plain (Endangered), consisting of two individuals, were recorded within 20 m of the Project area. Further spring surveys are required to confirm the absence/presence of this species and potential numbers within the Project area. Six TECs, five of which are listed under the EPBC Act, were identified during the desktop assessment. These are: • Banksia Woodlands of the Swan Coastal Plain – BC Act (Priority 3) EPBC listed (Endangered); • *Banksia attenuata* and/or *Eucalyptus marginata* of the eastern side of the Swan Coastal Plain - BC Act (Endangered), EPBC listed (Endangered); • Clay Pans of the Swan Coastal Plain - BC Act (Vulnerable), EPBC listed (Critically Endangered); • *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain SCP3a TEC – BC Act (Critically Endangered) EPBC listed (Endangered); • *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain SCP3c TEC- BC Act (Critically Endangered) EPBC listed (Endangered); and Southern wet shrublands, Swan Coastal Plain - BC Act (Endangered). Two of these TECs were inferred as occurring within the Project area (Figure 5). Statistical analyses were inconclusive about the relationship of vegetation within the survey area to TECs mapped within and in proximity to the survey area. This was due to the degraded condition of the vegetation and high weed prevalence, leading to erroneous statistical outcomes (EcoLogical 2019): • Clay Pans of the Swan Coastal Plain - EPBC listed (Critically Endangered); and • *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain – EPBC listed (Endangered). The desktop assessment identified 17 conservation significant fauna species as potentially occurring within the Project area. Black Cockatoos were the only conservation significant species recorded within the Project area, specifically Forest Red-tailed Black Cockatoo and Baudin's Cockatoo. A habitat assessment for Black Cockatoos was undertaken by Kirkby (2019). This assessment determined that: • the Project will result in the clearing of up to 25.1 ha potential Black Cockatoo foraging habitat (Figure 7); • while no specific habitat quality assessment was undertaken, it is considered that due to overall degraded nature of vegetation within the Project area comprising of 20.7 ha of was assessed to be in a 'Completely Degraded' and 'Degraded' condition and the remaining 4.4 ha in 'Good' and 'Very Good' condition (Woodman 2019), that the majority of the mapped foraging habitat is of a 'Moderate' to 'Low' quality; • the vegetation within the Project area is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas; • approximately 351 suitable diameter at breast height (DBH) trees will be potentially impacted, of which 7 are considered to have suitable hollows present (Figure 8). No evidence of breeding was observed during the survey. Kirkby (2019) discusses that all suitable hollows were either being used by Galah's at the time or were of a smaller size suitable for small parrots; • no evidence or observations of night roosting was recorded within the Project area; removal of potential foraging habitat within the DE will not create a gap greater than 4 km between patches of Black Cockatoo habitat, with large patches occurring within 1 km to the east of the Project area. A further Fauna assessment will be completed to determine the Black Cockatoo habitat quality. The Project is likely to have a impact on threatened flora and ecological communities.

5.2 Assessment of vegetation clearing

5.2.1 Measures to avoid and minimise clearing

Impacts to vegetation will be minimised through the implementation of the following measures:

- the clearing area will be demarcated prior to the commencement of native vegetation clearing;
- refine Project footprint to avoid clearing as many potential cockatoo breeding trees as far as practicable;
- where possible vegetation will be pruned as opposed to removed;
- further project clearing will be avoided as the site office, materials storage areas, construction vehicles/machinery and access tracks will be located on previously disturbed or cleared areas; and
- development and implementation of a site-specific CEMP which will establish the following vegetation management actions including:
    - clearing and access control measures (such as demarcation of clearing boundaries);
    - weed and dieback management;
    - landscaping of earth-worked areas;
    - erosion and sediment control;
    - waste and fire management;
    - topsoil management;
    - dust control; and
    - tree and vegetation retention where possible.

The DE represents the maximum extent of disturbance for the Proposed Action. Where possible, vegetation and fauna habitat will be retained during detailed design and construction. The DE has been aligned where possible to minimise the impact on vegetation and will be further looking at opportunities to further reduce the footprint.

Options such as steepening batter slopes, reducing median widths, installation of safety barriers will be considered further during detailed design to minimise the clearing footprint. The laydown areas, stockpiles and access tracks will be constructed within existing cleared areas or within the permanent footprint of the works. No native vegetation will be cleared for temporary works outside of the permanent footprint.

The design of the interchange at Mundijong Road is still under consideration and may lead to a reduced impact on the significant flora along Mundijong Road. Further traffic modelling is required to determine the type of interchange required. Main Roads will continue to refine the design in this location in order to minimise the impact on TEC and threatened flora, whilst ensuring that the road design and layout is in accordance with modern safety in design standards.

5.2.2 Vegetation details

5.2.2.1 Regional Vegetation

The Project area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (Melaleuca) in swampy areas (Mitchell *et al*. 2002).

Vegetation occurring within the region was initially mapped at a broad scale (1: 1 000 000) by Beard during the 1970s. This dataset formed the basis of several regional mapping systems, including the biogeographical region dataset (IBRA) for Western Australia (GoWA, 2019), physiographic regions defined by Beard (1981), and System 6 Vegetation Complex mapping undertaken by Heddle *et al*. (1980).

The Project area comprises two Beard (1981) vegetation associations (VA), VA 968 and VA (Table 5.3). Most of the Project area is mapped as vegetation association 968 which is described as 'Medium woodland; jarrah, marri and wandoo', of which 6.62 % remains in the IBRA bioregion (GoWA, 2019), a small portion to the east is mapped as vegetation association 3 which is described as 'Medium forest: jarrah-marri' of which 18.14% remains in the IBRA region.

Table 5.2: Beard (1981) extent vegetation associations occurring in the Project Area

Pre-European Vegetation Association(s) in:	Pre–European extent (ha)	Current extent (ha)	Remaining (%)	% Remaining in DBCA reserves
Statewide Vegetation Association 968	296,877.84	95,048.82	32.02	57.64
IBRA Region Veg Association 968 in the IBRA Swan Coastal Plain Region	136,188.20	9017.32	6.62	21.61
Local Government Authority Vegetation association 968 within the Shire of Serpentine - Jarrahdale	24,351.49	1,121.13	4.6	12.49
Statewide Vegetation Association 3	2,661,404.62	1,803,437.48	67.76	81.5
IBRA Region Veg Association 3 in the IBRA Swan Coastal Plain Region	17,364.58	3,150.77	18.14	11.62
Local Government Authority Vegetation association 3 within the Shire of Serpentine - Jarrahdale	46,915.31	37,963.61	80.92	95.21

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. Native vegetation complexes as described by Heddle *et al.* (1980) within the Project area comprise:

- Beermullah Complex – Mixture of low open forest of *Casuarina obesa* and open woodland of *Eucalyptus calophylla – E. wandoo – E. marginata.* Minor components include closed scrub of *Melaleuca* spp. and occurrence of *Actinostrobus pyramidalis*;
- Guildford Complex – A mixture of open forest to tall open forest of *Eucalyptus calophylla – E. wandoo – E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis – Melaleuca rhaphiophylla*; and
- Forrestfield Complex – Vegetation ranges from open forest of *Eucalyptus calophylla* – E. *wandoo* – E. *marginata* to open forest of E. *marginata* – E. *calophylla – Allocasuarina fraseriana* – Banksia spp. Fringing woodland of E. *rudis* in the gullies that dissect this landform.

These complexes are below the minimum threshold of 10% target for the retention of vegetation complexes in constrained areas on the Swan Coastal Plain (EPA, 2000). The current remaining extent of these vegetation complexes (GoWA, 2019) are detailed in Table 5.4.

Table 5.3: Heddle *et al.* (1980) extent vegetation complexes occurring in the Project area

Vegetation Complex	System 6 Code	Pre–European extent (ha)	Current Extent (ha)	Remaining (%)
IBRA Region Guildford Complex in the IBRA Swan Coastal Plain Region	32	90,513.13	4,607.91	5.09
Local Government Authority Guildford Complex within the Shire of Serpentine - Jarrahdale		12,986.67	552.25	4.25
IBRA Region Beermullah Complex in the IBRA Swan Coastal Plain Region	36	3,682.79	42.73	1.16
Local Government Authority Beermullah Complex within the Shire of Serpentine - Jarrahdale		6,707.27	447.21	6.67
IBRA Region Forrestfield Complex in the IBRA Swan Coastal Plain Region	29	22,812.92	2,803.36	12.29
Local Government Authority Forrestfield Complex within the Shire of Serpentine - Jarrahdale		4,514.76	411.02	9.10

5.2.2.2 Project site vegetation description

The Project area comprises of approximately 37.6 ha of vegetation which ranges in condition from 'Completely Degraded' to 'Very Good'.

The reconnaissance flora and vegetation survey conducted by Woodman Environmental (2019) identified 13 vegetation units as intact vegetation, with a further 16 units comprising of highly disturbed vegetation or remnant ingenious trees within the DE. Five units of planted vegetation are also present within the Project area . A full summary of the vegetation units within the DE is provided within Table 12 of the Woodman (2019) report.

The Level 1 Flora and Vegetation Survey (Woodman, 2019) concluded that vegetation types S1, S2 and S3 represent the Clay Pans of the Swan Coastal Plain TEC; W3 representing *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrubland of the Swan Coastal Plain; and W6 representing the Banksia Dominated Woodlands of the Swan Coastal Plain ecological community.

The targeted spring survey along Mundijong Road (Ecological, 2019) inferred the presence of Clay Pans of the Swan Coastal Plain TEC, however, found via FCT analysis that vegetation representing *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrubland of the Swan Coastal Plain (FCT3c) was more closely associated with *Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain – FCT3a. It was also confirmed through FCT analysis that no Banksia Dominated Woodlands of the Swan Coastal Plain TEC is present with the Project area.

5.2.3 Assessment against the Ten Clearing Principles

As the Project has been assessed under Part IV of the EP Act and was approved by then Minister for the Environment and Heritage through the release of Ministerial Statement 595, no further State environmental approvals are required, and no assessment has been undertaken.

6. Additional action required

Table 6.1 summarises what further assessment and management is required in relation to the project.

Table 6.1: Summary of Further Assessment or Approval(s) Required

Aspect	Permit, Approval or Licence
Flora and Vegetation	• Detailed spring survey within the local region to inform accurate impact assessment against conservation significant flora and ecological communities. • Approval under the EPBC Act. • Permit to take under the BC Act.
Fauna	• Level 1 Fauna Assessment (to be finalised) including Cockatoo Foraging Quality Assessment)
Bush forever	Development Approval Planning and Development Act 2005.
Groundwater	• Application to disturb an Aboriginal Heritage site (s18 Notice).
Surface water	• Hydrological assessment of surface water drainage. • Bed and Banks permit under s 21 of the RIWI Act 1914.
Heritage	Application to disturb an Aboriginal Heritage site (s18 Notice).

7. Environmental management

A project specific EMP has been developed to manage environmental impacts associated with the project. The EMP is provided in Appendix E.

8. Commonwealth aspects and impacts

A preliminary assessment involving a desktop analysis of MNES was undertaken. The assessment was used to determine whether the project significantly impacts on a MNES and would require referral to the Commonwealth DotEE.

The Protected Matters Search Tool (PMST) was used to identify potential MNES within the project area. A copy of the PMST report is provided at Appendix D.

All EPBC listed threatened species and ecological communities listed in the PMST were assessed at a desktop level to determine whether the species is likely to occur, or whether its habitat is likely to occur, within the project area (Table 8.1 and 8.2).

A desktop assessment against all MNES has been conducted (Table 8.3). There is likely to be a significant impact against EPBC listed threatened species and ecological communities, further investigation is required to determine the full extent of the potential impact. There will be no significant impact on other MNES (other than threatened species and ecological communities).

Table 8.1: Listed Threatened Species – Likelihood of Occurrence

Species	Common Name	EPBC Status	Likelihood of occurring
Birds			
Botaurus poiciloptilus	Australasian Bittern	Endangered	Unlikely – historical record only
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	May occur
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Vulnerable	Confirmed
Calyptorhynchus baudinii	Baudin's Cockatoo	Endangered	Confirmed
Calyptorhynchus latirostris	Carnaby's Cockatoo, Short-billed Black-Cockatoo	Endangered	Likely to Occur
Leipoa ocellata	Malleefowl	Vulnerable	Unlikely – not recorded within 5km
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Unlikely – not recorded within 5km
Rostratula australis	Australian Painted-snipe	Endangered	Unlikely – not recorded within 5km
Insects			
Leioproctus douglasiellus	a short-tongued bee	Critically Endangered	Does not occur – only known from Forrestdale Lake
Neopasiphae simplicior	Native bee	Critically Endangered	Does not occur – only known from Forrestdale Lake
Mammals			
Bettongia penicillata ogilbyi	Woylie	Endangered	Unlikely to occur
Dasyurus geoffroii	Chuditch, Western Quoll	Vulnerable	Unlikely to occur
Pseudocheirus occidentalis	Western Ringtail Possum	Critically Endangered	Unlikely to occur
Setonix brachyurus	Quokka	Vulnerable	May occur
Other			
Westralunio carteri	Carter's Freshwater Mussel	Vulnerable	Unlikely to occur
Plants			
Andersonia gracilis	Slender Andersonia	Endangered	Unlikely to occur
Anthocercis gracilis	Slender Tailflower	Vulnerable	Unlikely to occur
Caladenia huegelii	Grand Spider-orchid	Endangered	Unlikely to occur – no suitable habitat
Diuris micrantha	Dwarf Bee-orchid	Vulnerable	Unlikely to occur
Diuris purdiei	Purdie's Donkey-orchid	Endangered	Unlikely to occur
Drakaea elastica	Glossy-leafed Hammer Orchid	Endangered	Unlikely to occur
Drakaea micrantha	Dwarf Hammer-orchid	Vulnerable	Unlikely to occur
Eleocharis keigheryi	Keighery's Eleocharis	Vulnerable	Unlikely to occur
Eucalyptus balanites	Cadda Road Mallee	Endangered	Unlikely to occur
Grevillea curviloba subsp. incurva	Narrow curved-leaf Grevillea	Endangered	Unlikely to occur
Lepidosperma pterocarpum	Wing-fruited Lasiopetalum	Endangered	Unlikely to occur
Lepidosperma rostratum	Beaked Lepidosperma	Endangered	Unlikely to occur
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Selena's Synaphea	Critically Endangered	Unlikely to occur
Synaphea sp. Serpentine	N/A	Critically Endangered	Confirmed
Synaphea sp. Pinjarra Plain	N/A	Endangered	Confirmed

Species	Common Name	EPBC Status	Likelihood of occurring
Tetraria australiensis	Southern Tetraria	Vulnerable	Confirmed
Thelymitra dedmaniarum	Cinnamon Sun Orchid	Endangered	Unlikely to occur
Thelymitra stellata	Star Sun-orchid	Endangered	Unlikely to occur
Verticordia plumosa var. *ananeotes*	Tufted Plumed Featherflower	Endangered	Unlikely to occur
Reptiles			
Caretta caretta	Loggerhead Turtle	Endangered	Does not occur
Chelonia mydas	Green Turtle	Vulnerable	Does not occur
Dermochelys coriacea	Leatherback Turtle	Endangered	Does not occur
Natator depressus	Flatback Turtle	Vulnerable	Does not occur
Ecological Communities			
Banksia Woodlands of the Swan Coastal Plain ecological community	-	Endangered Community	May occur within project area – further investigation to confirm
Clay Pans of the Swan Coastal Plain	-	Critically Endangered Community	Confirmed
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	-	Endangered Community	Unlikely to occur. No suitable soil formation in project area.
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community	-	Critically Endangered Community	Unlikely to occur

Table 8.2: Migratory and Marine Listed Species - Likelihood of Occurrence

Species Name	Migratory Species	Marine Listed Species	Likelihood of Occurrence
Apus pacificus (Fork-tailed Swift)	Marine	✓	Likely to occur
Motacilla cinereal (Grey Wagtail)	Terrestrial	✓	Potential to occur
Actitis hypoleucos (Common Sandpiper)	Wetlands	✓	Potential to Occur.
Calidris acuminata (Sharp-tailed Sandpiper)	Wetlands	✓	
Calidris ferruginea (Curlew Sandpiper)	Wetlands	✓	
Calidris melanotos (Pectoral Sandpiper)	Wetlands	✓	
Numenius madagascariensis (Eastern Curlew, Far Eastern Curlew)	Wetlands	✓	
Pandion haliaetus (Osprey)	Wetlands	✓	
Tringa nebularia (Common Greenshank, Greenshank)	Wetlands	✓	
Ardea modesta (Great Egret, White Egret)	-	✓	
Ardea ibis (Cattle Egret)	-	✓	
Haliaeetus leucogaster (White-bellied Sea-Eagle)	-	✓	
Rostratula australis (Australian Painted Snipe)	-	✓	
Thinornis rubricollis (Hooded Plover)	-	✓	
Merops ornatus (Rainbow Bee-eater)	-	✓	Likely to occur.

8.1 Threatened species and ecological communities

The surveys undertaken confirmed the presence of six listed threatened and ecological communities within the Project area.

Black Cockatoos

The DE is within the known distribution of all three black cockatoo species. The Proposed Action will require the clearing of up 25.2 ha of foraging habitat representing 13% of the DE (Figure 5).

The *EPBC Act 1999: referral guidelines for the three threatened black cockatoo species* (DSEWPaC 2012) states that the following impacts have a high risk of a significant impact upon Black-cockatoos:

- Clearing of any known nesting tree
- Clearing or degradation of any part of a vegetation community known to contain breeding habitat
- Clearing of more than 1 ha of quality foraging habitat
- Clearing or degradation of a known night roosting site
- Creating a gap of greater than 4 km between patches of black cockatoo habitat

With reference to the referral guidelines the following information is provided:

- the Proposed Action will result in the clearing of up to 25.1 ha potential Black Cockatoo foraging habitat;
- while no specific habitat quality assessment was undertaken, it is considered that due to overall degraded nature of vegetation within the DE comprising of 20.7 ha of was assessed to be in a 'Completely Degraded' and 'Degraded' condition and the remaining 4.4 ha in 'Good' and 'Very Good' condition (Woodman 2019), that the majority of the mapped foraging habitat is of a 'Moderate' to 'Low' quality;
- the vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas;
- approximately 351 suitable diameter at breast height (DBH) trees will be potentially impacted, of which 7 are considered to have suitable hollows present. No evidence of breeding was observed during the survey. Kirkby (2019) discusses that all suitable hollows were either being used by Galah's at the time, contained beehives or were of a smaller size suitable for small parrots;
- no evidence or observations of night roosting by Black Cockatoos was recorded within the DE; and
- removal of potential foraging habitat within the DE will not create a gap greater than 4 km between patches of Black Cockatoo habitat, with large patches occurring within 1 km to the east of the DE.

Noting the information provided, it is considered likely that there is a high-risk of a significant impact to Black Cockatoos and that referral is required.

The Commonwealth Significant Impact Guidelines 1.1 adopts criteria for assessment of impact to threatened species relating to 'populations' and/or 'important populations' (DotE, 2013). However, these terms have not been defined for Black Cockatoos, due to the mobile and widely distributed nature of these species, and the variation in flock compositions (e.g. between breeding and non-breeding seasons). For Black Cockatoos, it is more appropriate to consider significance in terms of impacts on habitat rather than a resident population (DSWEPaC, 2012; DEE, 2017).

Species recovery, as defined by the Carnaby's Cockatoo Recovery Plan (DPaW, 2013), is dependent upon stopping the further decline in the distribution and abundance of Carnaby's Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for their survival throughout their breeding and non-breeding range and ensuring that the reproductive capacity of the species remains stable or increases. Habitat critical to the survival of Carnaby's Cockatoo is defined as (DPaW, 2013):

- known breeding and nearby feeding habitat;
- former breeding habitat that has hollows intact; and
- vegetation that provides habitat for feeding, watering and regular night roosting.

Although not considered to be relevant for Black Cockatoos given their highly mobile nature, the impacts of the Proposed Action on Black Cockatoos have also been broadly assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE, 2013) and discussed in Table 8.3.

***Synaphea* sp. Serpentine**

Synaphea sp. Serpentine (G.R. Brand 103) occurs over a narrow geographic range from west of Byford to south of Serpentine, growing predominantly in grey-brown sandy-loam or clay in seasonally wet areas (DPaW, 2017).

The conservation advice for *Synaphea* sp. Serpentine states that the species is known from 4 populations with a total of 1,328 individuals recorded based on surveys undertaken between 2010 and 2012. The conservation advice for *Synaphea* sp. Serpentine further outlines that 125 individuals were recorded as being in 'poor' condition and as a result the overall population was expected to reduce in size in the near future (TSCC, 2018a). The Proposed Action is expected to reduce the size of the overall population of *Synaphea* sp. Serpentine by 13.5% with up to 180 individual plants being impacted.

The impact of the Proposed Action on *Synaphea* sp. Serpentine has been assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE, 2013) and discussed in Table 8.3.

***Synaphea* sp. Pinjarra Plain**

Synaphea sp. Pinjarra Plain (A.S. George 17182) is found in a linear band from just north of Mundijong (36km south, south-east of Perth) to West Coolup (84km south of Perth). Plants are predominantly found in grey-brown sandy loams but have also been recorded from heavier brown clay-sand overlain by laterite pebbles (DPaW, 2016).

The conservation advice (TSCC, 2018b) highlights that *Synaphea* sp. Pinjarra Plain is known to have a total of 751 individuals within 12 populations in six locations, occurring in a linear band from north of Mundijong to West Coolup. The locations are fragmented and located mostly within road and rail reserves. It is not anticipated that the Proposed Action will directly impact individuals of *Synaphea* sp. Pinjarra Plain, however two individuals are located within 20 m of the DE and there is potential for these individuals to be indirectly impacted during construction of the Proposed Action.

The potential impact of the Proposed Action on *Synaphea* sp. Pinjarra Plain has been assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE, 2013) and discussed in Table 8.3.

Tetraria australiensis

Tetraria australiensis is a perennial, tufted herb, with stems to 1 m high. The conservation advice states that the species is known from 11 locations in the area between Perth and the South West Capes in south-west Western Australia. The species distribution is severely fragmented with the known populations occurring in isolated remnant pockets of vegetation (DoEE, 2019).

Currently there is no accurate total population count for this species, with the current estimate at 1455. This is considered inaccurate as the majority of populations have not been surveyed since 1993.

The species was recorded as present within the DE by Woodman (2019), however as no counts were taken, data from the Department of Biodiversity, Conservation and Attractions (DBCA) has been used to assess potential impacts to this species. It should be noted that Main Roads will be undertaking a count of this species in spring 2020.

The potential impact of the Proposed Action on *Synaphea* sp. Pinjarra Plain has been assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE 2013) and discussed below.

Corymbia calophylla – Kingia australis woodlands on heavy soils TEC

The *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan Coastal Plain ecological community is one of three listed Marri *(Corymbia calophylla)* dominated plant communities. It is known from forty-one occurrences totaling about 192.5 ha that have been located between Ruabon and Guildford (DoEE 2017).

Based on mapping undertaken by Ecological (2019), up to 1.79 ha of the TEC will be directly impacted.

The impact of the Proposed Action on *Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain TEC has been assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE 2013) and discussed in Table 8.3.

Clay Pans of the Swan Coastal Plain TEC

The Clay Pans of the Swan Coastal Plain ecological community occurs in Western Australia where clay soils form an impermeable layer close to the landscape surface, and wetlands form that rely solely on rainfall to fill and then dry to impervious pans in summer. There are 114 occurrences of the TEC in 50 separate locations occupying a total are of 909 ha (DPaW, 2015).

The TEC is comprised of four State listed TECs and one PEC. The four State listed TECs are;

- Herb rich saline shrublands in clay pans (SCP07 - Swan Coastal Plain community type 7):
- Herb rich shrublands in clay pans (SCP08 - Swan Coastal Plain community type 8);
- Dense shrublands on clay flats (SCP09 - Swan Coastal Plain Community type 9); and
- Shrublands on dry clay flats (SCP10a - Swan Coastal Plain Community type 10a).

Within the Project area this TEC is represented by the WA State listed TEC Herb rich shrublands in clay pans SCP08. Based on mapping undertaken by Ecological (2019) up to 1.36 ha of the TEC will be directly impacted.

The impact of the Proposed Action on the Clay Pans of the Swan Coastal Plain TEC has been assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE 2013) and discussed in Table 8.3.

8.1.1 Assessment against significant impact guidelines

Table 8.3 discusses the potential impacts on MNES that are present within the Project area as assessed against the *Significant Impact Guidelines 1.1* (DotE 2013).

Table 8.3: Assessment of MNES within the Project Area

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
Lead to a long-term decrease in the size of a population	**Significant impact Unlikely** The Proposed Action will necessitate the clearing of up to 22.1 ha of potential Carnaby Cockatoo foraging habitat, which represents 0.3% of the total available potential foraging habitat within 6 km of the DE based on remnant native vegetation associations known to be utilised by Carnaby Cockatoos. The Proposed Action is not expected to lead to a long-term decrease in the size of Carnaby Cockatoo populations. The vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. Within 3 km of DE exists the Cardup Nature Reserve, Brickwood Reserve and Watkins Road Nature Reserve, each containing relatively large areas of remnant vegetation and better-quality foraging habitat than that within the DE. Regional mapping indicates that a	**Significant impact Unlikely** The Proposed Action will necessitate the clearing of up to 22.1 ha of potential foraging habitat, which represents 0.3% of the total available potential foraging habitat within 6 km of the DE based on remnant native vegetation associations known to be utilised by Baudin's Cockatoo. The Proposed Action is not expected to lead to a long-term decrease in the size of Baudin's Cockatoo populations. The vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. Within 3 km of DE exists the Cardup Nature Reserve, Brickwood Reserve and Watkins Road Nature Reserve, each containing relatively large areas of remnant vegetation and better-quality foraging habitat than that within the DE. Regional mapping indicates that a total of 7,740 ha and 30,151 ha of potential Baudin's Cockatoo foraging habitat	**Significant impact Likely** The Conservation Advice for *Synaphea* sp. Serpentine states that 'When considering the very small extent of occurrence, area of occupancy, continuing decline and identified multiple threatening processes, all populations are considered important.' Given this, it is considered that the 180 individuals recorded within the DE make up an important population. In considering the potential significance of the impact from the Proposed Action, the Interim Recovery Plan from *Synaphea* sp. Serpentine (DPaW, 2017) considers that the recovery of the species will be considered unsuccessful if the number of mature plants decreases by >10%. The Proposed Action is expected to reduce the size of the overall population of *Synaphea* sp. Serpentine by 13.5% with up to 180 individual plants being impacted. On this basis it is likely that the Proposal will lead to a long-term decrease in the size of a population and have a significant impact on the	**Significant impact Unlikely** The Proposed Action is not expected to reduce the size of an important population of *Synaphea* sp. Pinjarra Plain as there are no individuals within the DE. Two individuals are located in close proximity to the DE and may be subject to indirect impacts, the CEMP will include measures to control clearing within the DE. On this basis it is unlikely that the Proposal will lead to a long-term decrease in the size of a population.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	total of 7,740 ha and 30,151 ha of potential Carnaby Cockatoo foraging habitat occurs within 6 km and 12 km of the DE, respectively, with 19,167 ha of this habitat (within 12 km) located within DBCA managed lands as conservation estate (Figure 6). The majority of this vegetation is contained within the Jarrah forest of the Darling Scarp. On this basis it is unlikely that the Proposal will lead to a long-term decrease in the size of a population.	occurs within 6 km and 12 km of the DE, respectively, with 19,167 ha of this habitat (within 12 km) located within DBCA managed lands as conservation estate (Figure 6). The majority of this vegetation is contained within the Jarrah forest of the Darling Scarp. On this basis it is unlikely that the Proposal will lead to a long-term decrease in the size of a population.	species.	
Reduce the area of occupancy of the species	**Significant impact Unlikely** The Proposed Action is not expected to reduce the area of occupancy of Carnaby's Cockatoo. The Proposed Action is located within the mapped distribution of Carnaby's Cockatoo, (DSEWPaC, 2012; DoEE, 2017). The majority of the DE consists of cleared farmland with isolated strand of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis.* There is approximately 7,740 ha of mapped potential Carnaby Cockatoo foraging habitat within 6 km of the DE, based on native remnant vegetation associations known to be utilised by Carnaby Cockatoos, this number was determined through intersecting vegetation associations consistent with suitable habitat with the latest	**Significant impact Unlikely** The Proposed Action is not expected to reduce the area of occupancy Baudin's Cockatoo. The Proposed Action is located within the mapped distribution of Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo (DSEWPaC, 2012; DoEE, 2017), with Forest Red-tailed Cockatoo being recorded in the field. The majority of the DE consists of cleared farmland with isolated strand of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis.* There is approximately 7,740 ha of mapped potential Black Cockatoo foraging habitat within 6 km of the DE, based on native remnant vegetation associations known to be utilised by Baudin's Cockatoo, this number was	**Significant impact Likely** The Proposed Action is expected to reduce the area of occupancy of *Synaphea* sp. Serpentine with up to 180 individual plants being impacted by the Proposed Action	**Significant impact unlikely** Two individuals were located outside of the Project area. The Proposed Action is not expected to reduce the area of occupancy of *Synaphea* sp. Pinjarra.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	remnant native vegetation spatial data. A removal of 0.3% of this potential foraging habitat is unlikely to result in significant impact with quality foraging habitat within bushland and reserves in close proximity to the Proposed Action. Removal of up to 22.1 ha of potential foraging habitat within the DE represents 0.07% of the total available potential foraging habitat within 12 km of the DE, based on native remnant vegetation associations known to be utilised by Black Cockatoos. On this basis the Proposal is unlikely to reduce the area of occupancy of this species.	determined through intersecting vegetation associations consistent with suitable habitat with the latest remnant native vegetation spatial data. A removal of 0.3% of this potential foraging habitat is unlikely to result in a significant impact given the vegetation occurs in a road reserve adjacent to a high speed and volume highway, with quality foraging habitat within bushland and reserves in close proximity to the Proposed Action. Removal of up to 22.1 ha of potential foraging habitat within the DE represents 0.07% of the total available potential foraging habitat within 12 km of the DE, based on native remnant vegetation associations known to be utilised by Baudin's Cockatoo. On this basis the Proposal is unlikely to reduce the area of occupancy of this species.		
Fragment an existing important population into two or more populations	**Significant impact Unlikely** The Proposed Action is not expected to fragment populations of Carnaby Cockatoos as they are a highly mobile species and are not dependent on a particular patch of foraging habitat within the DE and are expected to forage outside the DE amongst large patches of potential foraging habitat within 3 km of the DE. Foraging habitat within the DE is	**Significant impact Unlikely** The Proposed Action is not expected to fragment populations of Baudin's Cockatoo. Baudin's Cockatoo are highly mobile species and are not dependent on a particular patch of foraging habitat within the DE and are expected to forage outside the DE amongst large patches of potential foraging habitat within 3 km of the DE. Foraging habitat within the DE is	**Significant impact Likely** As the entire mapped extent of *Synaphea* sp. Serpentine is mapped within the DE it is unlikely that the Proposed Action will fragment the existing important population into two or more populations.	**Significant impact possible** The Proposed Action is not expected to fragment an existing important population into two or more populations of *Synaphea* sp. Pinjarra as the Proposed Action is not intersecting a known important population. The Proposed Action may potentially indirectly impact two individual plants outside the DE with no other individuals recorded within either the DE or the

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	scattered and highly fragmented. It is unlikely vegetation identified within the DE as potential habitat represents core foraging habitat, with better quality habitat available in nearby conservation reserves. The Proposed Action will not create a gap larger than 4 km between patches of habitat, with the largest gap being approximately 200m wide and is unlikely to fragment an existing population into two or more populations.	scattered and highly fragmented. It is unlikely vegetation identified within the DE as potential habitat represents core foraging habitat, with better quality habitat available in nearby conservation reserves. The Proposed Action will not create a gap larger than 4 km between patches of habitat, with the largest gap being approximately 200m wide and is unlikely to fragment an existing population into two or more populations.		wider survey area. Additional surveys are required within the Mundijong Road reserve to determine extent of population and potential fragmentation impacts.
Adversely affect habitat critical to the survival of a species	**Significant impact Unlikely** The Proposed Action is not expected to directly or indirectly impact habitat critical to the survival of Black Cockatoos. While DE comprises of suitable foraging, potential breeding habitat (although no known nesting hollows are present) the quality of this habitat is considered to be 'Low' to 'Moderate'. As discussed previously, the vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. The Proposal will also implement	**Significant impact Unlikely** The Proposed Action is not expected to directly or indirectly impact habitat critical to the survival of Baudin's Cockatoo. While DE comprises of suitable foraging, potential breeding habitat (although no known nesting hollows are present) the quality of this habitat is considered to be 'Low' to 'Moderate'. As discussed previously, the vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. The Proposal will also implement mitigation measures to reduce indirect	**Significant impact Likely** The Recovery Plan (DPaW 2017) defines habitat critical to the survival of the species as one that includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations. It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations. Within the DE individuals of *Synaphea* sp. Serpentine are clustered within vegetation association S1, considered to represent the herb rich shrublands in clay plan TEC. Clearing as a result of the Proposal will result in a loss of this habitat known to contain 180	**Significant impact Unlikely** The Interim Recovery Plan (DPaW, 2016) defines habitat critical to the survival of the species as all known habitat for wild populations as critical to the survival of the species. This includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations. It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations. Habitat associated with *Synaphea* sp. Pinjarra is defined in the Conservation Advice for the species (DoEE, 2018) as Open Woodland of *Corymbia calophylla*, *Xanthorrhoea preissii* over Open Shrubland

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	mitigation measures to reduce indirect impacts that may reduce the quality of adjacent/retained habitat.	impacts that may reduce the quality of adjacent/retained habitat.	individuals of *Synaphea* sp. Serpentine. This habitat is considered to be critical to the survival of the species as the presence of 180 individuals is considered to be an important population. On this basis it is considered likely that the Proposed Action will adversely affect habitat critical to the survival of a species.	of *Pericalymma ellipticum*, *Kunzea micrantha*, *Hakea varia*, *Adenanthos meisneri*, *Stirlingia latifolia* S. *petiolaris* and S. *gracillima* over Sedgeland of *Mesomelaena tetragona* and *Tetraria octandra*. Within the DE this habitat is associated with vegetation associations W1, W3, S1 and S2. The Proposed Action will result in the clearing of habitat known to be associated with *Synaphea* sp. Pinjarra Plain. The Conservation advice for the species highlights that within 5 km of the DE, in the suburbs of Serpentine and Mardella, there is suitable habitat present with approximately 430 individuals within nature reserves and road/rail reserves. On this basis it is considered likely that the Proposed Action will adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of a population	**Significant impact Unlikely** The Proposed Action is not expected to disrupt the breeding cycle of a population of Carnaby's Cockatoos as no known breeding of occurs in the DE. Although the Proposed Action will result in the loss of up to 351 suitable DBH trees, 7 containing suitable sized hollows, there was no evidence of breeding observed within the Proposal Action during the field survey, with all	**Significant impact Unlikely** The Proposed Action is not expected to disrupt the breeding cycle of a population of Baudin's Cockatoo as no known breeding of Baudin's Cockatoo occurs in the DE. Although the Proposed Action will result in the loss of up to 351 suitable DBH trees 7 containing suitable sized hollows, there was no evidence of breeding observed within the Proposal Action during the field survey, with all	**Significant impact Likely** As this population is isolated within the DE and will be completely removed it is considered likely that the Proposed Action will disrupt the breeding cycle of an important population.	**Significant impact Unlikely** As only two individuals were recorded outside of the Project area, it is considered unlikely that the Proposed Action will disrupt the breeding cycle of an important population.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	suitable hollows either in use by smaller parrots or empty (Kirkby, 2019). The DE is also located within close proximity of the Jarrah forest of the Darling Scarp which is considered to provide more suitable breeding habitat for FRTBC. The removal of potential breeding trees and foraging habitat may result in some disruption to the species breeding cycle. However, when considered in the context of habitat availability within the local area (based on suitable remnant vegetation within a 12 km radius), the potential loss of 22.1 ha Black Cockatoo foraging habitat (representing a 0.07% reduction in potential foraging and breeding habitat within the local area) is not considered a significant impact to the species.	suitable hollows either in use by smaller parrots or empty (Kirkby, 2019). The DE is also located within close proximity of the Jarrah forest of the Darling Scarp which is considered to provide more suitable breeding habitat for FRTBC. The removal of potential breeding trees and foraging habitat may result in some disruption to the species breeding cycle. However, when considered in the context of habitat availability within the local area (based on suitable remnant vegetation within a 12 km radius), the potential loss of 22.1 ha Baudin's Cockatoo foraging habitat (representing a 0.07% reduction in potential foraging and breeding habitat within the local area) is not considered a significant impact to the species. Furthermore, as outlined by Kirkby (2019), the Baudin's Black Cockatoo is likely to only frequent the area between August and October before heading south to breed.		
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant impact Unlikely** The Proposed Action is not expected to impact the availability or quality of habitat to the extent that Black Cockatoos are likely to decline. The clearing of approximately 22.1 ha of potential habitat represents a 0.07%	**Significant impact Unlikely** The Proposed Action is not expected to impact the availability or quality of habitat to the extent that Black Cockatoos are likely to decline. The clearing of approximately 22.1 ha of potential habitat represents a 0.07%	**Significant impact Likely** As discussed previously, within the DE individuals of *Synaphea* sp. Serpentine are clustered within vegetation association S1, considered to represent the herb rich shrublands in clay plan TEC. Clearing as a result of the	**Significant impact Unlikely** As discussed previously, habitat associated with this species consists of vegetation associations W1, W3, S1 and S2., the condition of which ranges from 'Degraded' to 'Very Good'. The Proposed Action will result in habitat being removed.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
	reduction in potential foraging and breeding habitat for Black Cockatoos within the local area (suitable remnant vegetation within a 12 km radius). The reduction in foraging and potential breeding habitat for may result in a minor residual impact associated with the Proposed Action. On this basis, the Proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.	reduction in potential foraging and breeding habitat for Baudin's Cockatoos within the local area (suitable remnant vegetation within a 12 km radius). The reduction in foraging and potential breeding habitat for may result in a minor residual impact associated with the Proposed Action. On this basis, the Proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.	Proposal will result in clearing of habitat known to contain 180 individuals of *Synaphea* sp. Serpentine. This habitat is considered to be critical to the survival of the species as the presence of 180 individuals is considered to be an important population. Considering this the Proposed Action is considered likely to result in the modification, and removal of habitat to the extent that the species is likely to decline.	The Conservation advice for the species highlights that within 5 km of the DE, in the suburbs of Serpentine and Mardella, there is suitable habitat present with approximately 430 individuals within nature reserves and road/rail reserves. The condition of these areas ranges again from 'Degraded' To Very Good' with most sites being considered in 'Very Good' condition. Considering the wider availability of habitat, it is unlikely that the Proposal will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	**Significant impact Unlikely** The Project is unlikely to result in the introduction of a harmful invasive species to the Carnaby's Cockatoo. There is the potential for *Phytophthora* Dieback and the introduction of weeds to occur in the Project area as a result of the proposed works. Weed and hygiene control measures are outlined in the CEMP and including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of *Phytophthora* Dieback and weed species being introduced to the proposed Project area.	**Significant impact Unlikely** The Project is unlikely to result in the introduction of a harmful invasive species to the Baudin's Cockatoo. There is the potential for *Phytophthora* Dieback and the introduction of weeds to occur in the Project area as a result of the proposed works. Weed and hygiene control measures are outlined in the CEMP and including all plant and machinery to be certified clean prior to arrival at site and segregation of topsoil according to weed/disease status. Construction of the proposed action is unlikely to increase the threat of *Phytophthora* Dieback and weed species being introduced to the Project area.	**Significant impact Unlikely** The Proposed Action is unlikely to introduce invasive species that will be established within the habitat of *Synaphea* sp. Serpentine. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.	**Significant impact Unlikely** The Proposed Action is unlikely to introduce invasive species that will be established within the habitat of *Synaphea* sp. Pinjarra Plain. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.

Impact Criteria (Critically Endangered (CR) and Endangered (EN) species	Calyptorhynchus latirostris (Carnaby's Cockatoo) EPBC Act (Endangered)	Calyptorhynchus baudinii (Baudin's Cockatoo) EPBC Act (Endangered)	*Synaphea* sp. Serpentine – (Critically Endangered)	*Synaphea* sp. Pinjarra Plain (Endangered)
Introduce disease that may cause the species to decline			**Significant impact Unlikely** The Proposed Action is unlikely to introduce diseases that may cause the species to decline. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.	**Significant impact Unlikely** The Proposed Action is unlikely to introduce diseases that may cause the species to decline. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.
interfere with the recovery of the species	**Significant impact Unlikely** The Recovery Plans (DBCA, 2013 and DEC, 2008) provide measures for the species recovery. These include identifying, protecting and managing important habitat. The Proposed Action is not inconsistent with the recovery plans for Carnaby's Cockatoo.	**Significant impact Unlikely** The Recovery Plans (DBCA, 2013; DEC, 2008) provide measures for the species recovery. These include identifying, protecting and managing important habitat. The Proposed Action is not inconsistent with the recovery plans for Baudin's Cockatoo.	**Significant impact Likely** The Proposed Action is likely to interfere with the recovery of the species.	**Significant impact Likely** The Proposed Action is likely to interfere with the recovery of the species.

Impact Criteria for Vulnerable (VU) species	*Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) EPBC Act VU	*Tetraria australiensis* (Vulnerable)
Lead to a long-term decrease in the size of an important population of a species	**Significant impact Unlikely** The Proposed Action will necessitate the clearing of up to 23.8 ha of potential Forest Red-tailed Black Cockatoo (FRTBC)foraging habitat, which represents 0.3% of the total available potential foraging habitat within 6 km of the DE based on remnant native vegetation associations known to be utilised by FRTBC. The Proposed Action is not expected to lead to a long-term decrease in the size of FRTBC populations. The vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. Within 3 km of DE exists the Cardup Nature Reserve, Brickwood Reserve and Watkins Road Nature Reserve, each containing relatively large areas of remnant vegetation and better-quality foraging habitat than that within the DE. Regional mapping indicates that a total of 7,740 ha and 30,151 ha of potential FRTBC foraging habitat occurs within 6 km and 12 km of the DE, respectively, with 19,167 ha of this habitat (within 12 km) located within DBCA managed lands as conservation estate (Figure 6). The majority of this vegetation is contained within the Jarrah forest of the Darling Scarp. On this basis it is unlikely that the Proposal will lead to a long-term decrease in the size of a population.	**Significant impact Likely** As stated previously, *Tetraria australiensis* is known from 11 populations. The conservation advice for *T. australiensis* describes each subpopulation of this species and highlights that subpopulation 10 is within the proposed Tonkin Highway extension footprint. Subpopulation 10 contains 1054 individuals making it the third largest subpopulation based on counts provided within the conservation advice for the species. The Proposed Action will impact all individuals within subpopulation 10 leading to a long-term decrease in the size of an important population of *Tetraria australiensis.*
Reduce the area of occupancy of an important population	**Significant impact Unlikely** The Proposed Action is not expected to reduce the area of occupancy of FRTBC. The Proposed Action is located within the mapped distribution of Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo (DSEWPaC, 2012; DoEE, 2017), with Forest Red-tailed Cockatoo being recorded in the field. The majority of the DE consists of cleared farmland with isolated strand of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis.* There is approximately 7,740 ha of mapped potential Black Cockatoo foraging habitat within 6 km of the DE, based on native remnant vegetation associations known to be utilised by FRTBC, this number was determined through intersecting vegetation associations consistent with suitable habitat with the latest remnant native vegetation spatial data. A removal of 0.4 % of this potential foraging habitat is unlikely to result in a	**Significant impact Likely** The current area of occupancy for *Tetraria australiensis* is estimated to be 12.4 ha (DoEE, 2019). However, it is considered that this number is inaccurate as it has been based on three subpopulations only. Within the DE habitat containing *T. australiensis* will be cleared it is expected that the Proposed Action will reduce the area of occupancy of *Tetraria australiensis*.

Impact Criteria for Vulnerable (VU) species	*Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) EPBC Act VU	*Tetraria australiensis* (Vulnerable)
	significant impact given the vegetation occurs in a road reserve adjacent to a high speed and volume highway, with quality foraging habitat within bushland and reserves in close proximity to the Proposed Action. Removal of up to 23.8 ha of potential foraging habitat within the DE represents 0.07% of the total available potential foraging habitat within 12 km of the DE, based on native remnant vegetation associations known to be utilised by FRTBC. On this basis the Proposal is unlikely to reduce the area of occupancy of this species**.**	
Fragment an existing population into two or more populations	**Significant impact Unlikely** The Proposed Action is not expected to fragment populations of FRTBC. FRTBC are highly mobile species and are not dependent on a particular patch of foraging habitat within the DE and are expected to forage outside the DE amongst large patches of potential foraging habitat within 3 km of the DE. Foraging habitat within the DE is scattered and highly fragmented. It is unlikely vegetation identified within the DE as potential habitat represents core foraging habitat, with better quality habitat available in nearby conservation reserves. The gap created by the Proposed Action will be approximately 200 m wide and is unlikely to fragment an existing population into two or more populations.	**Significant impact Likely** The existing population is currently considered to be severely fragmented with most of the population occurring in small remnants separated by road, rail, tracks/firebreaks and cleared freehold land (DoEE, 2019). Given the position of the population within the DE, the Proposed Action is unlikely to fragment the existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Significant impact Unlikely** The Proposed Action is not expected to directly or indirectly impact habitat critical to the survival of FRTBC. While DE comprises of suitable foraging, potential breeding habitat (although no known nesting hollows are present) the quality of this habitat is considered to be 'Low' to 'Moderate'. As discussed previously, the vegetation within the DE is largely degraded consisting of isolated stands of *Corymbia calophylla, Eucalyptus marginata and Eucalyptus rudis* within cleared fields, narrow bands remnant vegetation associated with drainage lines and road reserves and replanted areas. The Proposal will also implement mitigation measures to reduce indirect impacts that may reduce the quality of adjacent/retained habitat.	**Significant impact Likely** Within the DE individuals of *Tetraria australiensis* are clustered within vegetation association S1, considered to represent the herb rich shrublands in clay plan TEC. Clearing as a result of the Proposal will result in approximately 1.3 ha of this habitat known to contain 1054 individuals of *Tetraria australiensis*. This habitat is considered to be critical to the survival of the species as the presence of 1054 individuals is considered to be an important population. On this basis it is considered likely that the Proposed Action will adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	**Significant impact Unlikely** The Proposed Action is not expected to disrupt the breeding cycle of a population of FRTBC as no known breeding of FRTBC occurs in the DE. Although the Proposed	As this population is isolated within the DE and will be completely removed it is considered likely that the Proposed Action will disrupt the breeding cycle of an important population.

Impact Criteria for Vulnerable (VU) species	*Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) EPBC Act VU	*Tetraria australiensis* (Vulnerable)
	Action will result in the loss of up to 351 suitable DBH trees with 7 containing suitable sized hollows, there was no evidence of breeding observed within the Proposal Action during the field survey, with all suitable either in use by small parrots empty (Kirkby, 2019). The DE is also located within close proximity of the Jarrah forest of the Darling Scarp which is considered to provide more suitable breeding habitat for FRTBC. The removal of potential breeding trees and foraging habitat may result in some disruption to the species breeding cycle. However, when considered in the context of habitat availability within the local area (based on suitable remnant vegetation within a 12 km radius), the potential loss of 23.8 ha Black Cockatoo foraging habitat (representing a 0.07% reduction in potential foraging and breeding habitat within the local area) is not considered a significant impact to the species.	
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Significant impact Unlikely** The Proposed Action is not expected to impact the availability or quality of habitat to the extent that FRTBC are likely to decline. The clearing of approximately 23.8 ha of potential habitat represents a 0.07% reduction in potential foraging and breeding habitat for FRTBC within the local area (suitable remnant vegetation within a 12 km radius). The reduction in foraging and potential breeding habitat for may result in a minor residual impact associated with the Proposed Action. On this basis, the Proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.	As discussed previously, within the DE individuals of *Tetraria australiensis* are clustered within vegetation association S1, considered to represent the herb rich shrublands in clay plan TEC. Clearing for the Proposed Action will result in approximately 1.3 ha of this habitat, known to contain 1054 individuals of *Tetraria australiensis,* being removed. Considering this the Proposed Action is considered likely to result in the modification, and removal of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Significant impact Unlikely** The Proposed Action is unlikely to introduce harmful or invasive species to the DE. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.	The Proposed Action is unlikely to introduce invasive species that will be established within the habitat of *Tetraria australiensis*. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.
Introduce disease that may cause the species to decline, or	**Significant impact Unlikely** The Proposal is unlikely to introduce a disease (e.g. beak and feather disease virus) that may cause the species to decline. There are no known diseases that may be introduced to the area that may cause the population to decline and it is unlikely	The Proposed Action is unlikely to introduce diseases that may cause the species to decline. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.

Impact Criteria for Vulnerable (VU) species	*Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) EPBC Act VU	*Tetraria australiensis* (Vulnerable)
	that any disease already exists in the Proposal Area that may be spread by the activities of the Proposal (as there has been no indication of any such disease).	
Interfere with the recovery of the species.	**Significant impact Unlikely** The Recovery Plans (DBCA, 2013; DEC, 2008) provide measures for the species recovery. These include identifying, protecting and managing important habitat. The Proposed Action is not inconsistent with the recovery plans for FRTBC.	As the Proposed Action is likely to result in the removal of 1054 individuals of *Tetraria australiensis,* it considered likely that the Proposed Action will interfere with the recovery of the species.

Criteria Endangered (EN) or Critically Endangered (CR) Ecological Communities	**Assessment**	
	Corymbia calophylla – Kingia australis woodlands on heavy soils, SCP3a TEC (EPBC Act EN)	Clay Pans of the Swan Coastal Plain TEC (EPBC Act CR)
Reduce the extent of an ecological community.	**Significant Impact Likely** The Proposed Action will impact approximately 1.79 ha of *Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain woodlands and shrublands, Swan Coastal Plain TEC. This will result in a reduction of the total known extent of *Corymbia calophylla – Kingia australis* TEC by 0.9%. Within the local area (Shire of Serpentine-Jarrahdale) there is approximately 47.8 ha of the TEC present (DEC, 2011), the Proposed Action will result in a local reduction in extent of this TEC by 3.74%. On this basis it is considered likely that the Proposed Action will reduce the extent of the ecological community.	**Significant Impact Likely** Within the DE the extent of the TEC is contained to a narrow strip of vegetation within the Mundijong Road reserve. The proposed clearing will result in removal of up to 1.36 ha of the Clay Pans of the Swan Coastal Plain TEC. The total known extent of the TEC is 909.5 ha of which 544.3 ha (59.8%) is contained within conservation reserves. The Proposed Action will result in a reduction of the total known extent of this TEC by 0.15%. Immediately adjacent to the DE a further 1.2 ha of the TEC has been mapped within the Mundijong road reserve. The Conservation Advice for the TEC (DoEE, 2012) describes altered hydrology as the most significant threat to the TEC. The CEMP will include measures to prevent indirect impacts on this adjacent area of TEC from any dewatering or drainage impacts to ensure no more than 1.36 ha of the TEC is disturbed.

Criteria Endangered (EN) or Critically Endangered (CR) Ecological Communities	Assessment	
	Corymbia calophylla – Kingia australis woodlands on heavy soils, SCP3a TEC (EPBC Act EN)	Clay Pans of the Swan Coastal Plain TEC (EPBC Act CR)
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	**Significant Impact Likely** The DE intersects Mundijong Road between Lampiter Drive and Adonis Street splitting the remnant native vegetation present within the road reserve. The Conservation Advice for *Corymbia calophylla – Kingia australis* TEC notes its current highly fragmented state, which is evident within the DE, as the TEC presents in three separate areas within the wider survey area. The Proposed Action will result in the larger portion of the TEC being impacted with approximately 1 ha of the patch left remining adjacent the DE, further increasing the distance between patches. The Proposed Action will increase the fragmentation of this occurrence of the TEC.	**Significant Impact Possible** The DE intersects Mundijong Road between Lampiter Drive and Adonis Street splitting the remnant native vegetation present within the road reserve. As it is considered likely that vegetation associated with the TEC occurs immediately outside of the DE, the Proposed Action will fragment this occurrence of the TEC.
Adversely affect habitat critical to the survival of an ecological community	**Significant Impact Unlikely** The Proposed Action will directly impact no more than 1.79 ha of *Corymbia calophylla – Kingia australis* TEC, the condition of which ranges from 'Degraded' to 'Good'. Locally there is approximately 47.9 ha of the TEC present, of which 43.3 ha is contained within the Brickwood Reserve managed by the Shire of Serpentine-Jarrahdale as conservation. The Proposed Action will result in net overall loss of less than 1% of the known TEC extent. It is considered unlikely that the Proposed Action will adversely impact habitat that is critical to the survival of the TEC given its presence, locally, within nearby reserves.	**Significant Impact Unlikely** The Proposed Action is not expected to adversely affect habitat critical to the survival of the Clay Pans of the Swan Coastal Plain TEC. The Proposed Action will directly impact no more than 1.36 ha of the TEC. The total known extent of the TEC is 909.5 ha of which 544.3 ha (59.8%) is contained within conservation reserves. The Proposed Action will result in a reduction of the total known extent of this TEC by 0.15%. The loss of 0.15% is not considered to be critical to the long-term survival of the community when over 50% is retained in conservation reserve.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's	**Significant Impact Unlikely** It is not anticipated that the Proposed Action will substantially modify or destroy abiotic factors necessary for the survival of the *Corymbia calophylla – Kingia australis* TEC including hydrology, nutrients or soil resources.	**Significant Impact Unlikely** The Proposed Action is not expected to modify abiotic factors necessary for the survival of the Clay Pans of the Swan Coastal Plain TEC. The Proposed Action will not substantially modify or destroy abiotic factors necessary for the survival of the TEC outside of the DE including hydrology, nutrients or soil resources.

Criteria Endangered (EN) or Critically Endangered (CR) Ecological Communities	Assessment	
	Corymbia calophylla – Kingia australis woodlands on heavy soils, SCP3a TEC (EPBC Act EN)	Clay Pans of the Swan Coastal Plain TEC (EPBC Act CR)
survival, including reduction of groundwater levels, or substantial alteration of surface water drainage pattern.	The CEMP will include measures to manage ASS, dewatering, stormwater, pollution, sedimentation and dust. It is noted that dewatering (if required) will be localised and temporary and is not expected to significantly affect TEC patches outside of the DE. The CEMP and proposed drainage infrastructure (including vegetated basins) will avoid and minimise mobilisation of fertilisers, herbicides or other chemicals or pollutants from the DE into the TEC. This includes use of stormwater drainage and treatment involving biofiltration areas and infiltration basins designed in accordance with the Western Australian Better Urban Water Management framework and Stormwater Management Manual (WAPC, 2008). No stormwater runoff generated within the DE will be discharged into any occurrences of *Corymbia calophylla – Kingia australis* TEC outside of the DE.	The CEMP will include measures to manage ASS, dewatering, stormwater, pollution, sedimentation and dust. It is noted that dewatering (if required) will be localised and temporary and is not expected to significantly affect TEC patches in the vicinity. The CEMP and proposed drainage infrastructure (including vegetated basins) will avoid and minimise mobilisation of fertilisers, herbicides or other chemicals or pollutants from the DE into the TEC. This includes use of stormwater drainage and treatment involving biofiltration areas and infiltration basins designed in accordance with the Western Australian Better Urban Water Management framework and Stormwater Management Manual (WAPC 2008). No stormwater runoff generated within the DE will be discharged into TEC patches.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	**Significant Impact likely** The Interim Recovery Plan for the *Corymbia calophylla – Kingia australis* TEC (DEC, 2011), describes the occurrence of the TEC within the Mundijong Road Reserve (Occurrence 18) as comprising an area of 2.4 ha within the road and rail reserve. The Proposed Action is expected to cause a substantial change in species composition of this occurrence of an ecological community as the clearing for the Proposed Action (1.79 ha), will reduce the extent of Occurrence 18 by 75.5% and the location of the clearing area is within a narrow corridor.	**Significant Impact Unlikely** The Proposed Action is not expected to cause substantial change in species composition or cause a decline or loss of functionally important species outside of the DE. Given the small scale of the proposed clearing footprint (1.36 ha), the Proposal will not result in an action that may cause a substantial change in the species composition of the occurrence of the overall TEC.

Criteria Endangered (EN) or Critically Endangered (CR) Ecological Communities	Assessment	
	Corymbia calophylla – Kingia australis woodlands on heavy soils, SCP3a TEC (EPBC Act EN)	Clay Pans of the Swan Coastal Plain TEC (EPBC Act CR)
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	**Significant Impact likely** The Proposed Action is expected to result in a substantial reduction in the quality or integrity of an occurrence of *Corymbia calophylla – Kingia australis* TEC post construction. While the Proposed Action will incorporate design and construction measures that will minimise spread of weeds and dieback and the CEMP will contain measures to avoid and minimise mobilisation of fertilisers, herbicides or other chemicals or pollutants from the DE into the TEC. It is considered likely that the implementation of the Proposed Action will result in edge effects that will continue to impact the remaining extent of this occurrence of the TEC.	**Significant Impact Unlikely** The Proposed Action is not expected to result in a substantial reduction in the quality or integrity of Clay Pans of the Swan Coastal Plain TEC outside of the DE. The Proposed Action will incorporate design and construction measures that will minimise spread of weeds and dieback. This is due to construction management including weed treatment and hygiene, and revegetation with native species on local harvested topsoil with restricted use of fertiliser. The CEMP and proposed drainage infrastructure (including vegetated basins) will avoid and minimise mobilisation of fertilisers, herbicides or other chemicals or pollutants from the DE into the TEC. This includes use of stormwater drainage and treatment involving biofiltration areas and infiltration basins designed in accordance with Western Australian Better Urban Water Management framework and Stormwater Management Manual (WAPC, 2008). No stormwater runoff generated within the DE will be discharged into TEC patches.
Interfere with the recovery of an ecological community.	**Significant Impact Unlikely** While some clearing of the inferred TEC within the Project area is required, these areas are largely degraded.	**Significant Impact Unlikely** While some clearing of the inferred TEC within the Project area is required, these areas are largely degraded.

8.1.2 Matters of National Environmental Significance assessed as not significant to the project

Table 8.4 summarises all other MNES that was determined to not be relevant to the Project.

Table 8.4: MNES not relevant to the Project

Matters of National Environmental Significance (MNES)	Existing environment and likely impact
Wetlands of International Importance	Two Wetlands of International Importance were identified from the PMST Report: • Forrestdale and Thomsons Lakes - together these lakes are a Ramsar wetland site; and • Peel-Yalgorup system. Forrestdale Lake and Thomsons Lake are located approximately 5 km and 13 km north-west of the Project area respectively. No wetlands of international importance will be impacted by the Project.
World Heritage Properties	As there are no properties identified within the Project area it is unlikely that there will be any world heritage properties impacted by the Project activities.
National Heritage Places	As no places were identified within the Project area it is unlikely that there will be any national heritage places impacted by the Project activities.
Commonwealth Land or Marine Areas	No Commonwealth land or marine areas were identified from the PMST Report.
Nuclear Actions	Not relevant to the proposed activity.
Water Resources in relation to a large coal mine or coal seam gas development	Not relevant to the proposed activity.

9. Summary of the assessment

The following biological surveys were commissioned to undertake a biological assessment and identify potential constraints in relation to the Project:

- a Level 1 fauna survey of the Project area (Bamford, 2019) is underway in accordance with the EPA Technical Guidance Statement - Terrestrial fauna surveys (2016);
- a Black Cockatoo Breeding, Feeding and Roosting Habitat Assessment was undertaken throughout the Project area by Tony Kirkby; and
- a detailed flora and vegetation survey (Eco Logical, 2019) was undertaken in the Mundijong Road section of the Project area in accordance with the EPA Technical Guidance Statement: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

9.1 Potential project constraints – biological aspects

The key biological constraints identified for the Project during the biological assessment are summarised in Table 9.1 below.

Table 9.1: Biological Constraints

Biological aspect	Potential constraint
Flora and Vegetation	The Project area is likely to contain vegetation associated with two threatened ecological communities, of which one is listed as critically endangered: • *Corymbia calophylla – Kingia australis* woodlands on heavy soils, SCP3a TEC (EPBC listed Endangered); and • Clay Pans of the Swan Coastal plain TEC (EPBC listed Critically Endangered). The Project is considered likely to have a significant impact on these ecological communities. The Project area exists in an extensively cleared local landscape. There is potential that some of the vegetation being impacted is considered significant as remnant vegetation in an extensively cleared landscape and forms part of a regional ecological linkage (Mundijong Road).
Conservation Significant flora species	The Proposal is expected to directly impact on the following threatened flora species listed under Commonwealth and/or State legislation: • *Synaphea* sp. Serpentine (G.R. Brand 103) – Critically Endangered • *Synaphea* sp. Pinjarra Plain (A.S. George 17182) – Endangered • *Tetraria australiensis* – Vulnerable. Impacts to *Synaphea* sp. Serpentine are likely to be significant due to the extent of the impact and the restricted nature of the species.
Conservation Significant fauna species	The Project is not expected to have a significant impact on conservation significant fauna species. Potential impacts to Black Cockatoos are unlikely to be significant due to the sparse nature and quality of vegetation present within the Project area and the lack of current breeding trees.
Hydrological	The Project will impact up to 208 ha of mapped geomorphic wetlands, 5.5 ha representing Conservation category Wetlands. Will impacts are likely, the implementation of the Wetland Mitigation Strategy, required under Ministerial Statement 595 will limit the extent of the impacts. It is likely that some temporary dewatering will be required during construction activities. Consideration should be given to the potential of impacts to the local hydrological regimes during this time. Hydrological investigations may be required to determine these potential impacts.

9.2 Potential project constraints – social aspects

The key social constraints identified for the Project during this assessment are summarised in Table 9.2 below.

Table 9.2: Social constraints

Social aspect	Potential constraint
Amenity	The Project is likely to lead to amenity impacts on rural residential properties within the immediate vicinity. The Project area runs through and adjacent to numerous properties. Consideration will need to be given to noise and dust impacts as a result of the Project.
Public Interest	There is potential that there may be some community resistance to the Project due to the requirement for land acquisition and the potential to impact on local tourist sites and equestrian centres.
Heritage	Five registered Aboriginal Heritage sites occur within the Project area. Consultation with the South West Land and Sea Council regarding the Project will be required. There will likely be a requirement for heritage surveys to be undertaken.

10. Recommendations for further assessment

While Main Roads is committed to minimising land disturbance and clearing activities in areas that support conservation fauna/fauna habitats. Where disturbance cannot be avoided, management measures based on sufficient knowledge of the species and likely impacts will be investigated and applied where appropriate.

Table 10.1 and 10.2 summarises what further assessment and management is required in relation to the Project.

Table 10.1: Recommendation for further assessment

Aspect	Permit, Approval or Licence
Flora and Vegetation Fauna	Approval under the EPBC Act. Permit to take under the BC Act.
Hydrology	Bed and Banks permit under s 21 of the RIWI Act 1914. s5C groundwater abstraction licence.
Bush Forever	Development Approval Planning and Development Act 2005.
Heritage	Application to disturb an Aboriginal Heritage site (s18 Notice).

Table 10.2: Summary of further surveys required

Aspect	Survey/studies Required
Flora and Vegetation	Detailed spring survey within the local region to inform accurate impact assessment against conservation significant flora and ecological communities.
Hydrology	Hydrological assessment of surface water drainage. Investigations into required dewatering and groundwater assessment, to support potential approvals under the RIWI Act 1914.
Heritage	Aboriginal heritage survey.
Social Surrounds	Noise Assessment.

11. Stakeholder consultation

The Project has previously been assessed and approved under Part IV of the EP Act. Extensive consultation was undertaken with State and Local Government and the community prior to the preparation and submission of the PER. The stakeholder groups that were previously consulted as part of this process are outlined below:

Local Governments

- City of Armadale;
- City of Gosnells; and
- Shire of Serpentine-Jarrahdale.

State Government agencies:

- Aboriginal Affairs Department (AAD);
- Department of Biodiversity Conservation and Attractions (Formerly known as Department of Conservation and Land Management (CALM));
- Department of Environmental Protection (DEP);
- Swan River Trust (SRT);
- Water and Rivers Commission (WRC);
- Water Corporation (WC);
- WA Museum Conservation organisations;
- BirdLife Australia – formerly Birds Australia (RAOU);
- Conservation Council of WA;
- Friends of Lake Forrestdale;
- Upper Canning/Southern Wungong Community Catchment Group;
- Waterbird Conservation Society; and
- Wetlands Conservation Society.

Aboriginal groups:

- Ballaruk Aboriginal Corporation;
- Bropho Family;
- Colbung Family/Bibbulmun Tribal Group;
- Collard/Riley Family;
- Darbalyung/Wilkes Family;
- Hansen/Bennell Family;
- Hume Family/Independent Corporation;
- Murray Districts Aboriginal Corporation; and
- Ninyette Family Winjan Aboriginal Corporation.

Heritage organisations

- Armadale Kelmscott Historical Society;

- Australian Heritage Commission;
- Forrestdale Progress Association;
- Friends of Forrestdale Gosnells Historical Society;
- Heritage Council of Western Australia;
- Mundijong Heritage Council National Trust of Australia (Western Australia); and
- Oakford Oldbury Association.

Given the historical nature of the consultation undertaken with the above listed groups, some of the stakeholders may no longer be current to the Project.

As the Project is further developed, Main Roads will liaise with affected stakeholders, landholders and the public. Furthermore, ongoing engagement will take place as the Project progresses through design and construction.

12. Decision to refer

This section provides environmental approvals and referrals advice based on the biological and social constraints identified within the Project area. The Project design has been refined to include opportunities to avoid and minimise the impacts on biological and social constraints. If the biological and social constraints can be avoided or impacts to these minimised it may negate the need for environmental approvals or referral to Commonwealth/State environmental agencies.

12.1 Referral to the Department of the Environment and Energy

Referral to the Department of the Environment and Energy (DoEE) under the EPBC Act is triggered if a proposed action has or potentially has a significant impact on any Matters of National Environmental Significant (MNES).

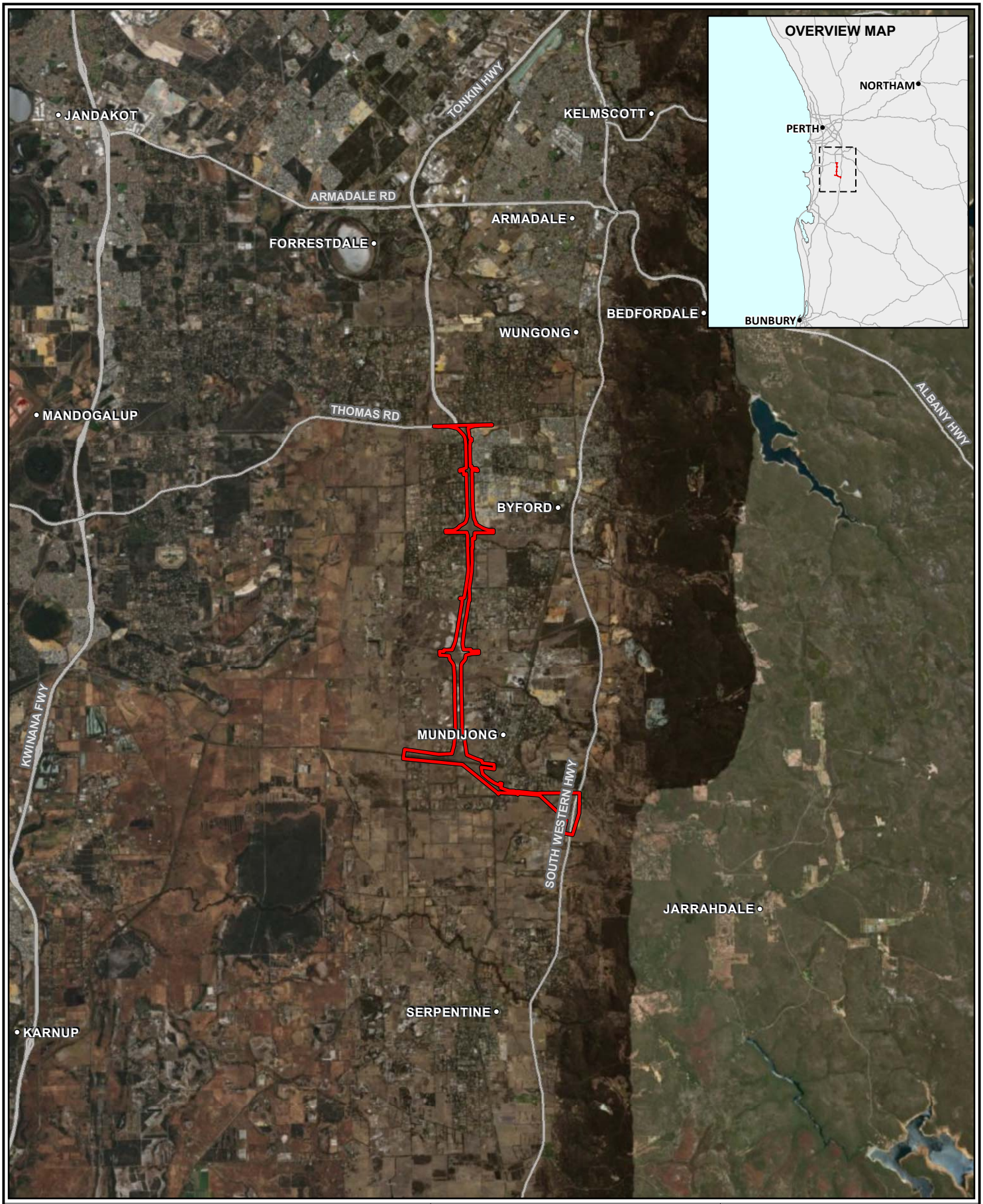
An assessment of the Project against key biological MNES is provided in Section 8 and it is considered that referral to DoEE is required for potential impacts to the following MNES:

- *Calyptorhynchus latirostris* (Carnaby's Cockatoo) (Endangered).
- *Calyptorhynchus baudinii* (Baudin's Cockatoo) (Endangered).
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (Vulnerable).
- *Synaphea* sp. Serpentine (Critically Endangered).
- *Synaphea* sp. Pinjarra Plain (Endangered).
- *Tetraria australiensis* (Vulnerable).
- Corymbia calophylla – Kingia australis woodlands on heavy soils, Swan Coastal Plain – FCT3a (Endangered). and
- Clay Pans of the Swan Coastal Plain (Critically Endangered).

12.2 Referral to the Environmental Protection Authority

The Project has previously been assessed and approved under Part IV of the EP Act, with Ministerial Statement 595 issued in June 2002. The Project has not been referred or assessed under the Commonwealth EPBC Act.

13. Constraints mapping



Legend:

- Development envelope
- Major road

Scale 1:150,000 at A4

0 1 2
Kilometres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: HS

Tonkin Highway Extension

SITE LOCATION

FIGURE 1

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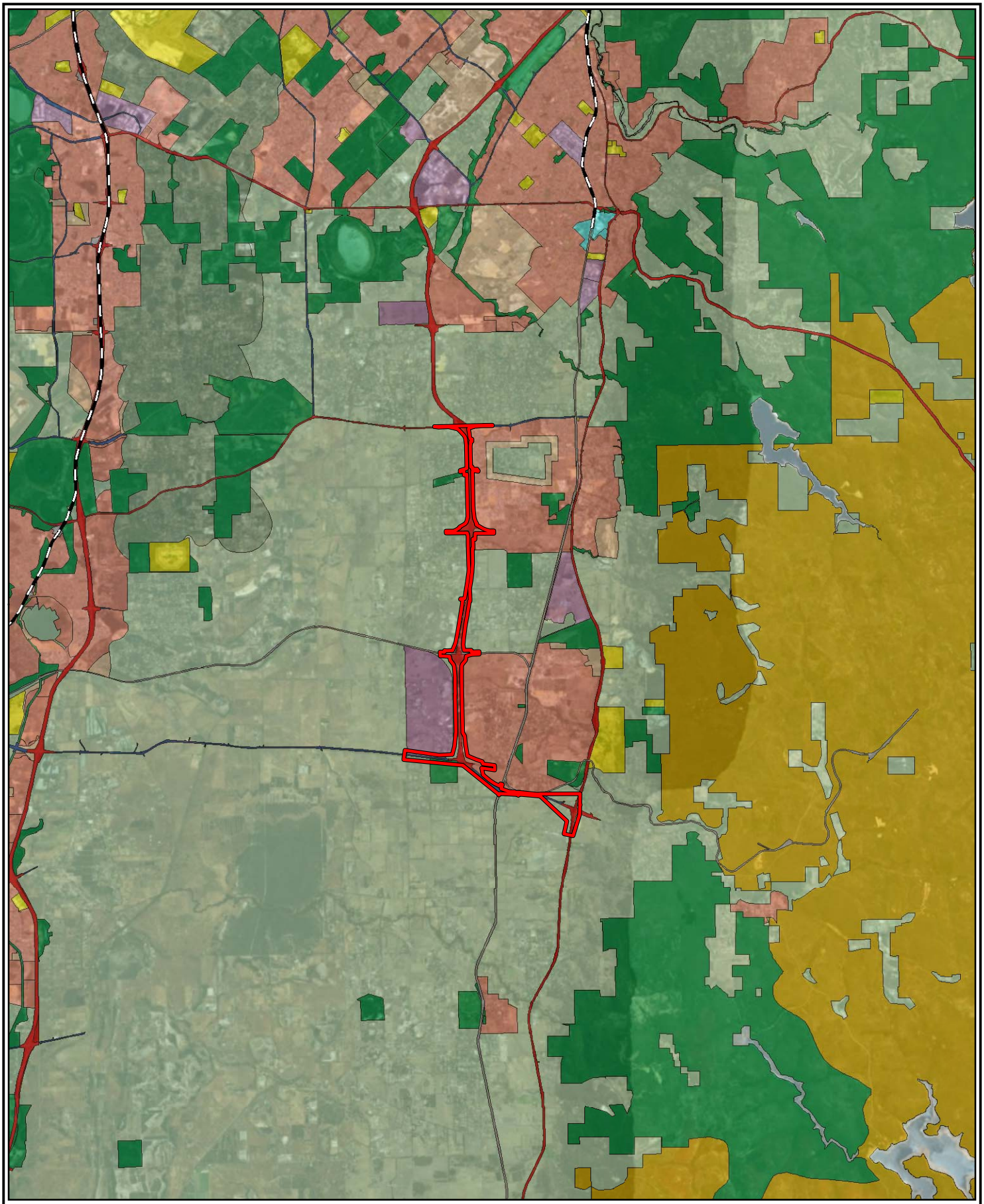
File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_01_ProjectArea.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend:

- Development envelope
- Train service

Existing Region Scheme Reserves

- Central city area
- Industrial
- Other regional roads
- Parks and recreation
- Primary regional roads
- Private recreation
- Public purposes
- Railways
- Rural
- Rural - water protection
- State forests
- Urban
- Urban deferred
- Waterways

Scale 1:150,000 at A4 (0 1 2 Kilometres)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**REGIONAL LOCATION AND LAND USE**
Job No: 5675204		
Client: Main Roads		**FIGURE 2**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_02_LandUse.mxd
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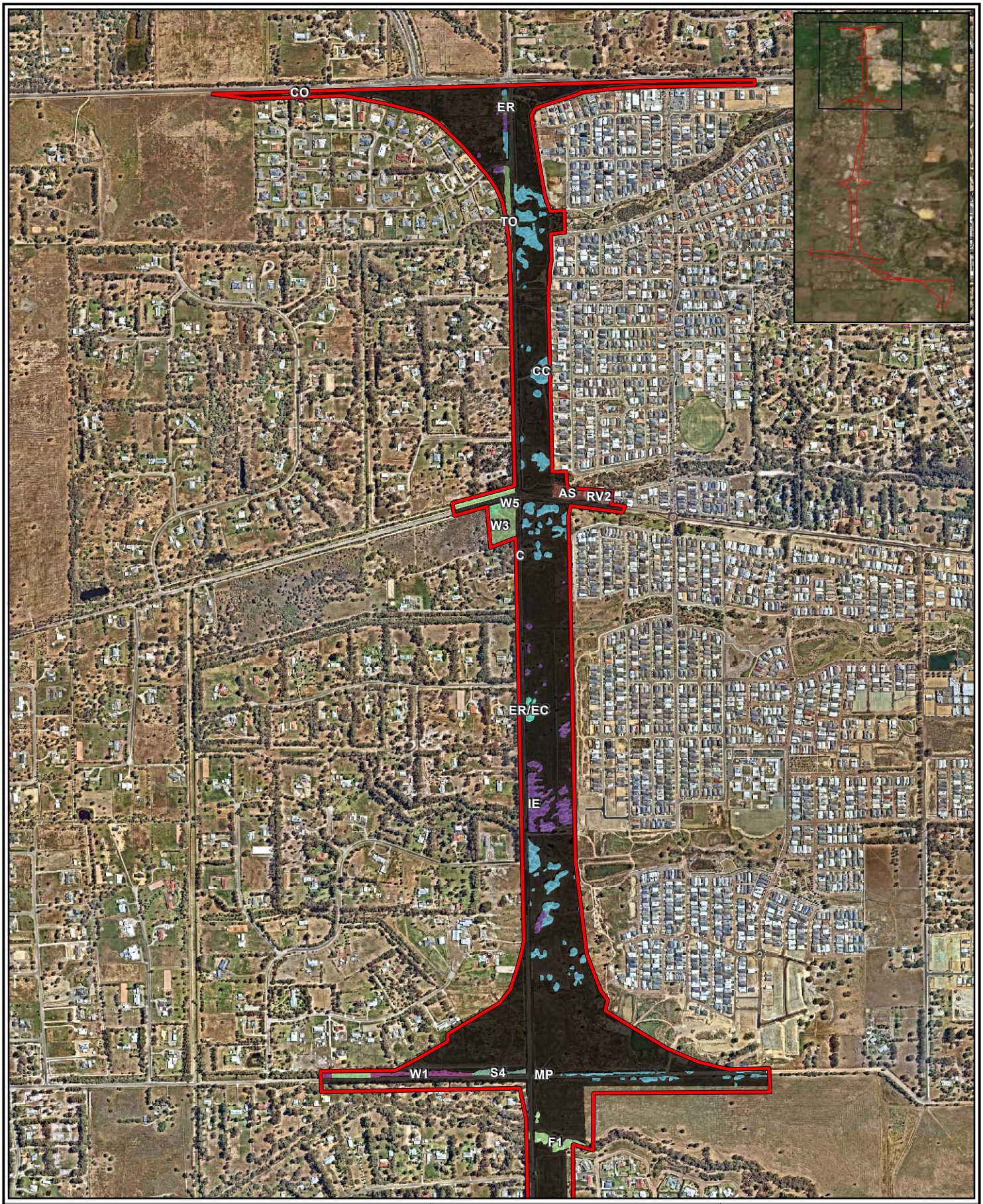


Legend

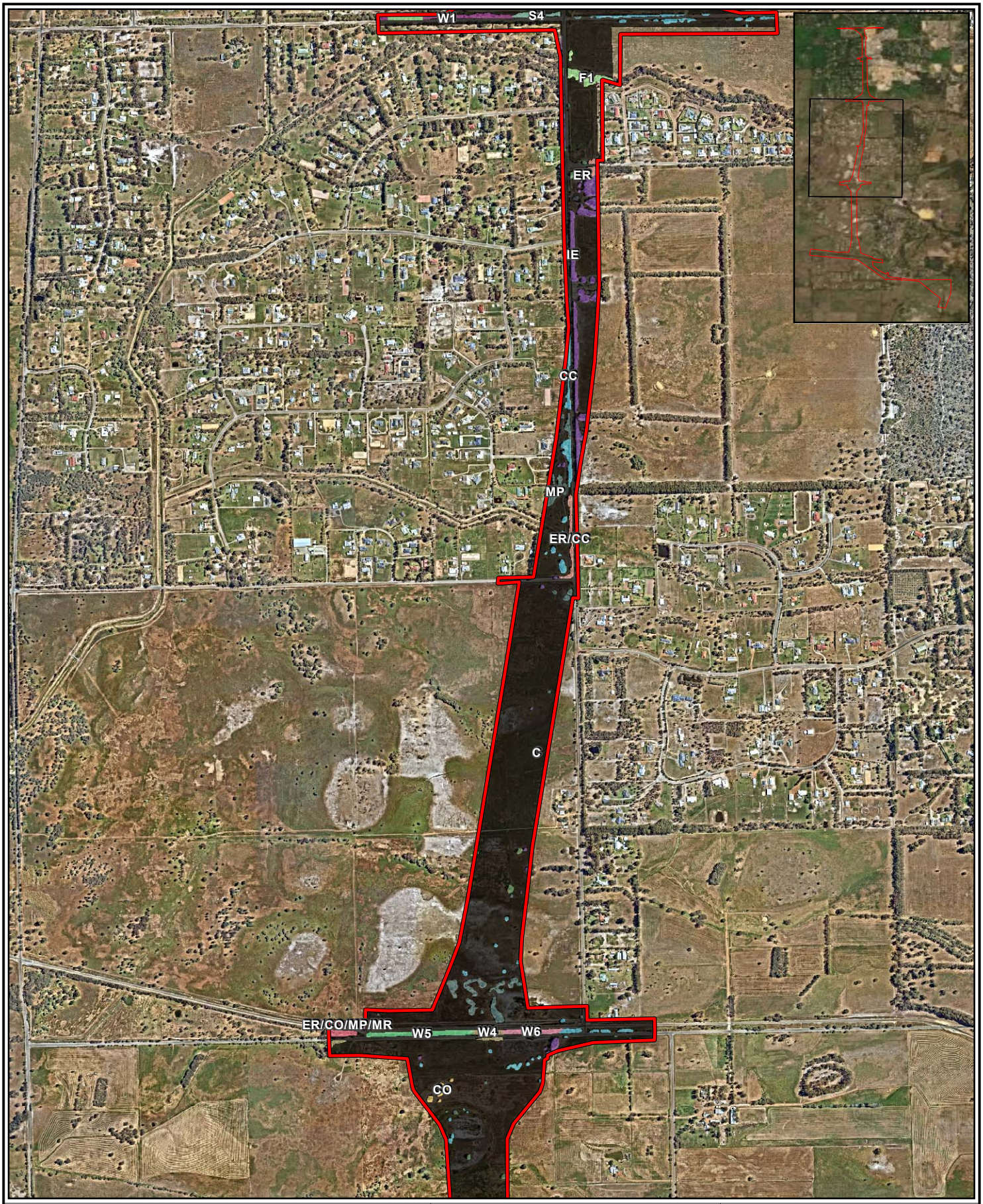
- Development envelope

Vegetation Association

- AS - *Acacia saligna* over pasture weeds
- C - Cleared land
- CC - Individual or stands of *Corymbia calophylla* over pasture weeds
- CO - *Casuarina obesa* over pasture weeds
- ER - *Eucalyptus rudis* over pasture weeds
- ER/EC - *Eucalyptus rudis* and planted *E. camaldulensis* over pasture weeds
- F1 - Mid closed forest of *Eucalyptus rudis* and *Maleleuca preissiana* over *Xanthorrhoea preissii* and *M. lateritia*
- IE - Planted non-native *Eucalyptus* species over pasture weeds
- MP - *Maleleuca preissiana* over pasture weeds
- RV 2 - Revegetated with *Corymbia calophylla* and *Eucalyptus rudis* over *Melaleuca rhaphiophylla* and mixed shrub species over pasture weeds
- S4 - Tall shrubland of *Maleleuca viminea subsp. viminea, Viminaria juncea* and *Jacksonia sternbergiana* over introduced grasses
- TO - Dense rushland of **Typha orientalis*
- W1 - Mid woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and occasional *Kingia australis*
- W3 - Mid woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Jacksonia sternbergiana* and mixed species
- W5 - Low woodland of *Maleleuca preissiana* over mid open shrubland

Scale 1:16,000 at A4 (0 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**VEGETATION ASSOCIATION PAGE 1**
Job No: 5675204		
Client: Main Roads		**FIGURE 3**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend

- Development envelope

Vegetation Association

- C - Cleared land
- CC - Individual or stands of *Corymbia calophylla* over pasture weeds
- CO - *Casuarina obesa* over pasture weeds
- ER - *Eucalyptus rudis* over pasture weeds
- ER/CC - *Eucalyptus rudis* and *Corymbia calophylla* over pasture weeds
- ER/CO/MP/MR - *Eucalyptus rudis*, *Casuarina obesa*, *Maleleuca preissiana* and *Maleleuca raphiophylla* over pasture weeds
- ER/MR - Mixed stand of *Eucalyptus rudis* and *Maleleuca raphiophylla* over pasture weeds
- F1 - Mid closed forest of *Eucalyptus rudis* and *Maleleuca preissiana* over *Xanthorrhoea preissii* and *M. lateritia*
- IE - Planted non-native *Eucalyptus* species over pasture weeds
- MP - *Maleleuca preissiana* over pasture weeds
- W4 - Mid woodland of *Corymbia calophylla*, *Maleleuca preissiana* and *M. raphiophylla* over *Lepidosperma longitudinale*
- W5 - Low woodland of *Maleleuca preissiana* over mid open shrubland
- W6 - Low woodland of *Banksia attenuata* and *B. menziesii* over *Jacksonia furcellata* and *Kunzea glabrescens* over *Maleleuca trichophylla* over introduced grasses

Scale 1:18,000 at A4

0 200 Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

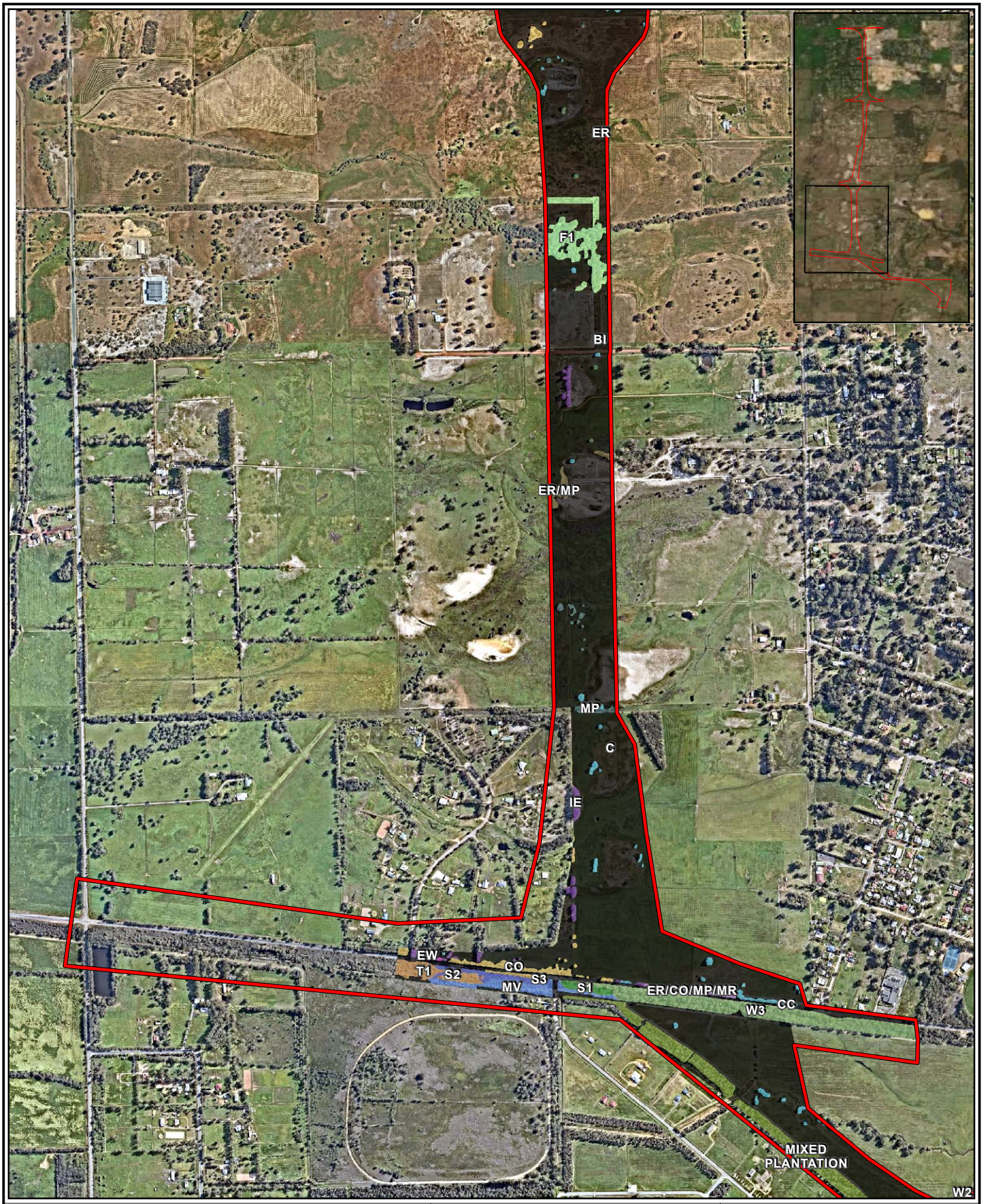
Tonkin Highway Extension

VEGETATION ASSOCIATION PAGE 2

FIGURE 3

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd



Legend

- Development envelope

Vegetation Association

- BI - *Banksia ilicifolia* over pasture weeds
- C - Cleared land
- CC - Individual or stands of *Corymbia calophylla* over pasture weeds
- CO - *Casuarina obesa* over pasture weeds
- EG - *Eucalyptus gomphocephala* over pasture weeds
- ER - *Eucalyptus rudis* over pasture weeds
- ER/CO/MP/MR - *Eucalyptus rudis, Casuarina obesa, Maleleuca preissiana* and *Maleleuca raphiophylla* over pasture weeds
- ER/MP - Mixed stand of *Eucalyptus rudis* and *Maleleuca preissiana* over pasture weeds
- EW - *Eucalyptus wandoo* over pasture weeds
- F1 - Mid closed forest of *Eucalyptus rudis* and *Maleleuca preissiana* over *Xanthorrhoea preissii* and *M. lateritia*
- IE - Planted non-native *Eucalyptus* species over pasture weeds
- MP - *Maleleuca preissiana* over pasture weeds
- MV - Highly modified areas of native vegetation
- Mixed Plantation
- S1 - Mixed shrubland of *Xanthorrhoea preissii* and *Kingia australis* over mid sedgeland
- S2 - Tall open shrubland of *Hakea varia, Jacksonia sternbergiana, Xanthorrhoea preissii* and *Kingia australis* over mid open shrubland
- S3 - Mid open shrubland of *Hakea incrassata* and *Allocasuarina microstachya* over mid closed sedgeland
- T1 - Tall closed shrubland of *Maleleuca osullivanii* and *Hakea varia* over low sedgeland
- W3 - Mid woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Jacksonia sternbergiana* and mixed species

Scale 1:16,000 at A4

0 200 Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

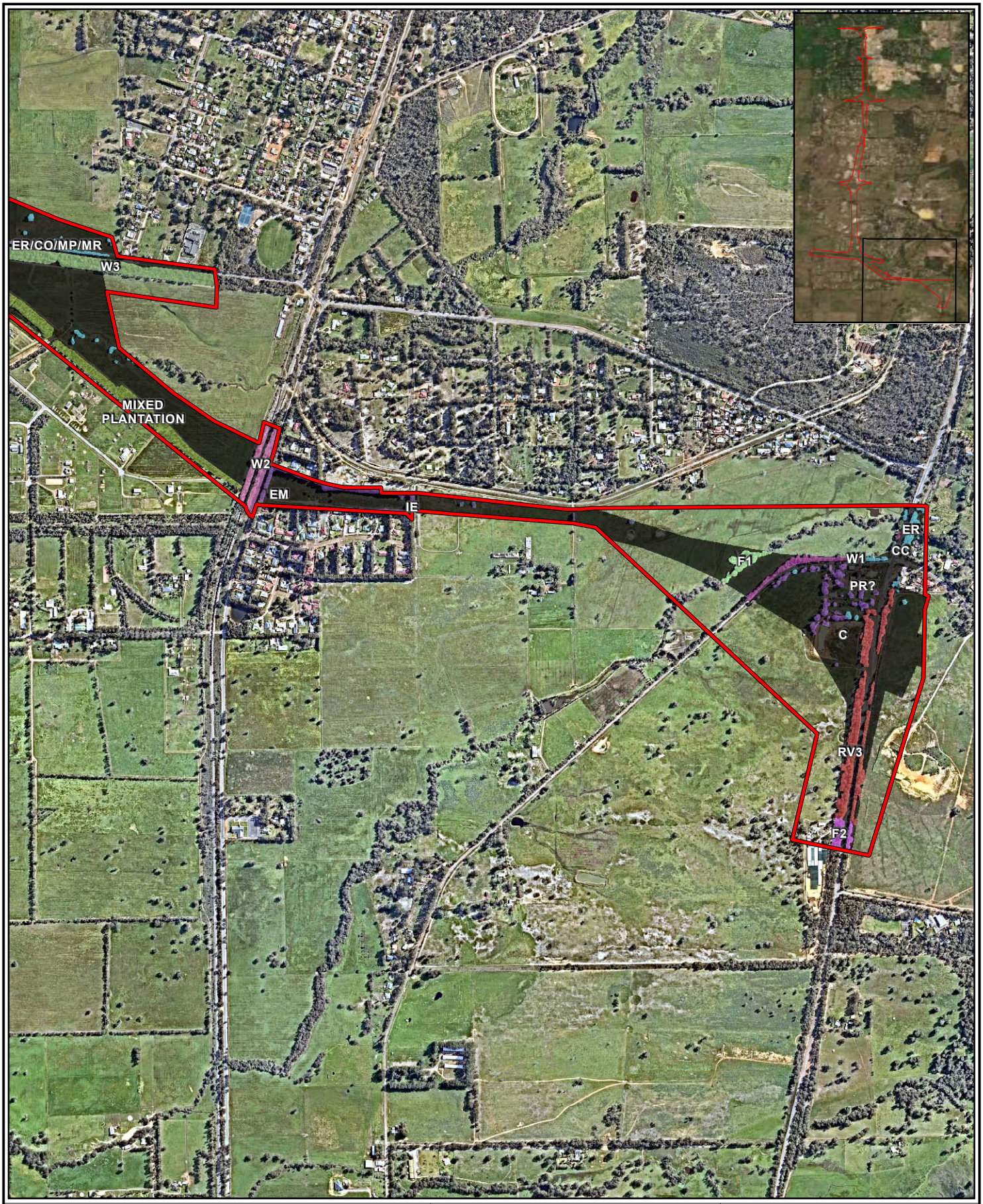
Tonkin Highway Extension

VEGETATION ASSOCIATION PAGE 3

FIGURE 3

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd



Legend

Development envelope

Vegetation Association

C - Cleared land

CC - Individual or stands of *Corymbia calophylla* over pasture weeds

EM - *Eucalyptus marginata* over pasture weeds

ER - *Eucalyptus rudis* over pasture weeds

EW - *Eucalyptus wandoo* over pasture weeds

F1 - Mid closed forest of *Eucalyptus rudis* and *Maleleuca preissiana* over *Xanthorrhoea preissii* and *M. lateritia*

F2 - Mid closed forest of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Allocasuarina fraseriana* and *Banksia grandis* over *Xanthorrhoea preissii* and *Hakea lissocarpha*

IE - Planted non-native *Eucalyptus* species over pasture weeds

Mixed Plantation

PR - *Pinus radiata* over pasture weeds

RV 3 - Revegetated road reserve dominated by *Corymbia calophylla*

W1 - Mid woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and occasional *Kingia australis*

W2 - Mid woodland of *Corymbia calophylla* and *Maleleuca preissiana* over mid open shrubland of *Xanthorrhoea preissii* and *Jacksonia sternbergiana* over mixed shrubland

Scale 1:18,000 at A4

0 200 Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

Tonkin Highway Extension

VEGETATION ASSOCIATION PAGE 4

FIGURE 3

strategen JBS&G

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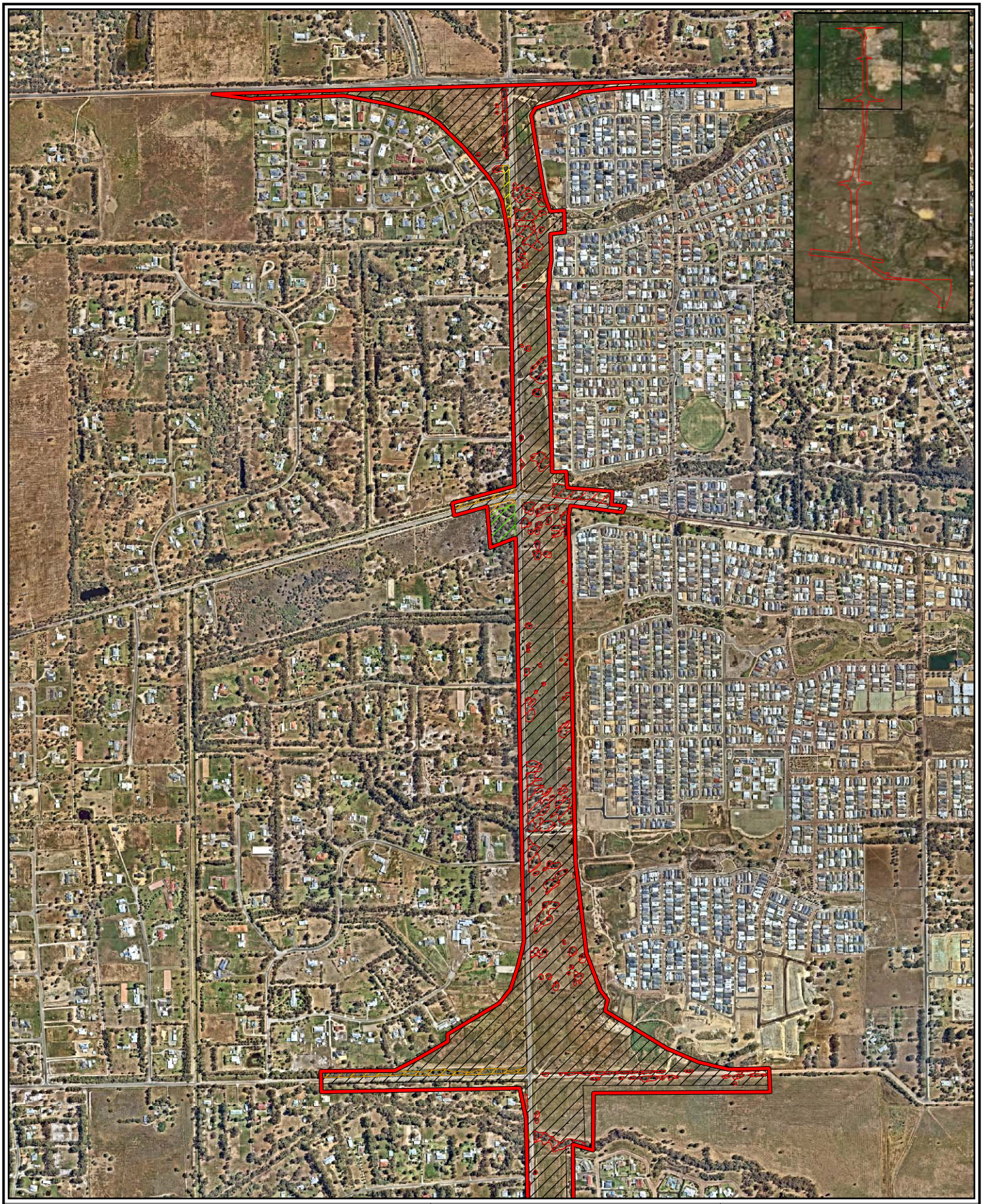


Legend

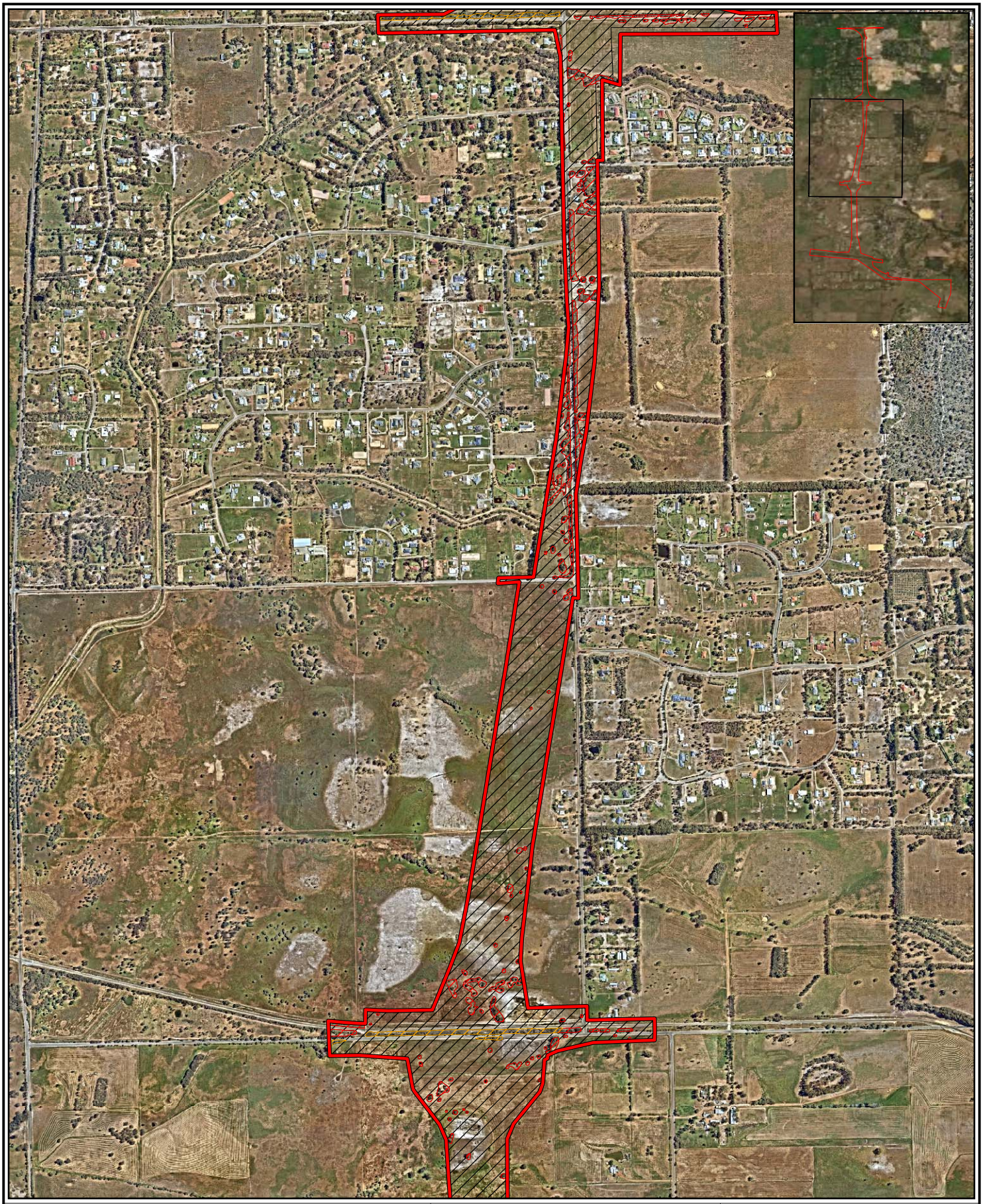
- Development envelope

Vegetation condition

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared Land

Scale 1:16,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**VEGETATION CONDITION PAGE 1**
Job No: 5675204		
Client: Main Roads		**FIGURE 4**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd



Legend

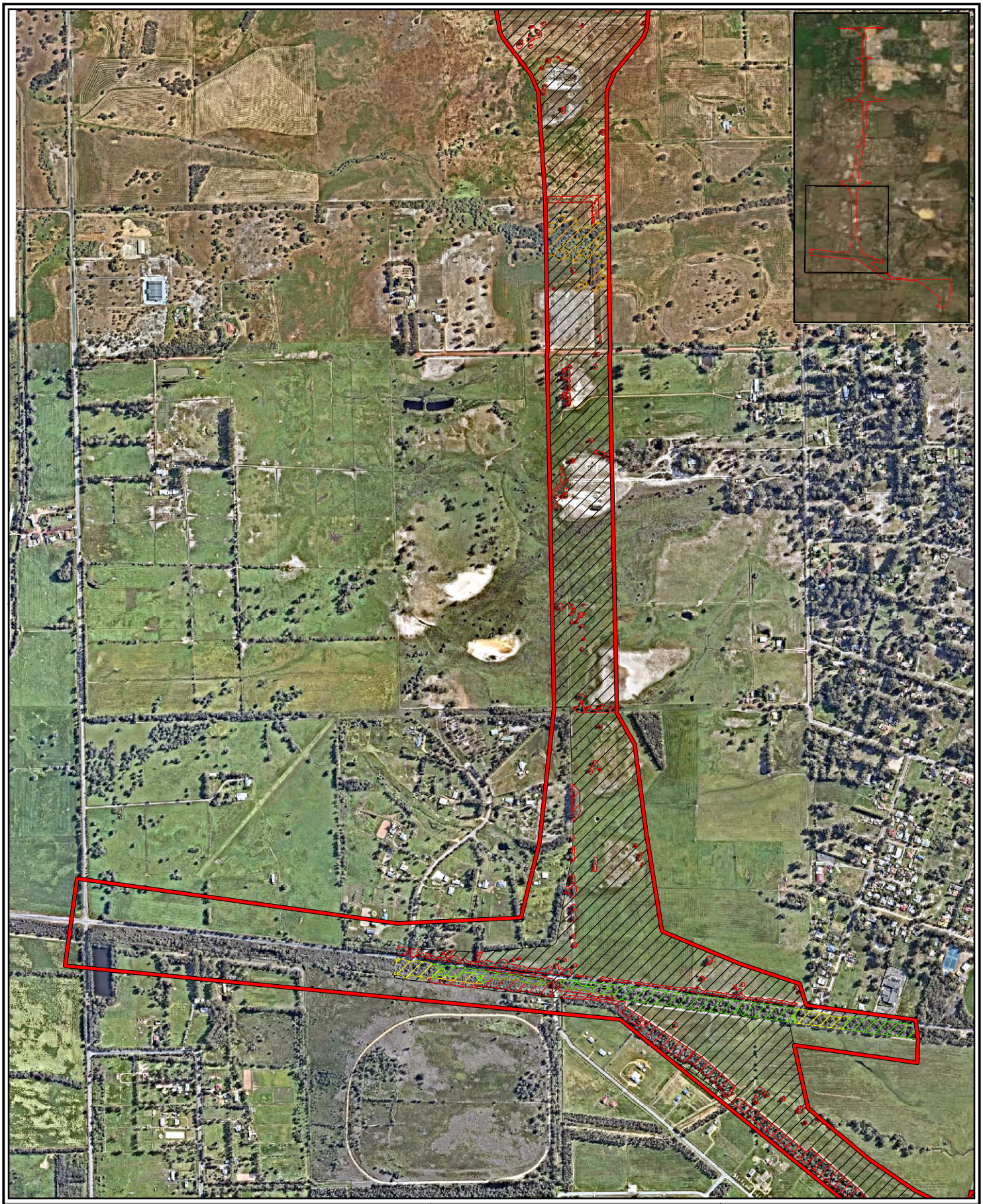
- Development envelope

Vegetation condition

- Degraded
- Completely Degraded
- Cleared Land

Scale 1:18,000 at A4 (0 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**VEGETATION CONDITION PAGE 2**
Job No: 5675204		
Client: Main Roads		**FIGURE 4**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend

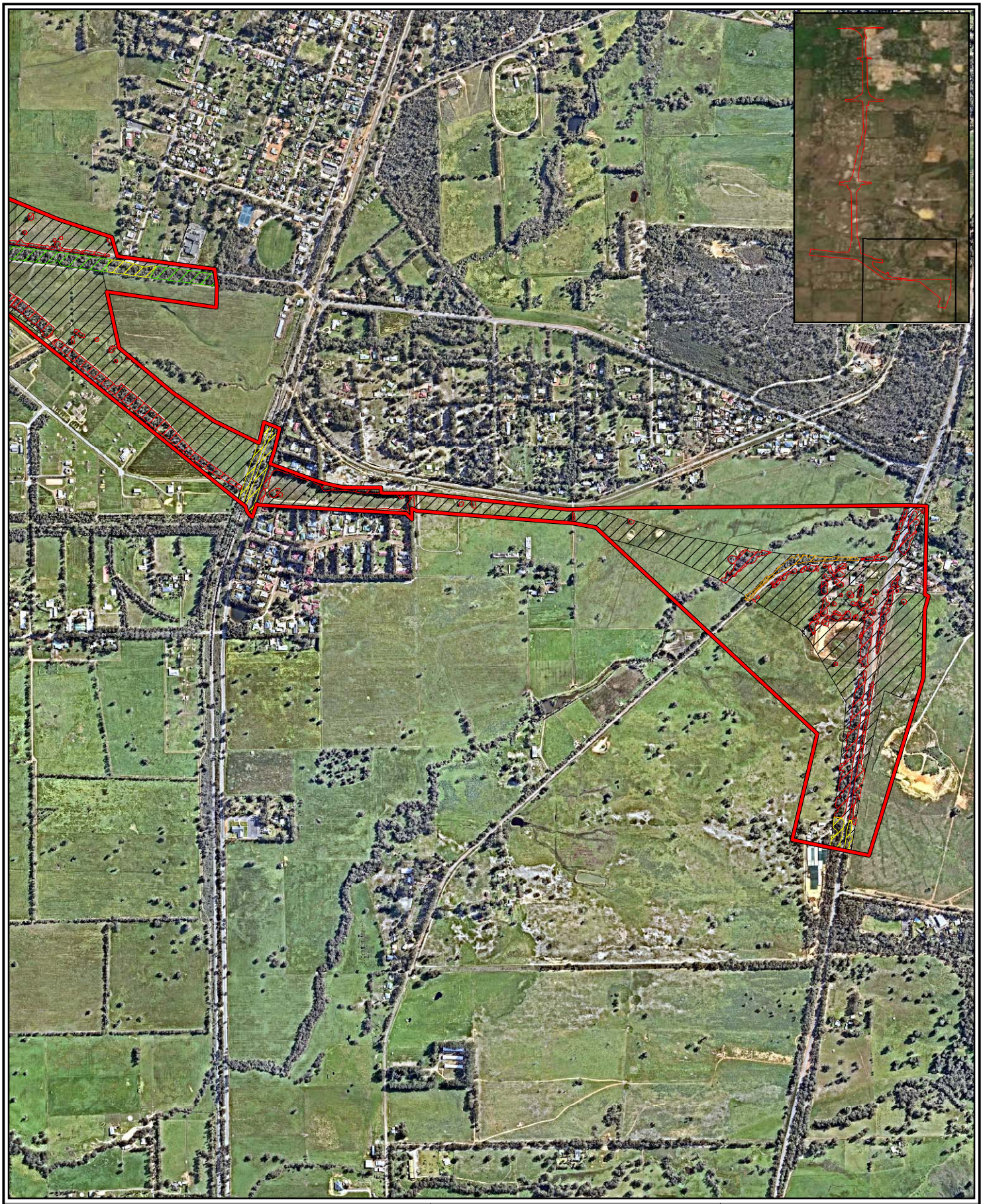
- Development envelope

Vegetation condition

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared Land

Scale 1:16,000 at A4	0 200 Meters	**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**VEGETATION CONDITION PAGE 3**
Job No: 5675204		
Client: Main Roads		**FIGURE 4**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd



Legend

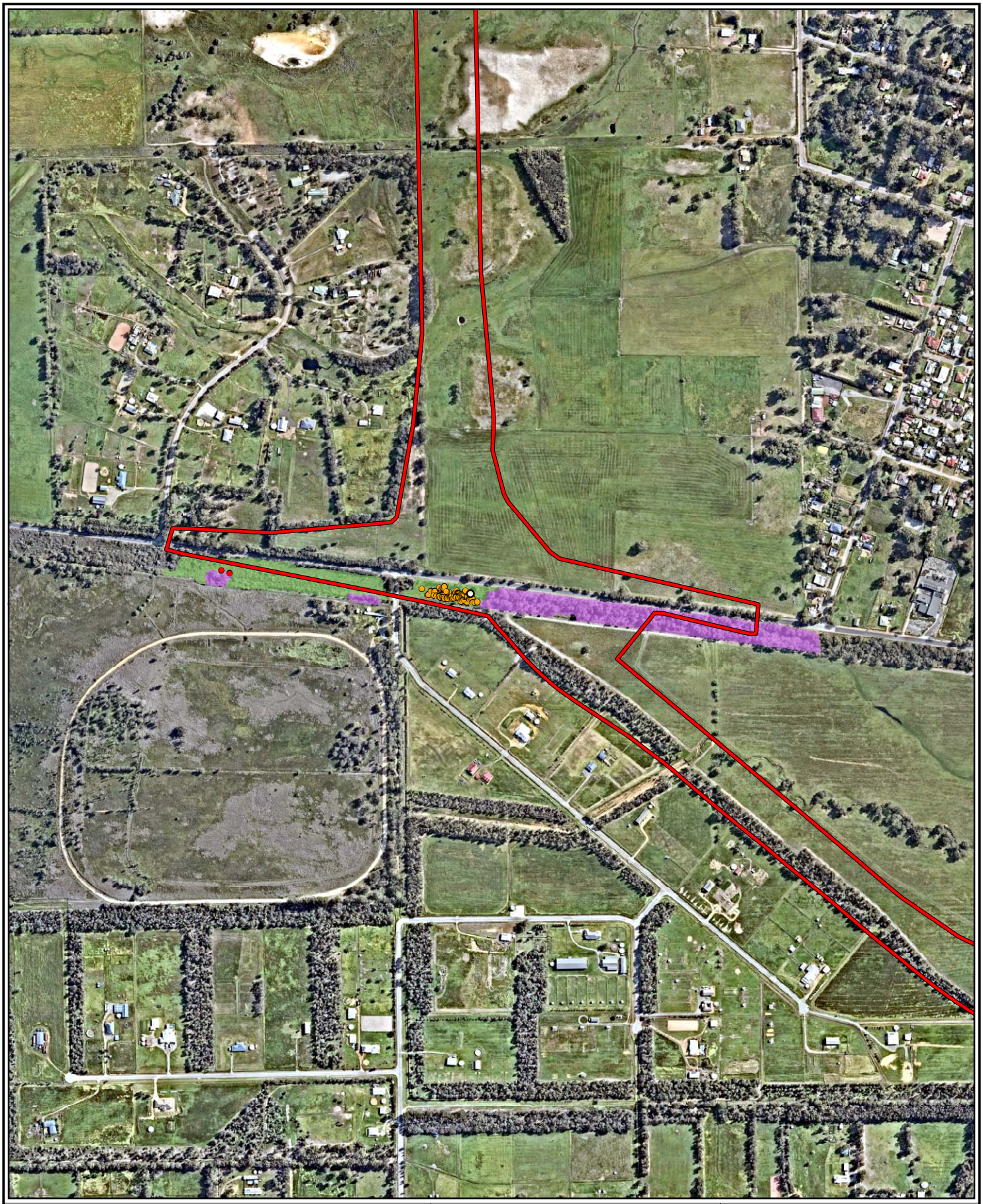
- Development envelope

Vegetation condition

- Good
- Degraded
- Completely Degraded
- Cleared Land

Scale 1:18,000 at A4	0 200 Meters	**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**VEGETATION CONDITION PAGE 4**
Job No: 5675204		
Client: Main Roads		**FIGURE 4**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_03_RemnantVegetation.mxd



Legend

Name

Development Envelope

Threatend Flora

Synaphea sp. Pinjarra Plain (A.S. George 17182)

Synaphea sp. Serpentine (G.R. Brand 103)

Tetraria australiensis

Ecological_Community

SCP08 - Herb rich shrublands in clay pans

SCP3a - Corymbia calophylla – Kingia australis woodlands on heavy soils

Scale 1:10,000 at A4

0 100 200

Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A

Date: 02-Dec-2019

Drawn By: esutherland

Checked By: CT

Tonkin Highway Extension

THREATENED FLORA AND ECOLOGICAL COMMUNITIES

FIGURE 5

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_04_TEC_DRF.mxd
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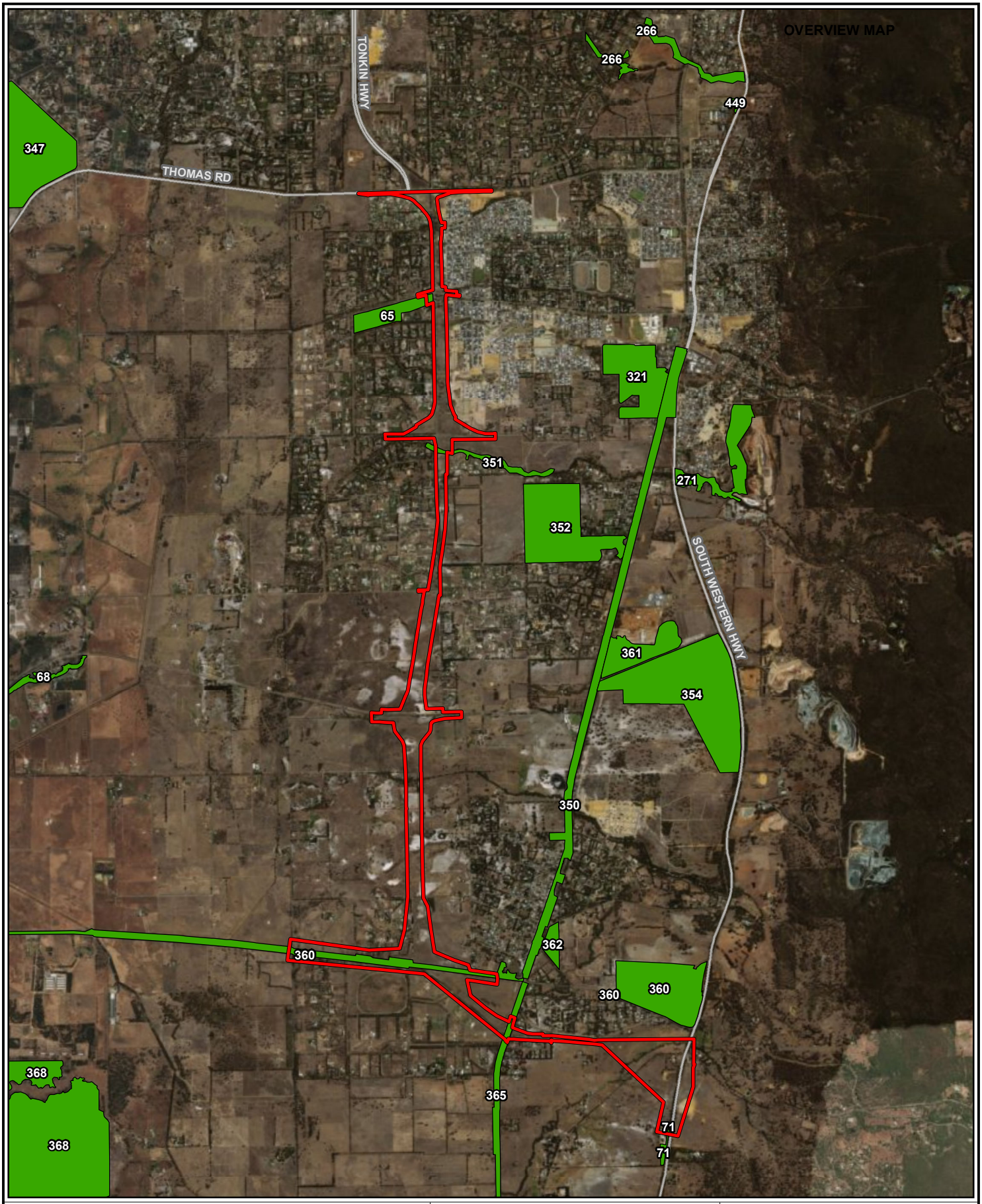


Legend:

- Development envelope
- Bush Forever
- Major road

Scale 1:65,000 at A4 (0, 1, 2 km)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: esutherland | Checked By: HS

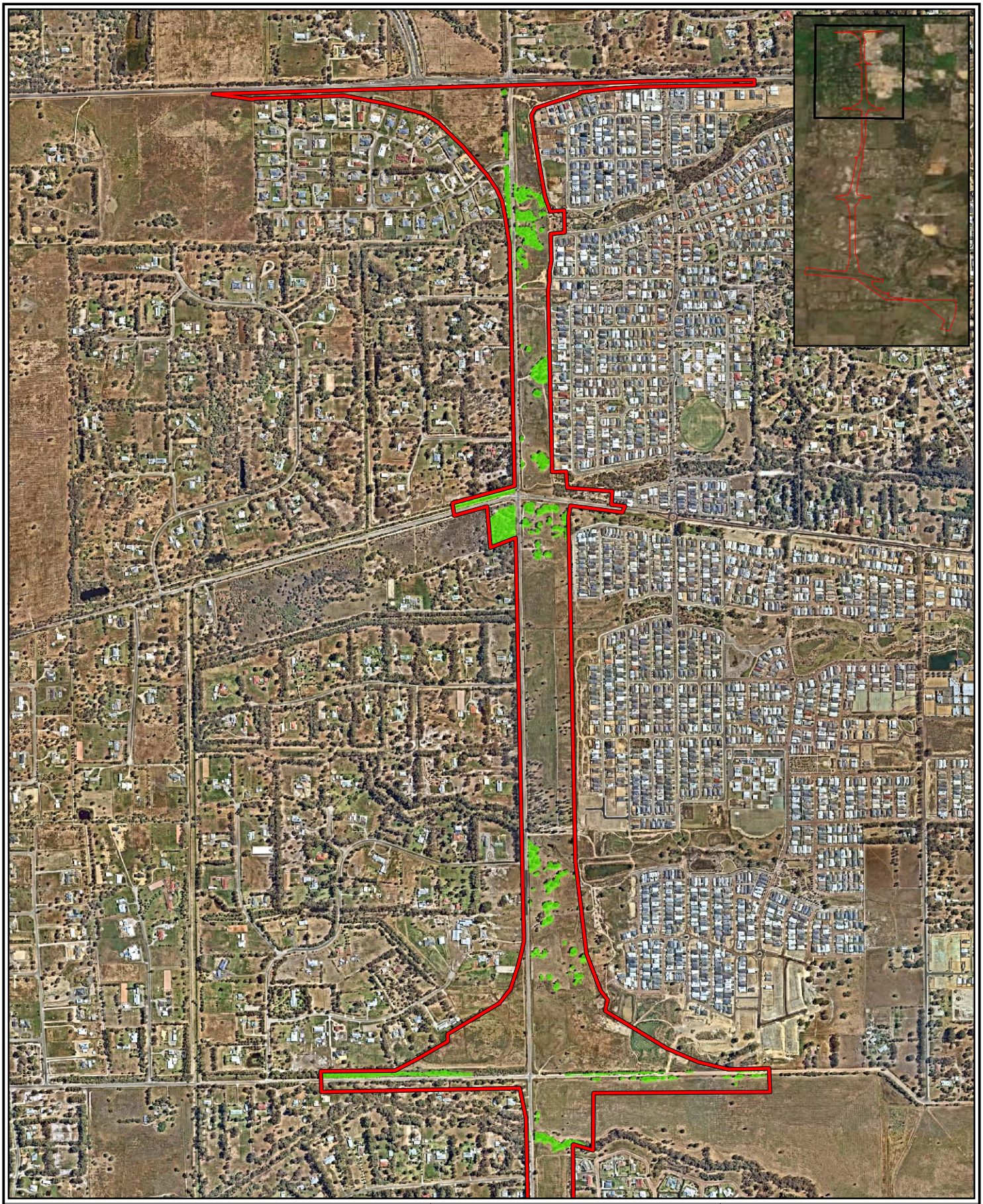
Tonkin Highway Extension

BUSH FOREVER SITES

FIGURE 6

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\5675204_07_MunicipalInventory.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

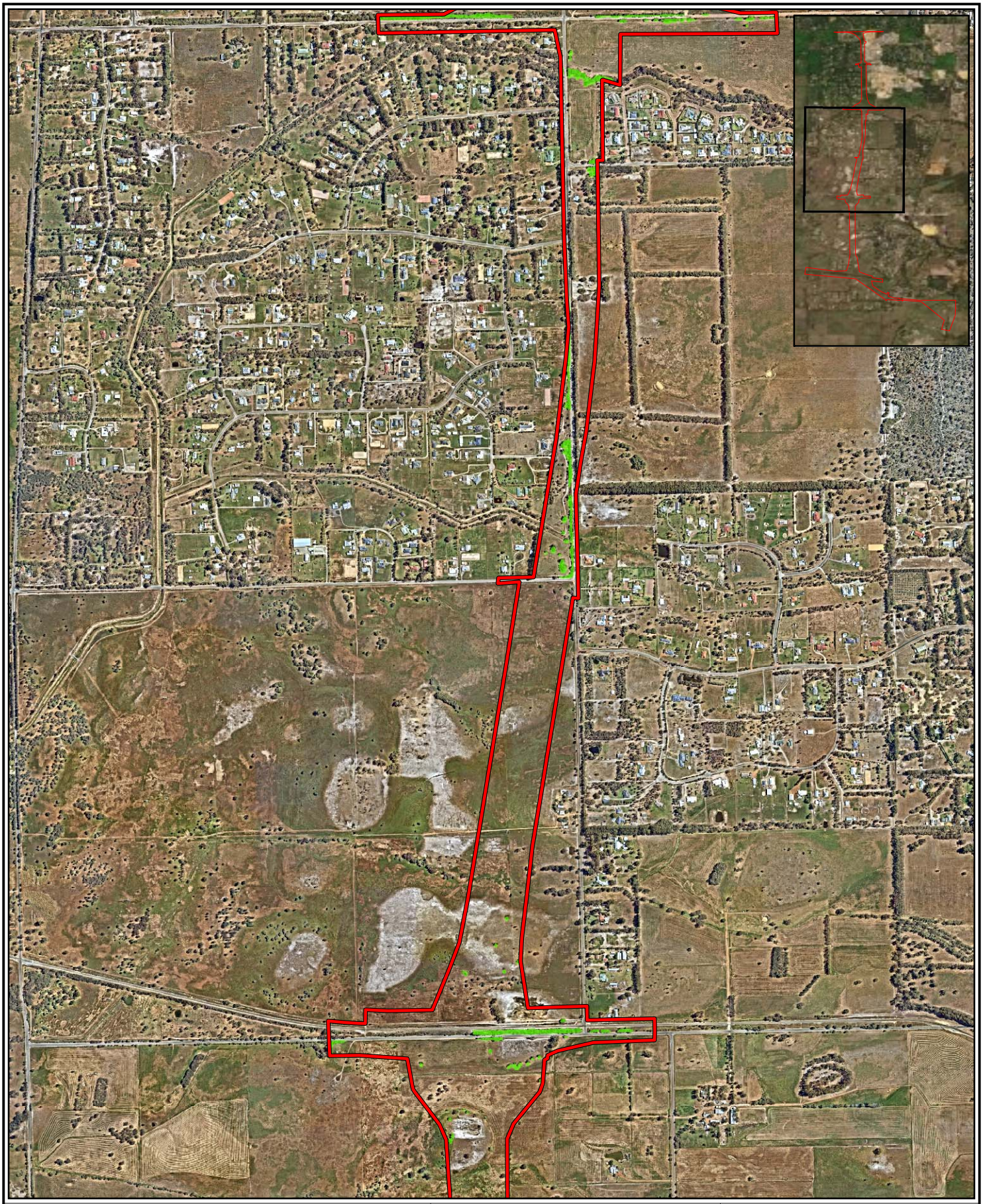


Legend:

- Development envelope
- Black cockatoo foraging habitat

Scale 1:16,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO FORAGING HABITAT PAGE 1**
Job No: 5675204		
Client: Main Roads		**FIGURE 7**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_09_BCHabitat.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

- Development envelope
- Black cockatoo foraging habitat

Scale 1:18,000 at A4

0 200 Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

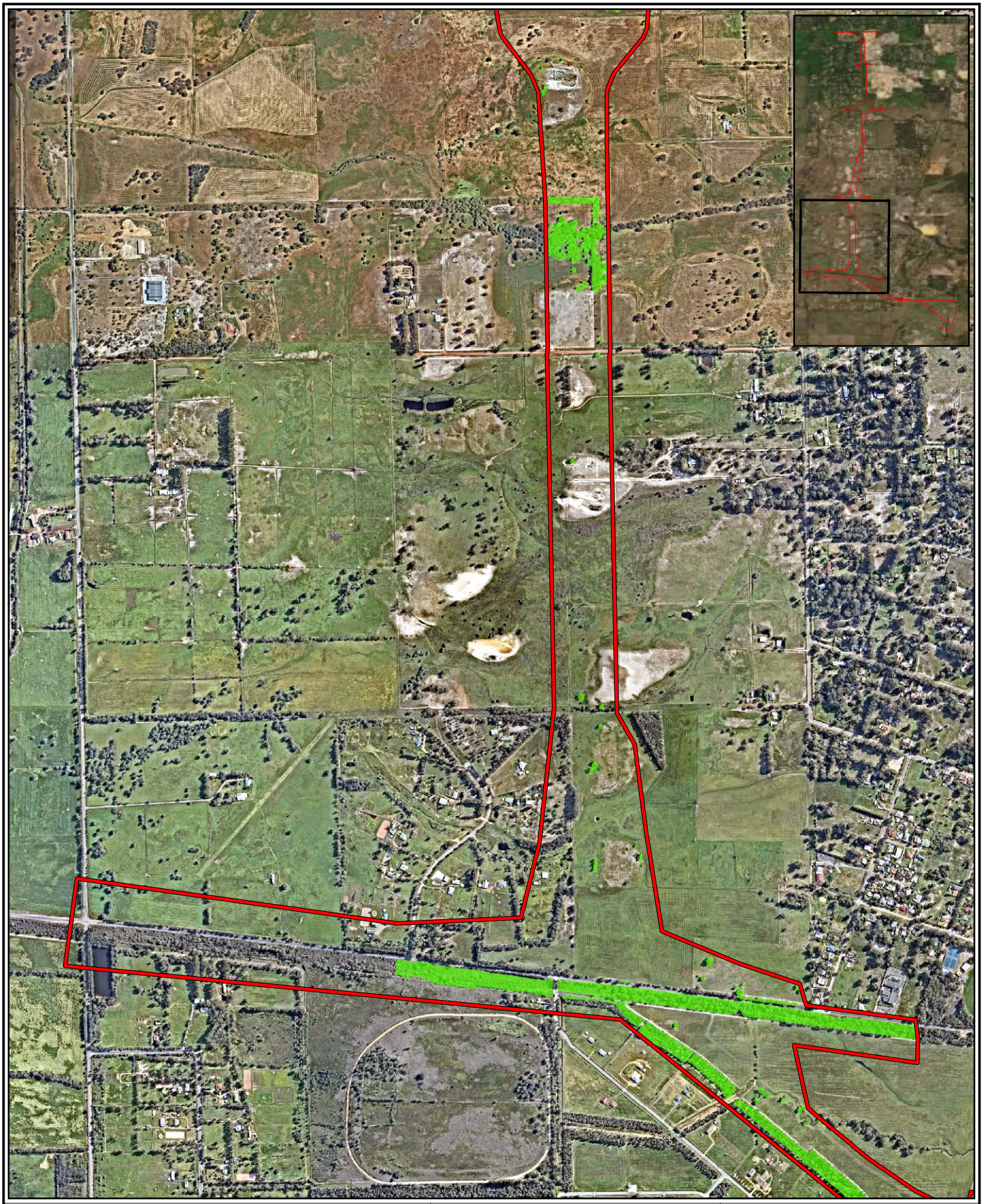
Tonkin Highway Extension

BLACK COCKATOO FORAGING HABITAT
PAGE 2

FIGURE 7

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_09_BCHabitat.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.

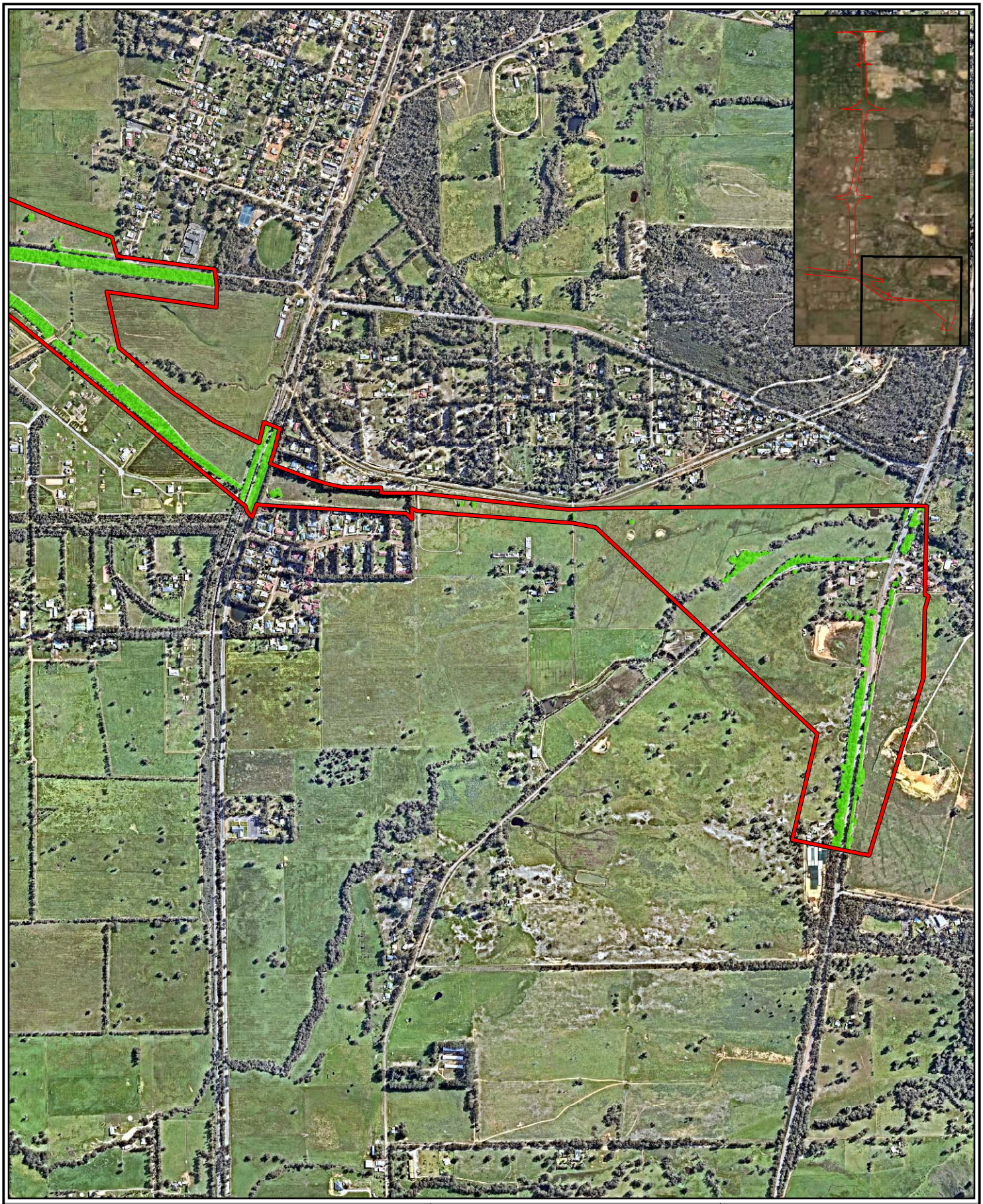


Legend:

- Development envelope
- Black cockatoo foraging habitat

Scale 1:16,000 at A4	0 200 Meters	**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO FORAGING HABITAT PAGE 3**
Job No: 5675204		
Client: Main Roads		**FIGURE 7**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_09_BCHabitat.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

- Development envelope
- Black cockatoo foraging habitat

Scale 1:18,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO FORAGING HABITAT PAGE 4**
Job No: 5675204		
Client: Main Roads		**FIGURE 7**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_09_BCHabitat.mxd
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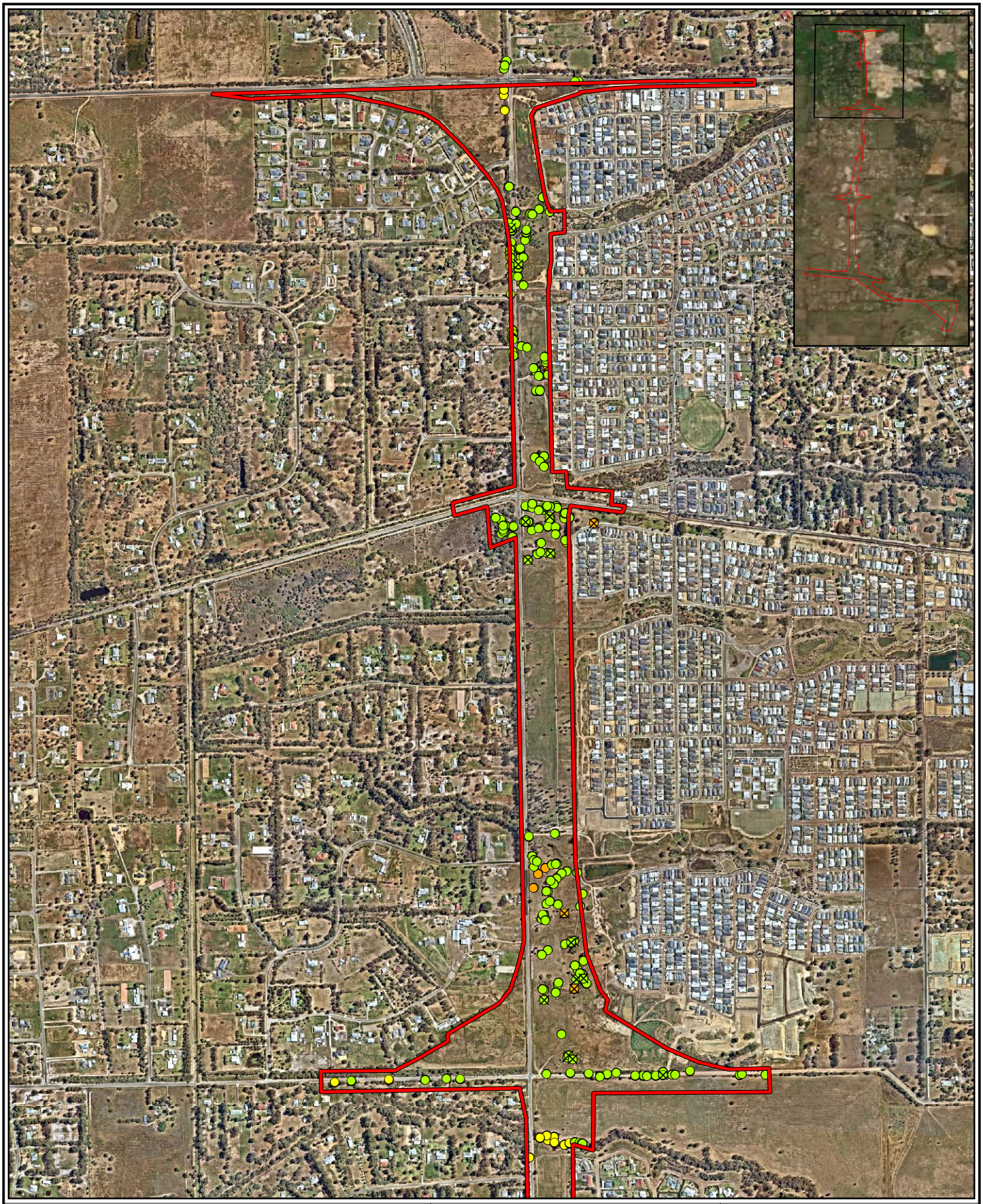


Legend:

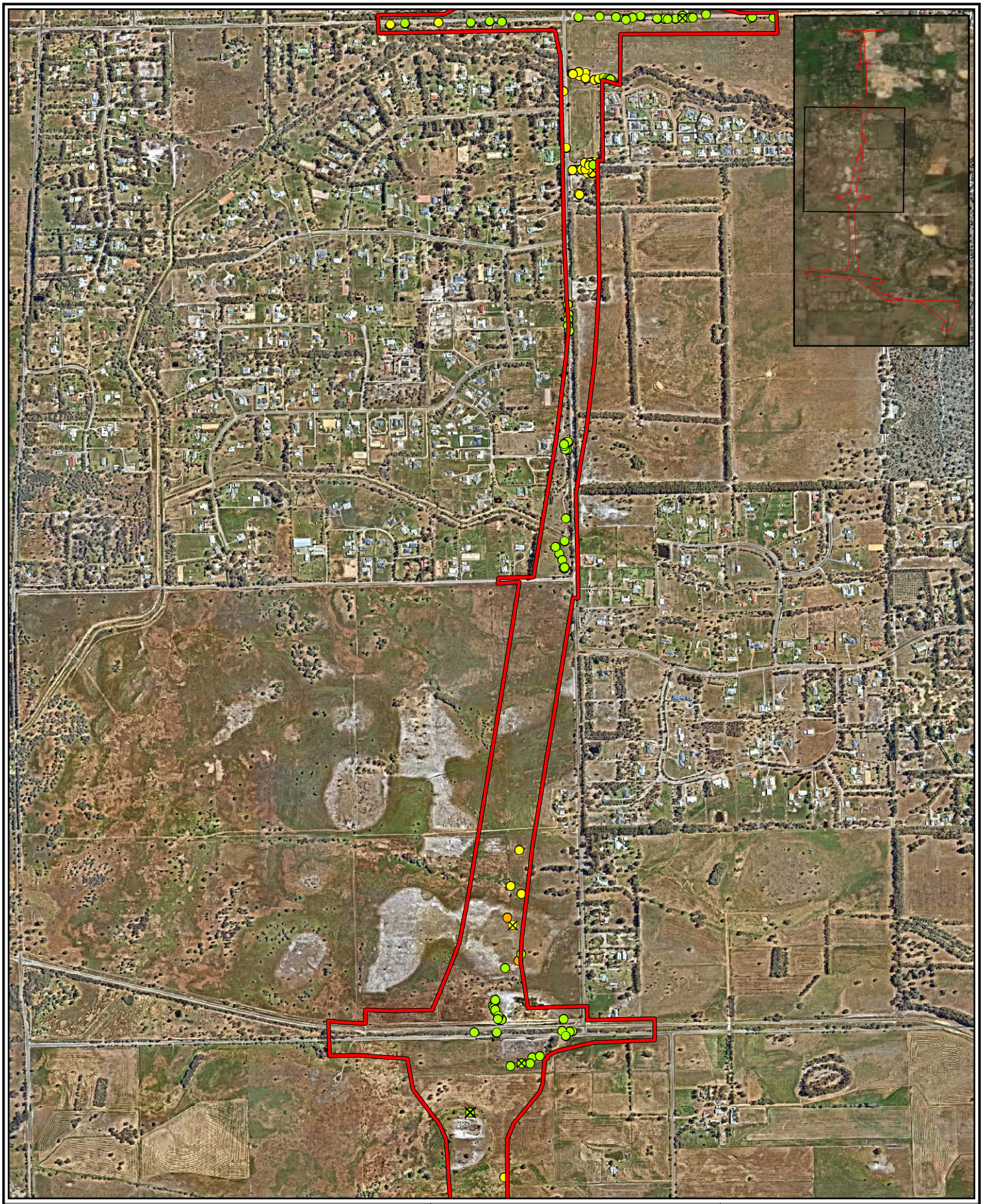
- Development envelope
- Significant black cockatoo trees with hollows

Significant Black Cockatoo trees

- Flooded Gum
- Jarrah
- Jarrah - dead
- Marri
- Marri - dead

Scale 1:16,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO TREES PAGE 1**
Job No: 5675204		
Client: Main Roads		**FIGURE 8**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_05_BCTrees_.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

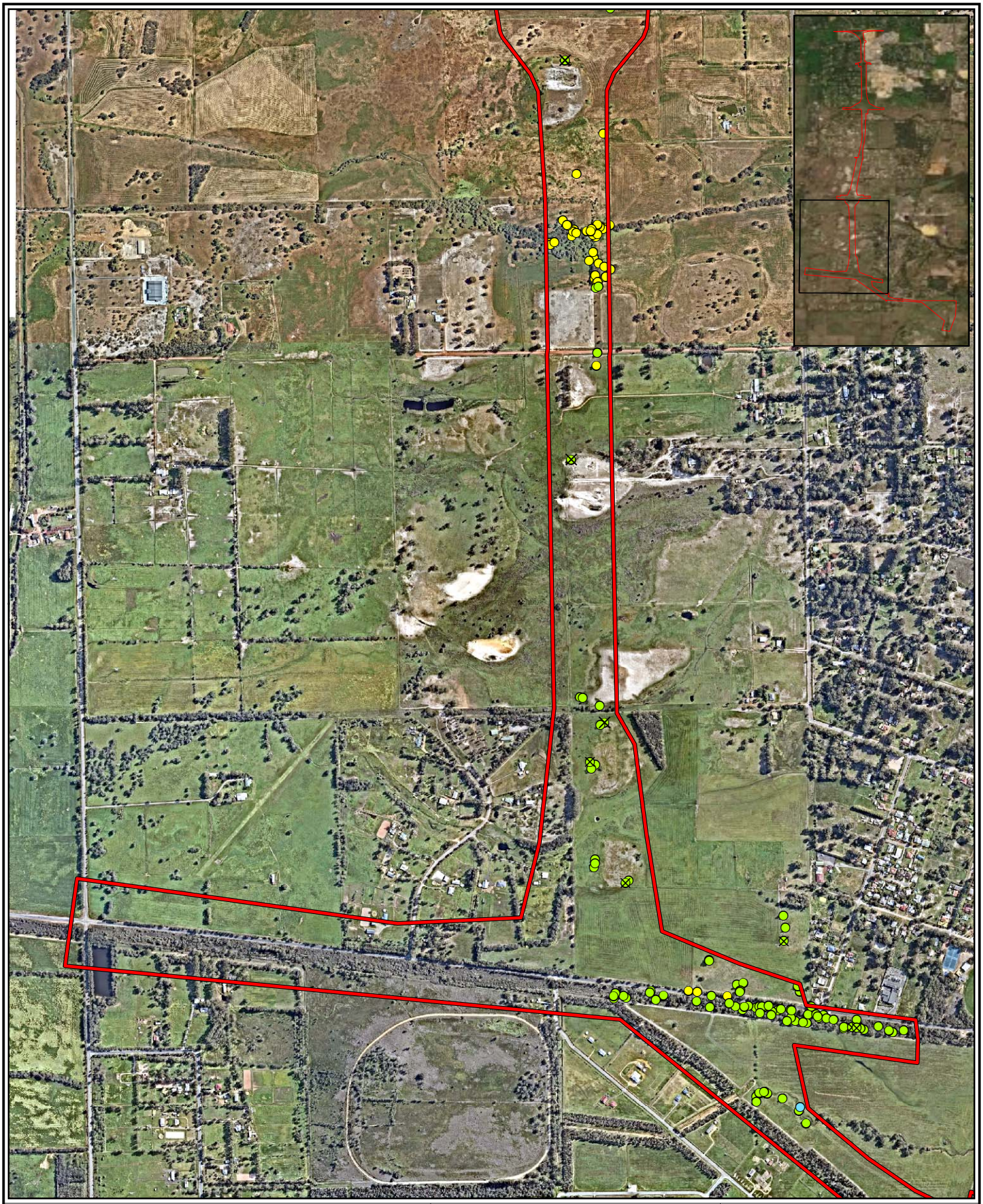
- Development envelope
- Significant black cockatoo trees with hollows

Significant Black Cockatoo trees

- Flooded Gum
- Flooded Gum - dead
- Jarrah
- Marri
- Marri - dead

Scale 1:18,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO TREES PAGE 2**
Job No: 5675204		
Client: Main Roads		**FIGURE 8**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_05_BCTrees_.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

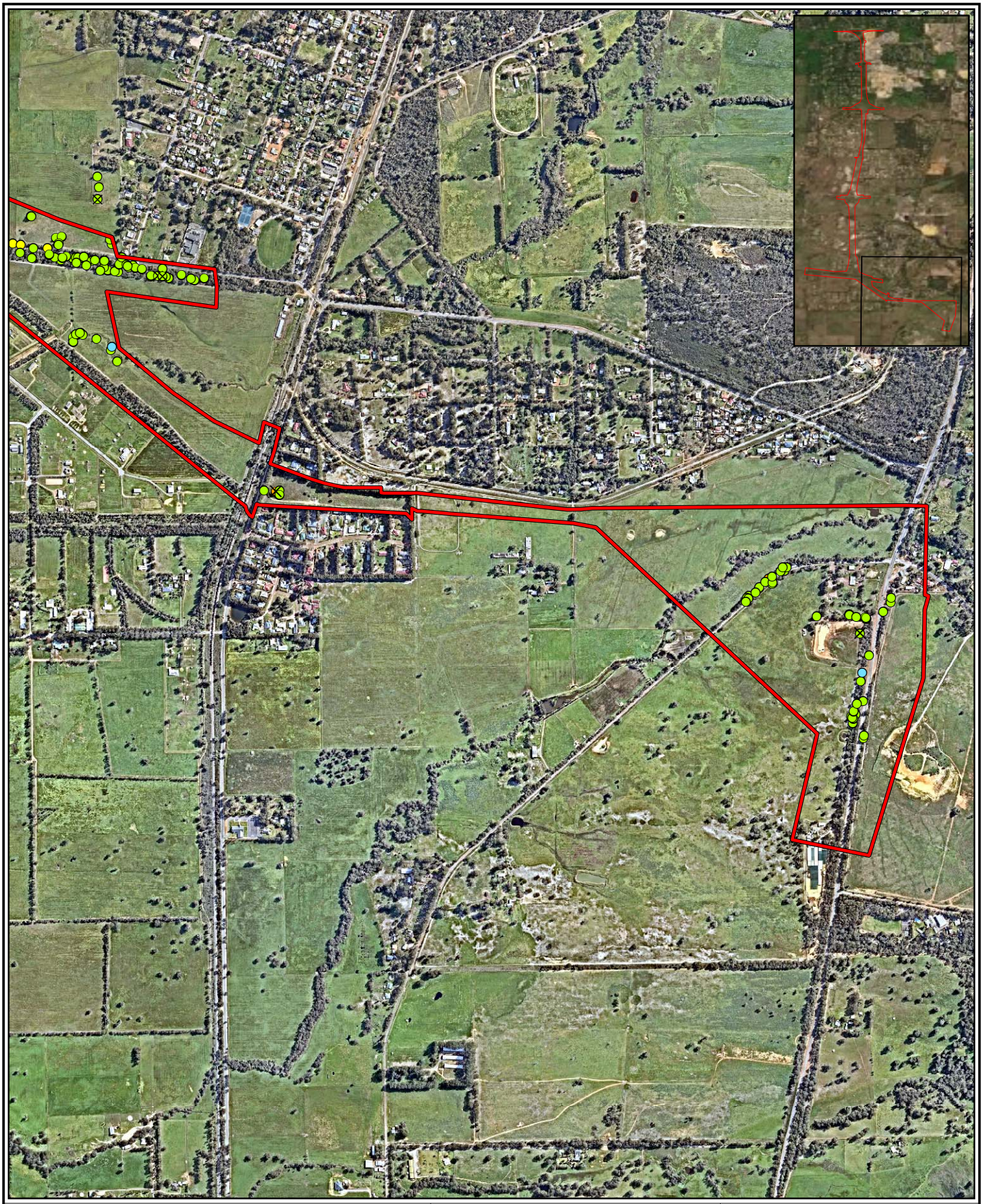
- Development envelope
- Significant black cockatoo trees with hollows

Significant Black Cockatoo trees

- Flooded Gum
- Marri
- Marri - dead
- Wandoo

Scale 1:16,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO TREES PAGE 3**
Job No: 5675204		
Client: Main Roads		**FIGURE 8**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_05_BCTrees_.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

- Development envelope
- Significant black cockatoo trees with hollows

Significant Black Cockatoo trees

- Flooded Gum
- Jarrah
- Marri
- Marri - dead
- Wandoo

Scale 1:18,000 at A4 (0 – 200 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**BLACK COCKATOO TREES PAGE 4**
Job No: 5675204		
Client: Main Roads		**FIGURE 8**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_05_BCTrees_.mxd
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Legend:

- Development envelope
- DBCA Managed Land
- Potential Black Cockatoo foraging areas

Scale 1:180,000 at A4 (0 2 4 Kilometers)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**REGIONAL BLACK COCKATOO HABITAT**
Job No: 5675204		
Client: Main Roads		**FIGURE 9**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

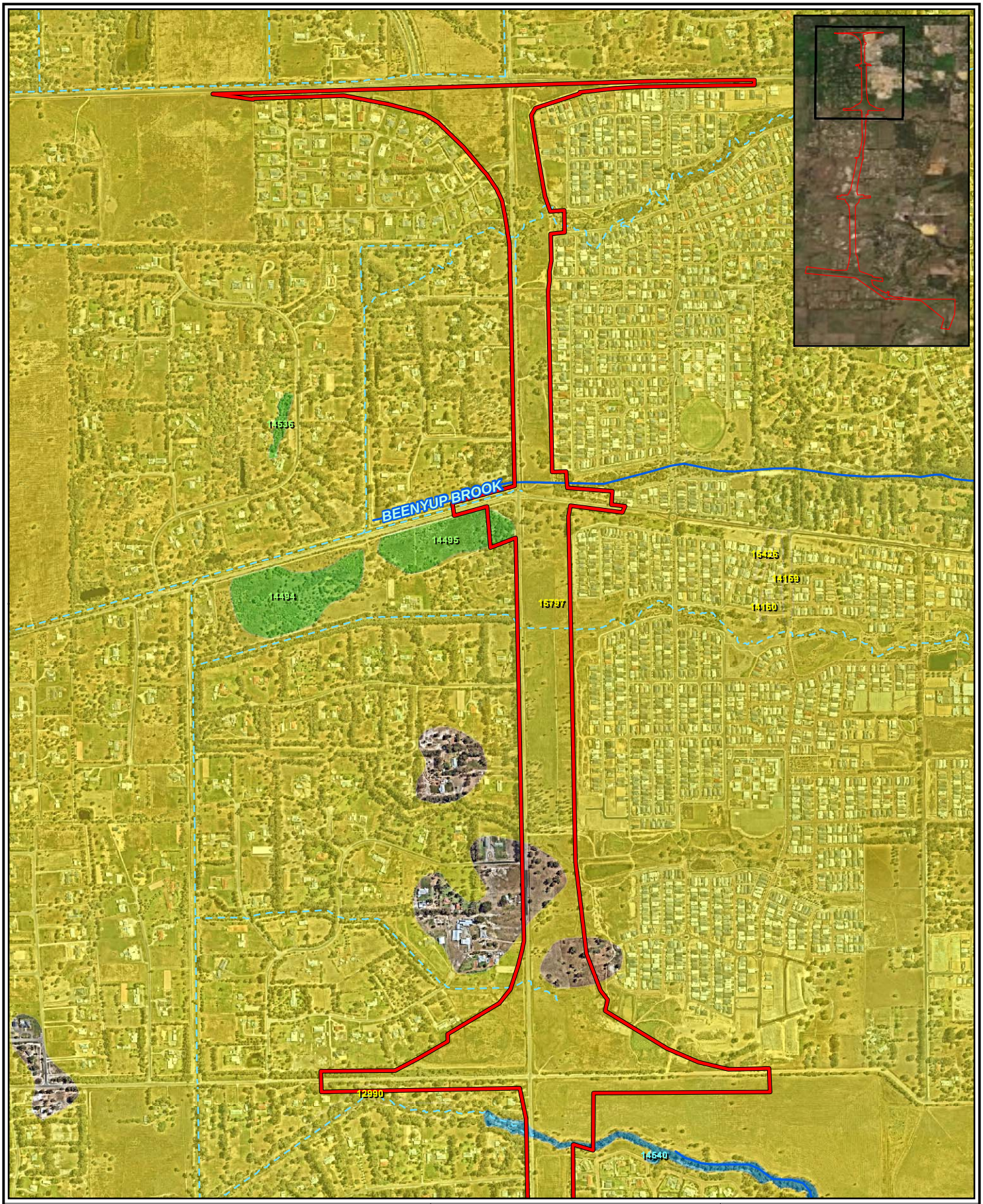
File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_06_RegionalBCHabitat.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.

Legend:

- Development envelope
- Nationally Important Wetlands

Scale 1:100,000 at A4 (0 – 2 Kilometers)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**NATIONALLY IMPORTANT WETLANDS**
Job No: 5675204		
Client: Main Roads		**FIGURE 10**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: esutherland	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_07_Wetlands.mxd

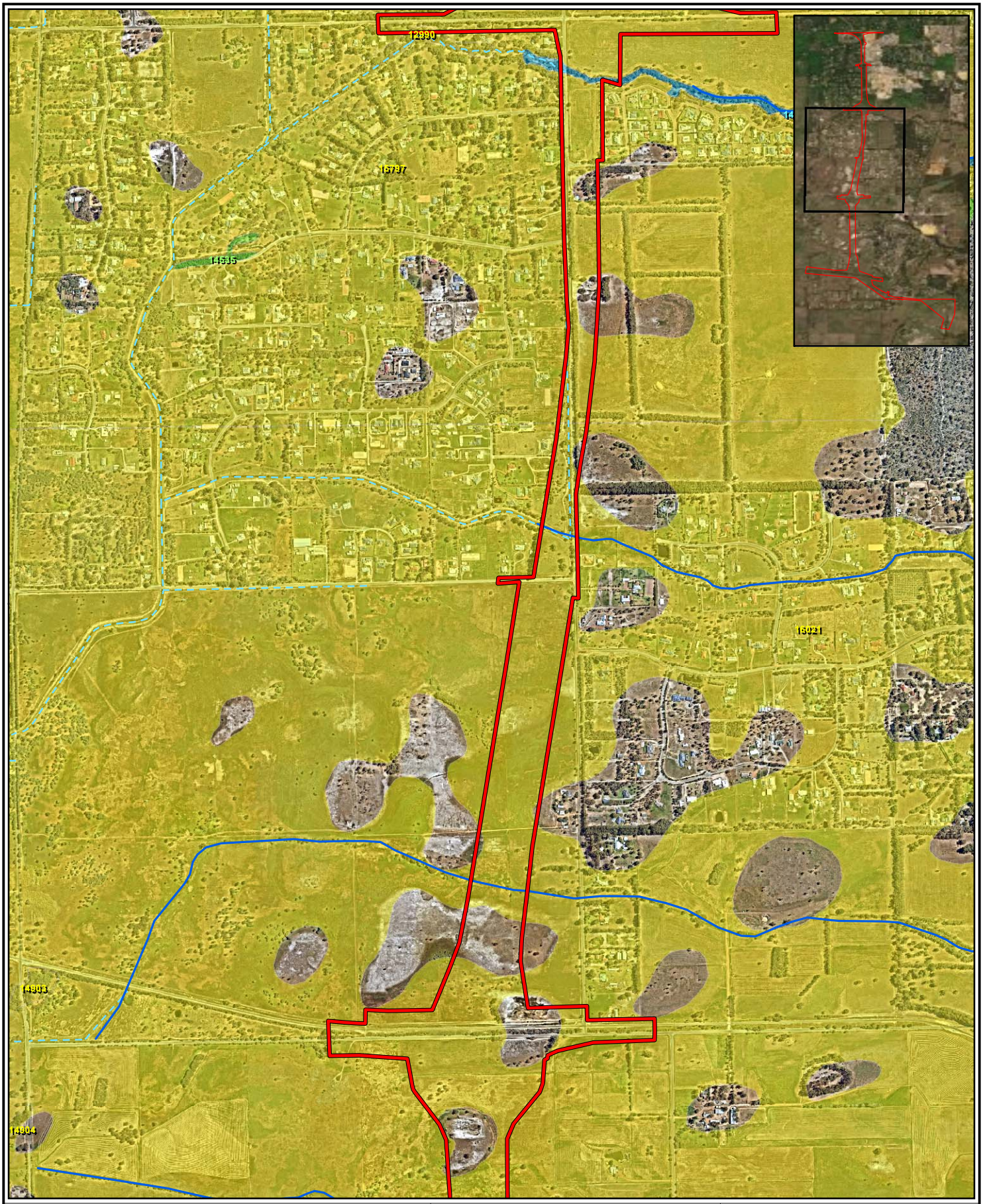


Legend:

- Development envelope
- Geomorphic Wetlands (DBCA)
  - Conservation
  - Resource Enhancement
  - Multiple Use
- Watercourses
- Drainage lines

Scale 1:16,000 at A4 (0 200 400 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**GEOMORPHIC WETLANDS AND WATERCOURSES PAGE 1**
Job No: 5675204		
Client: Main Roads		**FIGURE 11**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_08_Hydrography.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

- Development envelope

Geomorphic Wetlands (DBCA)

- Conservation
- Resource Enhancement
- Multiple Use
- Watercourses
- Drainage lines

Scale 1:18,000 at A4 (0 200 400 Meters)		**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**GEOMORPHIC WETLANDS AND WATERCOURSES PAGE 2**
Job No: 5675204		
Client: Main Roads		**FIGURE 11**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_08_Hydrography.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.

Legend:

- Development envelope
- Geomorphic Wetlands (DBCA)
  - Conservation
  - Multiple Use
- Watercourses
- Drainage lines

Scale 1:16,000 at A4

0 200 400 Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

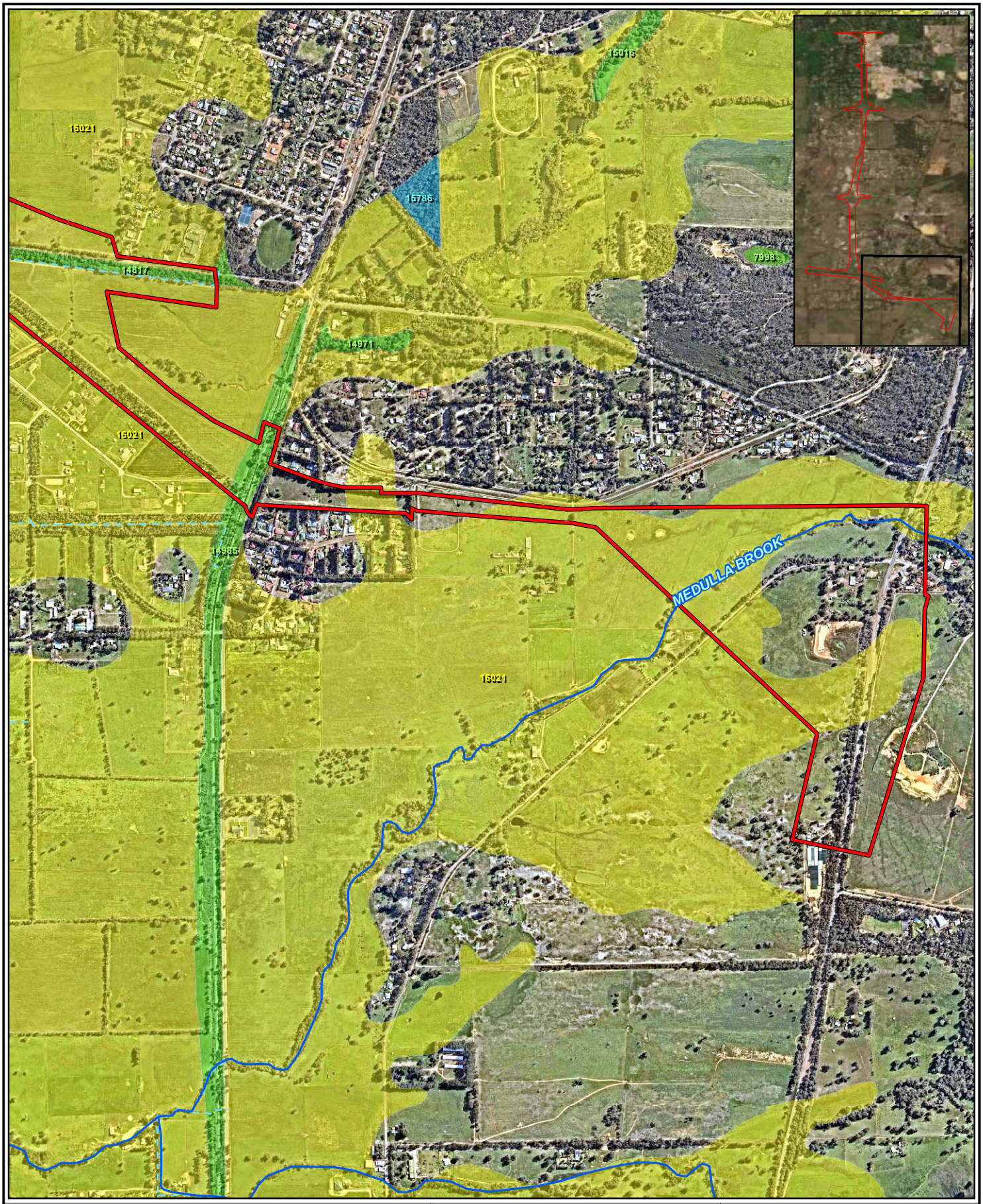
Tonkin Highway Extension

GEOMORPHIC WETLANDS AND WATERCOURSES
PAGE 3

FIGURE 11

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_08_Hydrography.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.



Legend:

- Development envelope
- Geomorphic Wetlands (DBCA)
  - Conservation
  - Resource Enhancement
  - Multiple Use
- Watercourses
- Drainage lines

Scale 1:18,000 at A4

0 200 400
Meters

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: CT

Tonkin Highway Extension

GEOMORPHIC WETLANDS AND WATERCOURSES PAGE 4

FIGURE 11

strategen JBS&G

File Name: W:\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\20191119\5675204_08_Hydrography.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community www.nearmap.com © - Imagery Date: 21 October 2019.

Legend:

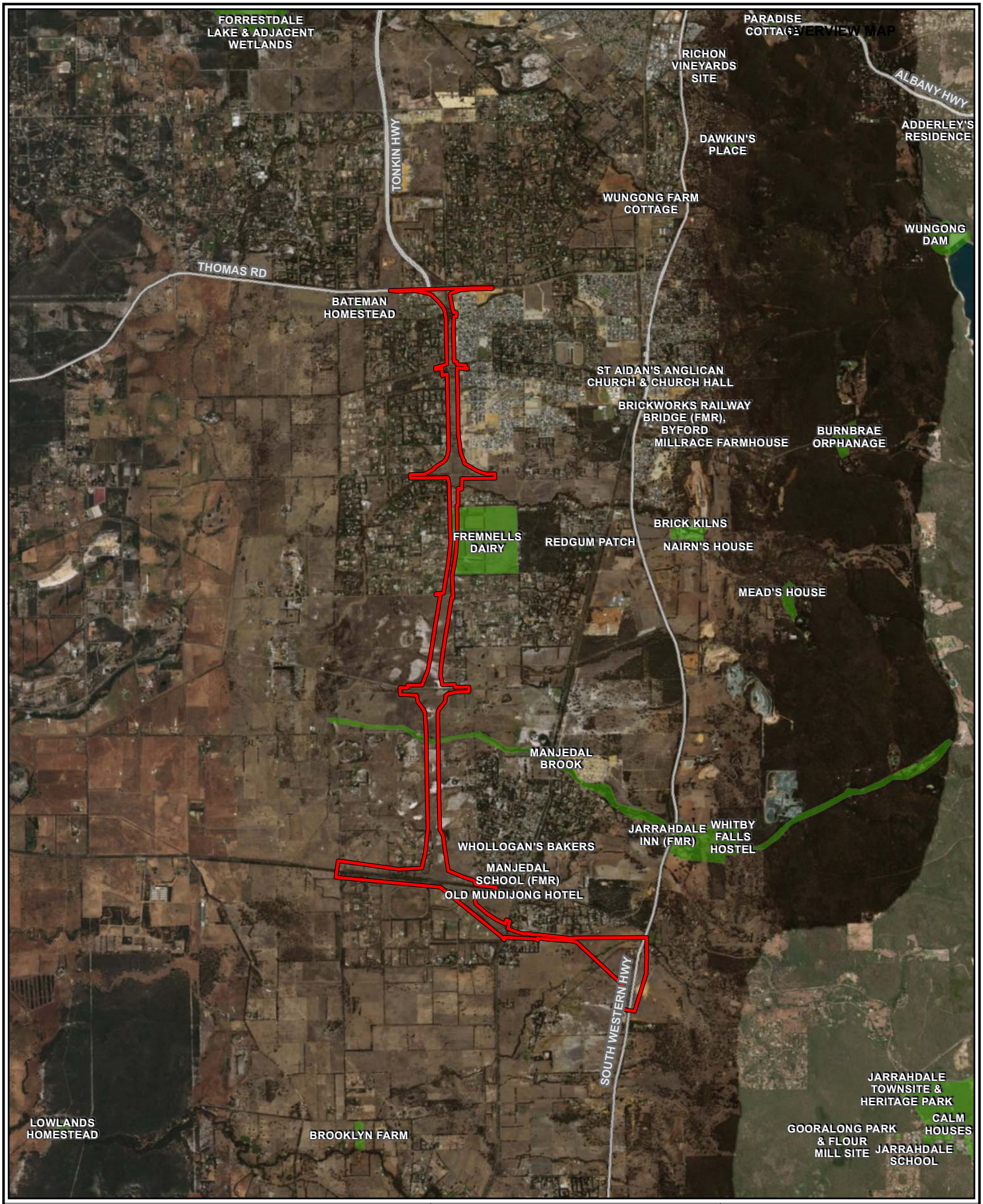
- Development envelope

Acid sulfate soil (DWER)

- High to moderate risk
- Moderate to low risk

Scale 1:60,000 at A4	0 0.5 1 Kilometres	**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**ACID SULFATE SOILS**
Job No: 5675204		
Client: Main Roads		**FIGURE 12**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: HS	

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\5675204_06_ASS.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend:

- Development envelope
- Municipal Inventory (SHO-005)
- Major road

Scale 1:85,000 at A4

0 1 2 Kilometres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 5675204

Client: Main Roads

Version: A | Date: 24-Dec-2019

Drawn By: hsullivan | Checked By: HS

Tonkin Highway Extension

MUNICIPAL INVENTORY PLACES WITHIN 2KM OF THE PROPOSAL AREA

FIGURE 13

strategen JBS&G

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\5675204_07_MunicipalInventory.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend:

- Development envelope

Aboriginal Heritage Places (DAA-001)

- Registered Site
- Other Heritage Place

Scale 1:60,000 at A4	0 0.5 1 Kilometres	**Tonkin Highway Extension**
Coord. Sys. GDA 1994 MGA Zone 50		**ABORIGINAL HERITAGE PLACES**
Job No: 5675204		
Client: Main Roads		**FIGURE 14**
Version: A	Date: 24-Dec-2019	strategen JBS&G
Drawn By: hsullivan	Checked By: HS	

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\MRO19005.01 Tonkin Hwy Extension\GIS\Maps\R02 Rev A\5675204_03_AborignalHeritage.mxd
Image Reference: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Appendix A Environmental Low Impact Screening Checklist

Environmental Low Impact Screening Checklist (LISC)

The Low Impact Screening Checklist (LISC) is part of the Main Roads corporate Environmental Assessment, Approval and Compliance Process. All proposed projects and associated activities are to be screened to identify those that are low impact. Activities (e.g. extraction of road building materials) that are not included in the project scope during initial screening must be screened separately.

In consultation with the relevant Environment Officer (EO), Project Managers are required to complete this form by filling in all blank cells and ticking "Yes" or "No" to all items. Projects that have "**No**" ticked for **all** items are considered **low impact** projects and will not require further environmental assessment. These projects are to be implemented using the standard clauses in the Tender Document Process or delivery arrangement equivalent. Projects that have "**Yes**" ticked for **any** item are considered **not low impact** projects and will require further environmental assessment. These projects must be implemented using an Environmental Management Plan with project specific clauses inserted into Tender Document Process or delivery method equivalent.

The LISC must firstly be sent to the relevant EO to review and then submit the completed checklist to the Environment Branch (via LISCandAHRA@mainroads.wa.gov.au) for review and endorsement by a Senior Environment Officer (SEO). The SEO may decide that further environmental assessment is not warranted even if the Project Manager has ticked "Yes" to an item. The EO and/or Project Manager will be advised within 5 business days of the LISC review.

NOTE: This checklist does not form part of the corporate Aboriginal Heritage Assessment and Approvals Process which is a separate process. Please refer to the Aboriginal Heritage Guideline. An Aboriginal Heritage Risk Assessment Checklist (AHRA) should be completed for all projects.

PROJECT DETAILS, SCOPE AND TYPE OF CLEARING APPROVAL

Project Name	Tonkin Highway Extension (Thomas Road to South Western Highway		
Region	Metropolitan		
Road Name and Number	Tonkin Highway H017		
Project Location (SLK)	N/A		
TRIM File Number	18/8840	**EOS Number**	1598

SCOPE OF THE PROJECT

Main Roads is proposing to extend Tonkin Highway from Thomas Road in Oakford to South Western Highway in Mundijong. The preliminary concept includes:

- approximately 14 kilometres of four lane dual carriageway from Thomas Road to South Western Highway
- construction/upgrades of intersections at Thomas Road, Abernethy Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway
- principal shared path along corridor

PROJECTS INVOLVING CLEARING OF VEGETATION

Estimated hectares of native vegetation clearing	21ha	**Estimated hectares of non-native vegetation clearing**	7

LOW IMPACT SCREENING

Item No.	Item	Yes	No
1.	The project involves the development of a new road or a new road reserve or the expansion of an existing road reserve.	☒	☐
2.	The project involves the development of a new or expansion of an existing road building material source extraction site. *This does not include commercial pits / quarries.*	☐	☒
3.	The project involves the development of new or expansion of an existing access track. *For example; to material pits / water sources or for traffic flow during construction.*	☐	☒
4.	The project involves the development of new or the expansion of an existing pedestrian or cycle pathways.	☒	☐
5.	The project is located within close proximity to a residential area and works are to occur outside normal working hours. *Normal working hours: Mon to Sat 7:00am - 7:00pm.*	☒	☐

6.	The project is a major redevelopment of an existing road (adding extra lanes or carriageways to increase traffic carrying capacity, or change in alignment) within 300 m of noise-sensitive premises.	☒	☐
7.	The project involves the demolition or removal of a bridge ≥ 60 years old, a building, a heritage garden, sign or plaque indicative of a heritage site.	☐	☒
8.	The project passes over, adjoins or drains directly into a wetland or watercourse.	☒	☐
9.	The project will change the local natural drainage regime or hydrology.	☒	☐
10.	The project involves dewatering, drawing water from an existing bore or surface water body, installation of a new or alteration of an existing water bore.	☒	☐
11.	The project is located on or adjacent to a potential source of hazardous materials. *For example; petrol station, industrial, waste disposal, landfill or acid sulphate soil site.*	☐	☒
12.	The project involves the clearing of native vegetation. *Clearing includes pruning which severs stems or trunks. Native vegetation includes all indigenous aquatic and terrestrial vegetation, dead or alive, and planted vegetation if it was done under a legislative requirement or for biodiversity purposes. This includes clearing at water extraction points (i.e. access tracks, turkeys nest), for site offices and fencing.*	☒	☐
13.	The project is located in a dieback susceptible area and there are protectable features in the vicinity of the works.	☒	☐
14.	The project involves the clearing of non-native vegetation that is suitable feeding, nesting or roosting habitat for black cockatoo species. *For example; revegetation, pine trees.*	☒	☐

Conclusion (*Tick all relevant boxes*)	**Yes**	**No**
Project requires further assessment	☐	☐
Project requires further assessment through:		
• **Project Environmental Risk Assessment**	☐	☐
• **PEIA/EIA**	☒	☐
• **Fast Track Assessment Form for Low Impact Clearing Projects**	☐	☐
• **PCIA/CIA**	☐	☐

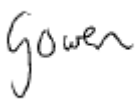
Type of Clearing Approval

☐ CPS 818	☐ CPS817	☐ Project Specific Permit
☐ Schedule 6 Exemption	☐ Exemption under Regulation *(insert exemption e.g. Reg 5 Item 22)*	
☐ Bed and Banks Permit	☐ CAWS Act	☒ Other (Ministerial Statement 595)

Additional Comments / Justification

The project will be constructed using Ministerial Statement 595 for the Extension of Tonkin Highway. The project will require referral to the Department of Environment and Energy

REVIEW AND ENDORSEMENT

	Completed by Project Manager	**Reviewed by Environment Officer**	**Endorsed by Environment Branch**
Signature			
Name	Lance Thomas	Elizabeth Johnston	Gaynor Owen
Title	Project Manager	Senior Environment Officer	SEO
Date	27/05/2019	21/05/2019	28/5/2019

Appendix B Aboriginal Heritage Risk Assessment

Aboriginal Heritage Risk Assessment (AHRA) Form

The purpose of the Aboriginal Heritage Risk Assessment (AHRA) form is to identify the risk a project has on impacting Aboriginal heritage sites as defined by the *Aboriginal Heritage Act 1972* (AHA). The risk assessment is based on the Department of Planning, Lands and Heritage (DPLH) *Cultural Heritage Due Diligence Guidelines* (version 3.0, 30 April 2013). Please refer to the Aboriginal Heritage Guideline for further information. The AHRA also forms part of the Main Roads corporate Environmental Assessment, Approval and Compliance Process. Environment Officers are required to complete all items of the AHRA and Project Managers are required to acknowledge and sign the form. The completed form must be submitted to Environment Branch (at LISCandAHRA@mainroads.wa.gov.au) for review and endorsement by Main Roads' Principal Heritage Officer (PHO) or Heritage Officer (HO). Text in red italics are guidance notes.

PROJECT DETAILS	
Project Name:	Tonkin Highway Extension (Thomas Road to South Western Highway
Region/Directorate:	Metropolitan
Expected Project Start Date:	Late 2021
Road Name and Number:	Tonkin Highway H017
Project Location (SLK):	N/A
TRIM File Number:	19/3204
TRIM Link to Spatial Data:	
EOS Number:	1598
SCOPE OF THE PROJECT	
Project Description:	Main Roads is proposing to extend Tonkin Highway from Thomas Road in Oakford to South Western Highway in Mundijong. The preliminary concept includes: • approximately 14 kilometres of four lane dual carriageway from Thomas Road to South Western Highway • construction/upgrades of intersections at Thomas Road, Abernethy Road, Orton Road, Bishop Rd, Mundijong Road and South Western Highway • principal shared path along the corridor
Machinery to be used:	road graders, large excavators etc
Will water be needed for the project:	Yes, source not determined at this stage
What ground disturbing activities will be undertaken:	Excavations will be required for stock underpasses and the majority of the road construction will be fill.
ABORIGINAL HERITAGE INQUIRY SYSTEM (AHIS) SEARCH[1]	
Which search did you use:	☐ Co-ordinates ☐ Shapefile ☒ Custom Area
How much of a buffer did you include:	0km
No. of Registered Sites in search area:	7
No. of Lodged sites in search area:	*6*

[1]AHIS Search is available at https://maps.daa.wa.gov.au/ahis/. Main Roads should exercise caution in areas where no surveys have been completed, or where surveys have only been completed for parts of the area where the proposed activity is intended. Heritage surveys that cover only part of the land may not have identified all possible sites. Sole reliance on information contained in the AHIS Register may not be sufficient and consultation in the first instance with a Heritage Officer is recommended in these situations.

No. of Insufficient/ Stored Data sites in search area:	*6*
Is the entire project area covered by existing surveys?	☒ Yes ☐ No
If yes, what are the survey(s) type:	☒ Ethnographic ☒ Archaeological
Provide any additional information:	

POTENTIAL TO AVOID HERITAGE SITES

If the project is going to impact on a heritage place or site, could the footprint of project be altered to avoid negative impacts?

☐ Yes ☒ No ☐ Unsure ☐ N/A

Comments: The sites occur within the middle of the proposed road reserve. In one location, the area has been developed as residential adjacent to the site.

PREVIOUS LAND USE *(select which best describes the project impact)*

Categories	Description	Select X
Built Environment	Urban land use, towns, metropolitan region	☐
Significantly Altered Environment	Cultivated and cleared land, farmland; rehabilitated landscape	☐
Moderately Altered Environment	Partially cleared lands, revegetated landscape	☒
Minimally Altered Environment	Urban bushland, regrowth areas, slightly disturbed natural bushland	☐
Unaltered Environment	Protected areas or pristine environment	☐

LIKELY LAND IMPACT OR DISTURBANCE FROM ACTIVITY *(select the most appropriate level)*

Categories	Description	Select X
NEGLIGIBLE	**Activities which are non-invasive and cause negligible or no impact to the land may include:** • walking, photography, filming for assessing project scope, vegetation and heritage • magnetic surveys • use of existing tracks, water courses • environmental monitoring • water and soils sampling using hand held instruments • fossicking using hand held instruments • spatial measurement • scientific research, using hand held tools	☐
MINIMAL	**Activities that cause minimal disturbance to the land may include:** • cultivation/grazing in areas previously cultivated/grazed • maintenance of existing paths, walls, roads, tracks, bridges, public infrastructure and community utilities within the existing footprint and adjacent service areas • feral animal eradication, weed, vermin and pest control, vegetation control and fire control • light vehicular access and camping	☐
MODERATE	**Activities that cause moderate disturbance to the land may include:** • maintenance of bridges that disturb river bed and/or banks	☐

	• sampling using hand held rig or rig mounted on a light vehicle • new fire breaks • road widening within existing corridor • re-vegetation • temporary power lines, material stockpiles, camps • surface vegetation clearing	
SIGNIFICANT	**Activities that cause significant disturbance to the land may include:** • creation of new roads, borrow pits or tracks • new public access ways, bridges, culverts, flood remediation and erosion levies • intensive soil/core sampling • new pipelines • significant reclamation works • major landscaping/contouring	☐
MAJOR	**Activities that cause major and lasting disturbance to the land may include:** • large-scale land clearing • material extraction • mechanical earthmoving, blasting • major construction works • large scale changes to waterways	☒

ABORIGINAL HERITAGE RISK MATRIX						
		LIKELY IMPACT ON HERITAGE SITES				
PREVIOUS LAND USE	**Built Environment**	**Negligible**	**Minimal**	**Moderate**	**Significant**	**Major**
	Significantly Altered	Low	Low	Low	Low	Medium
	Moderately Altered	Low	Low	Low	Medium	High
	Minimally Altered	Low	Low	Medium	Medium	High
	Unaltered	Low	Medium	Medium	High	High
		Low	Medium	High	High	High

RISK RATING
High

RISK RATING	POTENTIAL ACTIONS
LOW	**Consult with a Heritage Officer, if uncertain how to proceed. A range of further actions may be required, including:** • Consult the DPLH • Desktop survey • Aboriginal consultation
MEDIUM Review & Exercise Caution	**Consult with a Heritage Officer and a range of further actions may be required, including:** • Consult the DPLH • Desktop survey • Aboriginal consultation • Ethnographic survey • Archaeological survey
HIGH Consult; Survey; Approvals	**Consult with a Heritage Officer, and a range of further actions may be required, including:** • Desktop survey

	• Consult the DPLH • Aboriginal consultation • Ethnographic survey • Archaeological survey • Application for Section 18 of the AHA approval • Application for Regulation 7 or 10 of the AHR approval • Cultural Heritage Management Plan (CHMP)

HERITAGE AGREEMENT & ACTIVITY NOTICE CHECKLIST	
Is the project within an area Main Roads has a Heritage Agreement (HA) over? *e.g. Noongar Standard HA (NSHA), Esperance Nyungar Government Standard HA, Thalanyji HA*	Yes ☒ No ☐ Unsure ☐
If yes, which Native Title Group is the HA with? *e.g. Whadjuk, Thalanyji, Yawuru*	

SIGNATURES		
	Project Manager	**Environment Officer**
Name	**Lance Thomas**	**Elizabeth Johnston**
Signature		
Job Title	**Project Manager**	**Senior Environment Officer**
Date	**27/05/2019**	**21/05/2019**

HERITAGE OFFICER REVIEW					
Further Actions Required					
☐	**None**	☒	**Aboriginal Consultation**	☐	**Consult with DPLH**
☐	**Desktop Study**	☒	**Ethnographic Survey**	☒	**Archaeological Survey**
☐	**Reg. 10 Approval**	☒	**s18 Approval**	☒	**Activity Notice**
☐	**Cultural Heritage Management Plan (CHMP)**			☒	**Other**

Heritage Officer's Review Comments

The following heritage requirements apply to this scope of works:

1. Activity Notice to be sent to SWALSC for consideration by the Gnaala Karla Booja People
2. Activity Notice to note prior heritage survey and previous s18 consent received. The Activity Notice is to provide context that the land ownership has changed (requiring a new s18 application to be obtained) and that Main Roads wishes to survey the additional areas not covered by the prior survey as well as seek current opinion on the previously identified heritage sites for inclusion in a s18 application for consent to disturb all heritage sites within the footprint of the project.
3. S18 Aboriginal heritage survey required.
4. The Heritage Council to be consulted about:

- Kargotich Dairy (Heritage Council's Place Number 09625) as it is in the process of being assessed for inclusion on the Heritage Council's Register
- Jarrahdale to Rockingham Railway (Heritage Council's Place Number 9250) as it is in the process of being assessed for inclusion on the Heritage Council's Register

5. The Shire of Serpentine-Jarrahdale is to be consulted about the following listings on their Municipal Register:

- Manjedal Brook (Heritage Council's Place Number 08482)
- Kargotich Dairy (Heritage Council's Place Number 09625 – being assessed for the Heritage Council's Register) which is also listed as Fremnells Dairy under Place Number 24405

Reviewed and Endorsed by Heritage Officer	
Name	**Sandra Barkla**
Signature	*Sandra Barkla*
Job Title	**Principal Heritage Officer**
Date	**27/06/2019**

Appendix C Department of Planning, Lands and Heritage (DPLH) AHIS Search

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

Search Criteria

5 Registered Aboriginal Sites in Shapefile - Survey_Boundary

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

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South West Settlement ILUA Disclaimer

Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Gnaala Karla Booja People ILUA.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.dpc.wa.gov.au/swnts/South-West-Native-Title-Settlement/Pages/default.aspx.

Further advice can also be sought from the Department of Planning, Lands and Heritage at heritageenquiries@dplh.wa.gov.au.

Copyright

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.

Status:

- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972.*
- **Other Heritage Place which includes:**
  - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972.*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this *stage* to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972.*

Access and Restrictions:

- **File Restricted = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the place is not restricted in any way.
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- **Boundary Restricted = No:** Place location is shown as accurately as the information lodged with the Registrar allows.
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- **Restrictions:**
  - **No Restrictions:** *Anyone* can view the information.
  - **Male Access Only:** Only *males* can view restricted information.
  - **Female Access Only:** *Only* females can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

Basemap Copyright

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

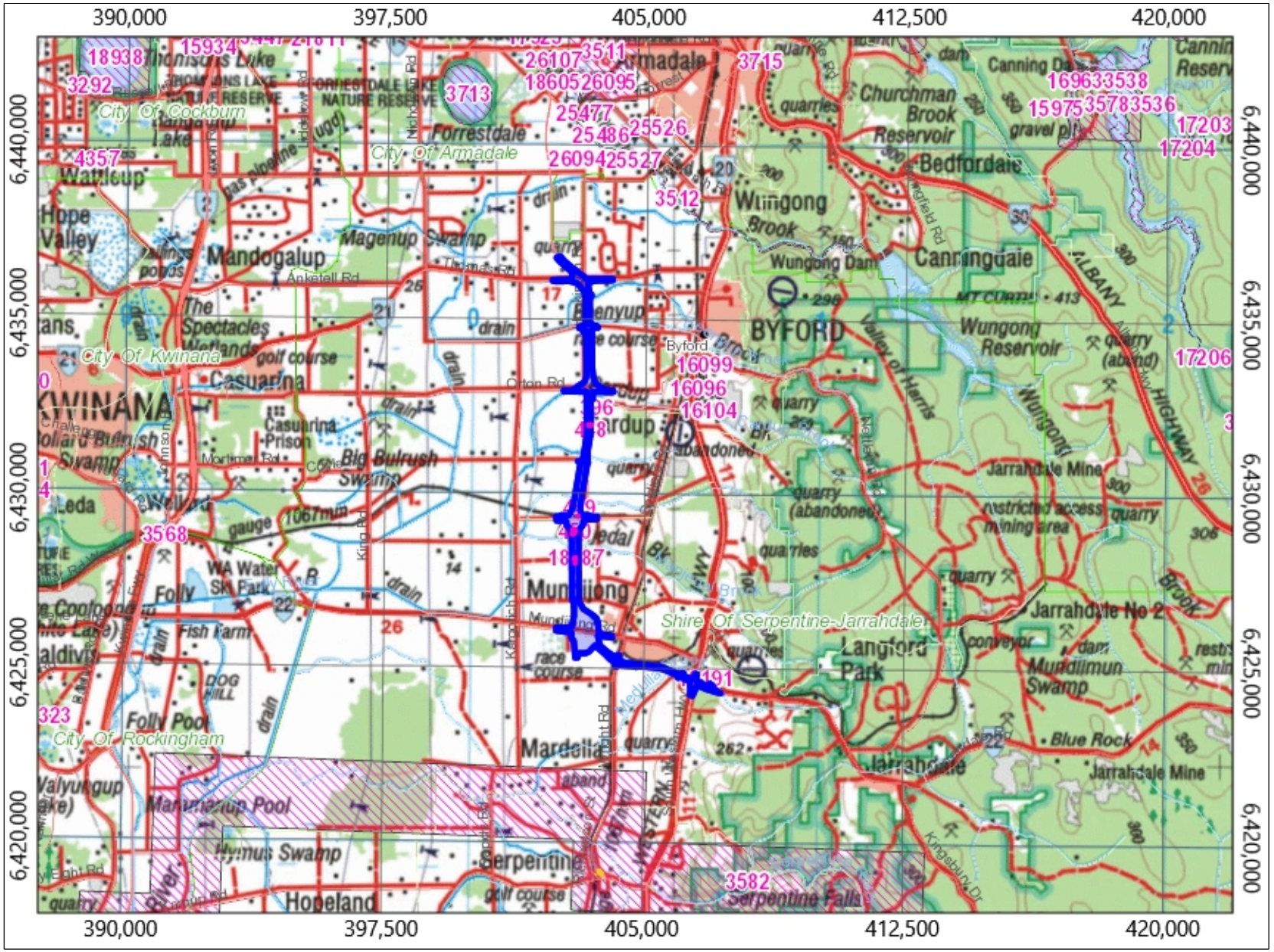
ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
448	SOUTH-EAST CORRIDOR 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	403350mE 6431996mN Zone 50 [Reliable]	S02953
449	SOUTH-EAST CORRIDOR 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	403039mE 6429389mN Zone 50 [Reliable]	S02954
450	SOUTH-EAST CORRIDOR 03	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	402915mE 6428941mN Zone 50 [Reliable]	S02955
18187	Tonkin highway - mundijong road scatter # 11	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	402958mE 6428173mN Zone 50 [Reliable]	
18188	Tonkin highway - mundijong road scatter # 12	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	402961mE 6428042mN Zone 50 [Reliable]	

Department of Planning, Lands and Heritage

Aboriginal Heritage Inquiry System

Map of Registered Aboriginal Sites

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

6.50 kilometres

Map Scale 1 : 197,000

MGA Zone 50 (GDA94)

Aboriginal Heritage Inquiry System

List of Other Heritage Places

Search Criteria

8 Other Heritage Places in Shapefile - Survey_Boundary

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Aboriginal Heritage Inquiry System

List of Other Heritage Places

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
16108	CARDUP BROOK	No	No	No Gender Restrictions	Stored Data / Not a Site	Mythological	*Registered Knowledge Holder names available from DAA	407530mE 6431805mN Zone 50 [Reliable]	
17923	IF #2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	403038mE 6427638mN Zone 50 [Reliable]	
18189	Tonkin highway - mundijong road scatter # 13	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	403043mE 6427990mN Zone 50 [Reliable]	
23919	Byford Archaeological Survey 006	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	403254mE 6433533mN Zone 50 [Reliable]	
24991	Beenyup Brook	No	No	No Gender Restrictions	Stored Data / Not a Site	Mythological, Natural Feature	*Registered Knowledge Holder names available from DAA	407501mE 6433928mN Zone 50 [Reliable]	
32616	MJ-03	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Arch Deposit	*Registered Knowledge Holder names available from DAA	403046mE 6428302mN Zone 50 [Reliable]	
32617	MJ-06	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Arch Deposit	*Registered Knowledge Holder names available from DAA	403112mE 6426496mN Zone 50 [Reliable]	
37117	MJ-07	No	No		Lodged		*Registered Knowledge Holder names available from DAA	403071mE 6426813mN Zone 50 [Reliable]	

Appendix D DoEE Protected Matters Database Search

Australian Government
Department of the Environment and Energy

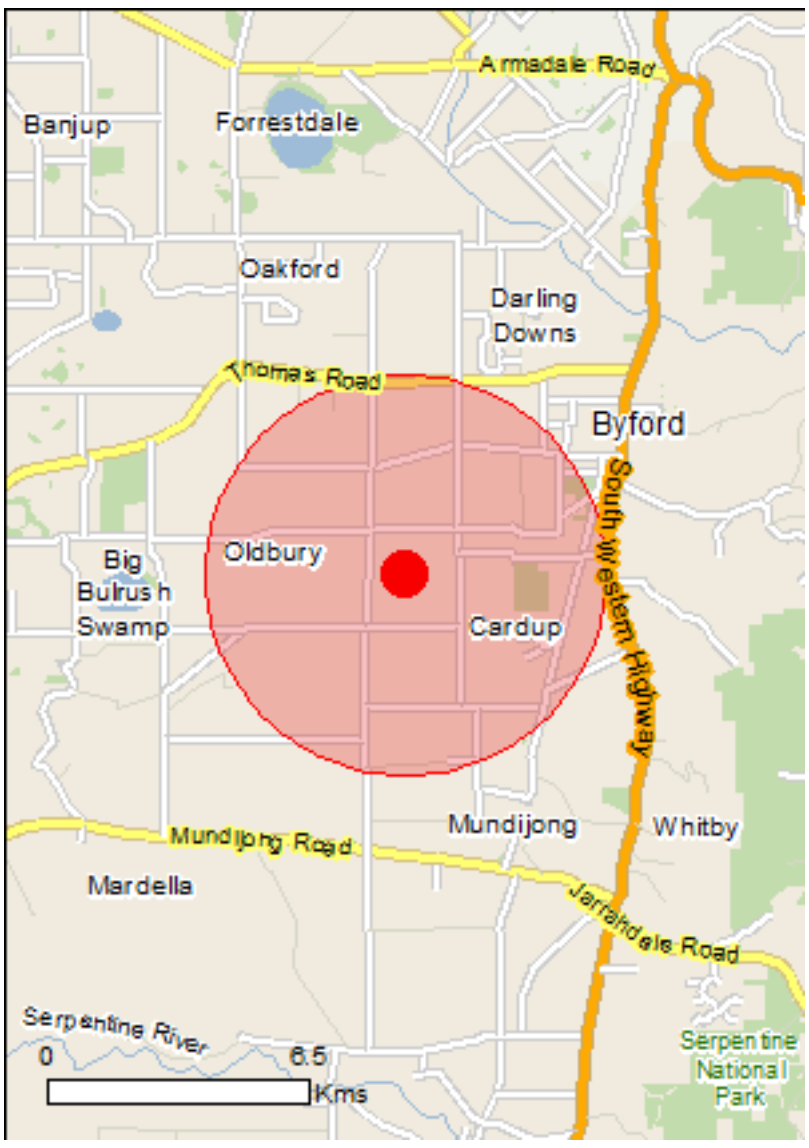
EPBC Act Protected Matters Report

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

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

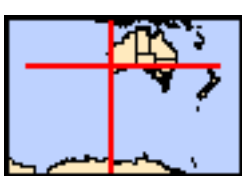
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/05/19 15:36:37



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

Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	25
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi		
Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites		
Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva		
Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103)		
[86879]	Critically Endangered	Species or species habitat known to occur within area
Tetraria australiensis		
Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra stellata		
Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Cardup	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.24382 115.96047

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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Appendix E Environmental Management Plan

Tonkin Extension Project

E1. Introduction

This Environmental Management Plan (EMP) has been developed for the Project area following the completion of the Environmental Impact Assessment (EIA) report. The aim of this EMP is to minimise the environmental impacts associated with the proposed works as well as to identify areas of responsibilities required for the implementation of management strategies.

This EMP addresses specific issues that were identified during the EIA. The project management measures identified within this EMP are in addition to the standard environmental management contract specifications used for Category 2 projects. Main Roads Western Australia (Main Roads) standard environmental contract specifications (Specifications 203, 204, 301, 302 and 304) are to be adhered to where appropriate.

The areas that require special management will be addressed in terms of:

- the timing of the various management actions;
- the topic (e.g. vegetation);
- the objectives for each area;
- the actions that are necessary to minimise the impact;
- the responsible party for implementing the action; and
- whether the action arose from external advice or is a Main Roads requirement.

E2. Communication Plan

Environmental issues specific to the project will be communicated as per Table E.1

Table E.1: Project Communication Plan

Method	Frequency	Participants	Reference	Record
Project Site				
Induction	Prior to Work	All personnel and subcontractors	EMP and Contractor Environmental Policy	Induction Meeting
Toolbox Meetings	Weekly	Project Personnel Main Roads'	Contractor Safety Plan	Minutes of Meeting
Contract Meetings	As required	Project Manager and Contractor Project Manager	EMP	Minutes of Meeting
Authority Consultation				
Department of Water and Environment Regulation	As required	Main Roads' Project Manager and Contractor Project Manager		Minutes of meeting

E2.1 External Communication and Complaints

A complaints register shall be maintained by the contractor. All complaints received shall be forwarded to the Main Roads' Project Manager for action. Serious complaints shall be investigated within 24 hours of the complaint being received.

E3. Monitoring

After project completion and project handover, the Asset Manager should develop a monitoring program to monitor for those aspects that have been identified as requiring monitoring.

E3.1 Contingency Measures

Contingency measures will be applied as required in response to an incident and upon the direction of the Manager Environment.

E3.2 Auditing

The implementation of the EMP will be audited three weeks after the contractor takes possession of site. This audit will be carried out by a Main Roads employee. Audits will be repeated as required until the project reaches practical completion. Table E.2 details the accountability for this CEMP.

E3.3 Ongoing Obligations

Once the project is completed, all remaining obligations will be captured in the Regional Environmental Management Plans (REMP's) Obligations Register.

Table E.2: Environmental Management Plan

ENVIRONMENTAL MANAGEMENT PLAN				
Project Component	**Management Action**	**Monitoring/Maintenance Program**	**Responsible Person**	**Completion Timeframe**
Standard Record Keeping Management				
Record Keeping	Ensure standard record keeping requirements are completed within 3 months of completion of the project activities. Ensure Environmental Compliance Checklist is completed within 1 month of completion of the project activities.	Post-construction record maintenance.	Environment Officer	Project Lifespan
Project Specific Aspects				
Aboriginal Heritage Sites	Ensure any s18 conditions are adhered to. Clearly demarcate the boundaries of heritage sites for protection where appropriate. Ensure on-site construction personnel are aware of potential Aboriginal heritage sites/artefacts and the requirement to protect them. A trained and competent person including appointed monitors will be engaged to identify Aboriginal artefacts and monitor all work in the vicinity of sites. In the event that human skeletal material is uncovered, work will cease within 25 metres of the material and the location of the material reported to Police. In the event that artefacts or material of Aboriginal origin is discovered, work will cease within 25 metres of the material and a qualified archaeologist will investigate the item(s) and take appropriate actions (i.e. contact DPLH, EO and PHO). Liquid spills, stormwater and runoff materials will be managed to ensure project activities and drainage do not adversely affect heritage sites or any wetland or water body including creeks, springs, swamps and soaks.	Pre-construction/ construction surveillance.	Project Manager	Project Lifespan
Dust	Clear vegetation only when necessary and treat areas requiring soil stabilisation as soon as practicable. Surface watering, spreading of hydro-mulch or similar will be used to protect loose surfaces or cleared areas. Apply dust suppression techniques to sealed roads on or near the project site that are affected by excessive dust. Water tankers will be made available to dampen exposed surfaces within construction and laydown areas, particularly during ground disturbing activities. Minimise or cease project activities during periods of high wind or when excessive dust is generated. Apply water, road sweeping and signage for suitable speed limits will be used during vehicle movement.	Construction and post-construction maintenance	Contractor	Project Lifespan

ENVIRONMENTAL MANAGEMENT PLAN				
Waste Management	• All waste materials from the Project area will be removed from the site upon completion of the project and to the satisfaction of the Project Manager or Site Superintendent. • Construction waste and other rubbish will be contained in bins with lids (where practicable) and removed regularly. • Use authorised waste disposal sites that meet the requirements of current WA state regulations and/or local government bylaws. • Contaminated soil will be disposed of at authorised waste disposal sites meeting the requirements of current WA state regulations and/or local government bylaws.	Construction and post-construction maintenance	Contractor	Project Lifespan
Surface Drainage	All spills will be contained immediately and removed within 24 hours to minimise the potential for contaminants to enter groundwater.	Pre-construction/ construction surveillance.	Project Manager	Project Lifespan
Groundwater	All spills will be contained immediately and removed within 24 hours to minimise the potential for contaminants to enter groundwater.	Construction maintenance	Project Manager	Project Lifespan
Hazardous Materials	• Bulk fuel and hazardous material storage areas will be bunded and managed in compliance with applicable Australian Standards. • Regular vehicle servicing will be undertaken at designated areas, at least 100 m away from watercourses. • Site personnel shall be trained in the use of emergency Fire suppressant equipment. • Spill trays and spill response equipment will be available near fuel storage or refuelling areas. • All hazardous material spills will be reported according to statutory requirements. • Hazardous materials will be disposed of at an approved and certified facility. • Temporary storage of bitumen, asphalt, concrete or aggregate shall occur at designated depots or controlled hardstands located within the project area. • Pre-coating of aggregate will only occur in approved and designated areas.	Construction maintenance	Contractor/Project Manager	Project Lifespan
Fire	• No fires shall be lit within the project area. • Machinery will be fitted with approved spark arresting exhaust systems. • Use of vehicle & equipment during Total Fire Ban Days to be avoided or seek advice from LGA. • All vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas. • All hot works will be undertaken in accordance with standard safety procedures.	Construction maintenance	Contractor/Project Manager	Project Lifespan

	• Construction personnel will extinguish and report fires occurring within the project area.			
Visual Amenity	• Stockpiles and other materials will be stored in designated areas and kept in a neat and tidy condition at all times. • The duration of ground disturbing activities will be limited as far as practicable.	Construction maintenance	Contractor/Project Manager	Project Lifespan
Wetlands/watercourses	• Road design should maintain existing surface water flows and incorporate soil erosion control measures. • No on-site storage of fuel, oils and other contaminant materials will be permitted within 100 m of a watercourse or wetland.	Pre-construction/ construction surveillance.	Project Manager	Project Lifespan
Terrestrial Fauna	• Inductions will be undertaken to ensure all contractors understand their obligations under the Biodiversity Conservation Act 2016. • No venomous snakes or other fauna will be purposefully killed during construction works. • All reasonable precautions are to be taken during the works to avoid destruction of native fauna and demarcated protection areas. • Undertake clearing in a manner to allow fauna to move away from the clearing area. • Restrict vehicle movements and assess access to areas cleared. • Ensure a clear demarcation of areas to be cleared and if required, those that are to be retained. • No pets, traps or firearms are allowed within the Project Area. • Native fauna is not to be fed or intentionally harmed or killed. • Pre-clearing inspections of any potential breeding trees identified to have hollows. • All Black Cockatoo potential breeding trees proposed to be retained will be marked and construction contractors will be made aware that these are not to be removed during construction.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Revegetation / Rehabilitation				
Revegetation / Rehabilitation	Implement the RP to revegetate/rehabilitate areas cleared for temporary purposes. Revegetation will be undertaken in accordance with Main Roads' 'Guideline Revegetation Planning and Techniques.	Post-Construction Maintenance	Environment Officer	Project Lifespan
Topsoil & Mulch	• Topsoil will be managed according to Main Roads Topsoil Management Guideline (TRIM D12#256186). • Topsoil will be stockpiled for revegetation purposes and the movement of topsoil will be restricted to the limits of the project area. • Where possible construction activities will be undertaken in summer to reduce the potential for soil erosion and drainage line siltation due to vegetation removal and heavy rains.	Construction and post-construction maintenance	Project Manager/Contractor	Project Lifespan

ENVIRONMENTAL MANAGEMENT PLAN				
	• Cleared vegetation will be stockpiled and stored for re-use within the project area			
Acid sulfate soil management	An ASS and Dewatering Management Plan will be prepared and implemented to manage ground-disturbance that may have the potential to disturb ASS.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Other Relevant Aspects				
Dieback	Refer to Construction Environmental Management Plan.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Vegetation	Refer to Construction Environmental Management Plan.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Conservation Significant Flora	Refer to Construction Environmental Management Plan.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Weeds	Refer to Construction Environmental Management Plan.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Contaminated Sites	Refer to Construction Environmental Management Plan.	Pre-construction/ construction surveillance	Contractor/Project Manager	Project lifespan
Noise and Vibration	Limit construction activity to 7 am and 7pm Monday to Saturday, where possible. Where out of hours works are required, a noise management plan is to be developed in accordance with the Environmental Protection (Noise) Regulations 1997 for approval by the City of Cockburn (as the appropriate delegated authority).	Pre-construction/ construction.	Project Manager/ Contractor	Project lifespan.
	A procedure is in place for recording all complaints regarding public nuisance, noise and vibration.	Pre-construction.	Project manager/ contractor	Project lifespan
	Develop a Construction Noise and Vibration Management Plan.	Construction.	Contractor	Construction.

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
A	S Puglisi/ E Sutherland	E Sutherland	E Sutherland		3/12/19
B	E Sutherland	E Sutherland	E Sutherland		24/12/2019

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